COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

1. LADY'S ISLAND LAKE

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1. LADY'S ISLAND LAKE

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1. LADY'S ISLAND LAKE, Co. Wexford

OS Grid Reference: T 099065, 1.50 000 Sheet No: 77
Alternative names: Our Lady's Island Lake, Loch Tochair

1.1 STUDY AREA

General features

Lady's Island Lake is a natural, brackish, percolating lagoon, situated on the southeast coast of Co Wexford about 3 km west of Carnsore Point and 5 km from Rosslare Harbour (Fig. 1.1.1). It is impounded by a sand and gravel barrier which has no natural outlet but is periodically breached to relieve flooding. The lake is named after Lady's Island which has been connected to the mainland by a causeway since early Christian times, and is still a place of pilgrimage in August.

Breaching of the barrier, which has been carried out since at least the 17th century, is needed to relieve flooding of farmland and also the pilgrimage route around Lady's Island. The cut is made in Spring when water levels are highest and the water level then falls until the lake becomes tidal for variable lengths of time. The practice has become contentious, however, because water levels sometimes fall too low, allowing predators to cross over the exposed bed of the lake to the important tern nesting sites on the Sgarbheen and Inish Islands.

The lagoon is of great ornithological interest, not only for up to 5,000 wintering waterfowl but also due to the presence of breeding tern colonies (Hutchinson 1979, Delany 1995, Sheppard 1993). Sandwich terns (*Sterna sandvicensis*) are the most numerous, but Common (*S. hirundo*), Arctic (*S. paradisaea*) and, recently Roseate terns (*S. dougalli*) also breed. Following Rockabill Island, which holds the largest colony in Europe of the globally threatened Roseate terns, this lagoon holds the second largest colony in Ireland.

There is almost no exploitation of the lake. Eels have been fished commercially in the past and there used to be some fishing for local consumption when fish were plentiful, but this appears to have ceased. The main leisure activity is sail-boarding; a few small boats are seen in summer.

Lady's Island Lake is the best documented lagoon in Ireland. There are published accounts of its geomorphology, ornithology, aquatic fauna and rare plants and further papers on fauna and hydrology are in preparation. Faunal studies are described in two publications (Healy *et al.* 1982, Norton and Healy 1984) and three student theses. The cockle (*Cerastoderma glaucum*) population was listed in a survey of the species in Britain and Ireland (Boyden and Russell 1972). The long list of publications, not all of which are cited in this report, reflect the scientific value of the lake as possibly the best remaining example in Europe of a distinct and relatively rare geomorphological formation. Both the barrier and the lagoon itself have provided exceptional opportunities for studying geomorphological, ecological and biological processes.

Due to ornithological value, the two islands are listed as a Refuge for Fauna and the lagoon is designated as a Special Protection Area. The barrier and lagoon shoreline are

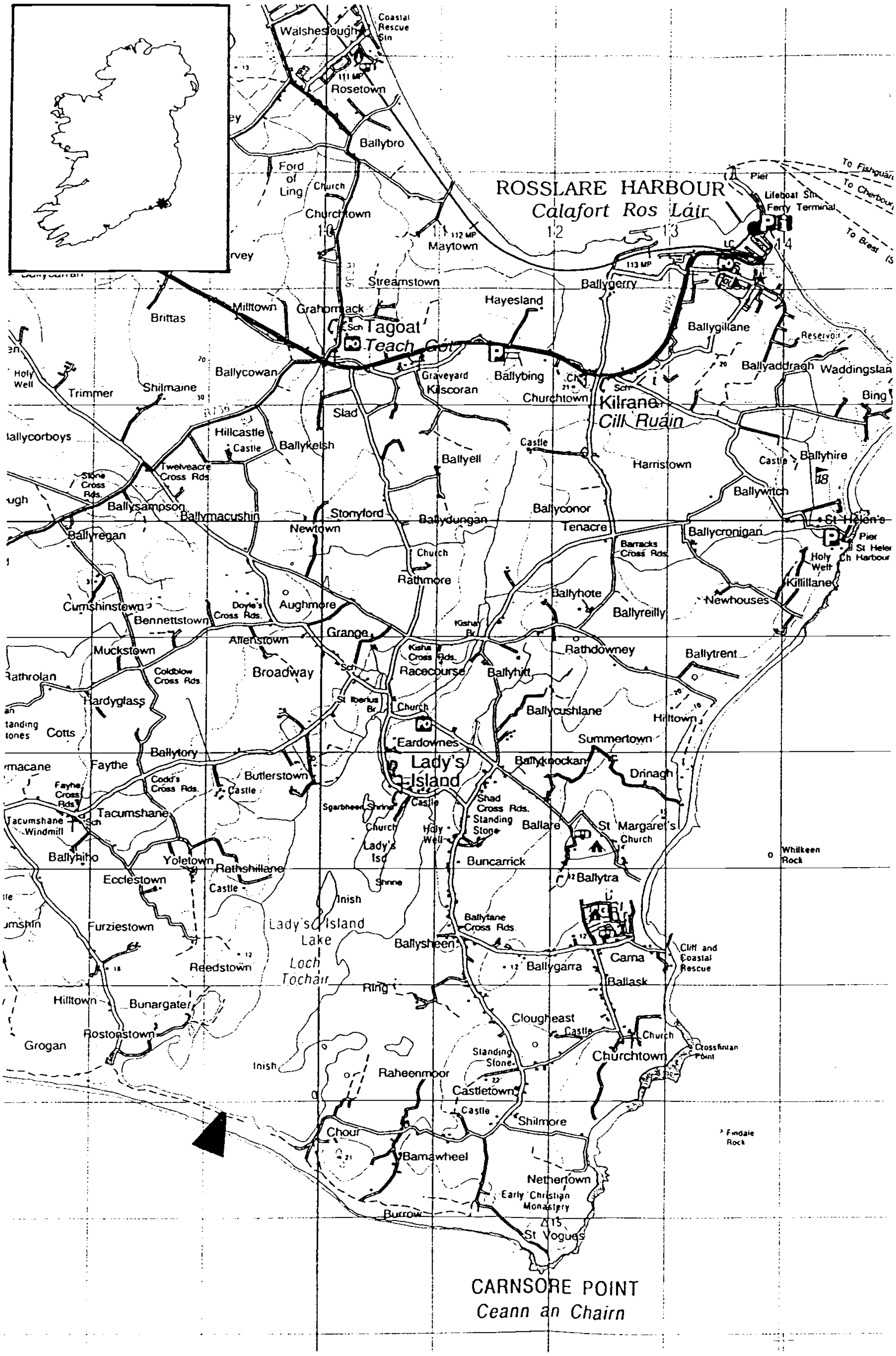

Fig. 1.1.1 Section of 1:50 000 map showing locality of Lady's Island Lake

also important for endangered plant species. The lagoon and barrier are a proposed National Heritage Area (Site Code No. 00704).

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6.5°C in January and 15°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is around 10 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 900 mm, and the number of rain days (1 mm or more) is <150. Winds are mainly from the southwest. Mean annual hourly wind speeds are between 5.9 m/s and a maximum wind speed of 47 m/s is estimated to occur once in 50 years. The mean annual number of hours of bright sunshine is 1700 which is the highest for the country. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, but inshore breakers rarely exceed 4.5 m with extremes reaching 8.5 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 18-20 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Rosslare is 3.1 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology

The area surrounding the lake is flat, consisting almost entirely of grazing or arable land with natural vegetation mostly confined to wet or rocky ground near the coast. A complex series of glacial deposits overlies a relatively flat Lower Palaeozoic bedrock (Carter and Orford 1982). A granite intrusion forms the headland at Carnsore Point and large granite boulders are numerous at the surface to the west of the Point and in the southeast corner of Lady's Island Lake. Surface geology consists of sand, gravel and gravelly till producing mostly dry mineral soils.

Lake topography

The lake is 3.7 km long and 0.8-1.8 km wide. The area varies seasonally but is generally estimated at around 450 ha although there are estimates of up to 900 ha in the literature. Sediments grade from soft sandy mud in the north to coarse, sandy gravel near the barrier. The bed is stony in places e.g. at the south end of the peninsula at Lady's Island and on the south shore and there are numerous granite boulders in the southeast.

Geomorphology of the barrier

Barrier systems extend uninterrupted for 12 km from Carnsore Point to near Kilmore Quay. Early explanations for lagoon formation in the area suggested that they became isolated by westward migrating spits (Lowry and Carter 1981), but later studies showed that the barrier on this part of the coast has been, and still is, moving onshore by a "rolling-over" process rather than extending alongshore (Orford and Carter 1982). Coring of the lake revealed clay sediments with lacustrine floral remnants, dating from about 5000 y BP, underlying more recent sediments derived from the barrier by washover

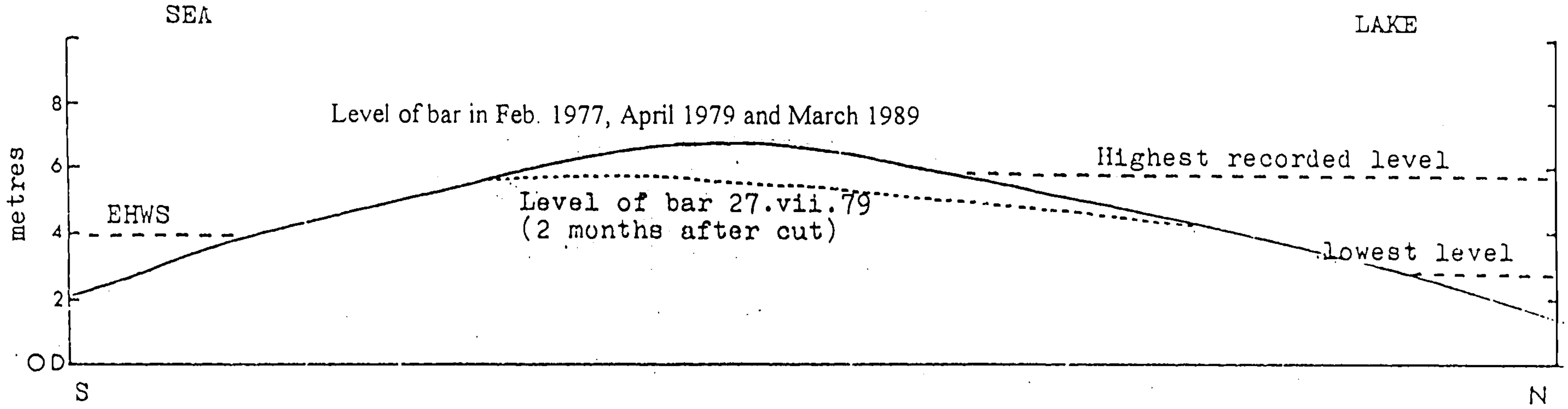

Fig. 1.1.2 Lady's Island Lake. Section through the region of the barrier where the breach is made, showing variations in the height of the bar and water levels in the lake relative to sea level.

(Orford and Carter 1982). The original lagoon bed extends under the barrier onto the shore where peat is visible at the surface in places.

The gravel-dominated barrier of Lady's Island Lake, known locally as the Coombe, is overlain with small aeolian dunes. It is composed of stratified coarse to fine gravels with median grain sizes between 0 and 4ϕ (0.06-1.0 mm), topped with small aeolian sand dunes, interrupted by relict washover fans (Carter & Orford 1980, Ruz 1989). At the point where the breach is made, laminations of coarse sediments representing washover fans are visible at the cut face . However, the barrier crest has now stabilised at 5-12 m OD and washover only occurs in the region of the breach (Fig. 1.1.2). The coarse sediments of the barrier allow extensive seaward seepage which is sufficient to prevent the formation of outlet streams. Their absence is characteristic of percolation lagoons (Orford and Carter 1984).

The beach is severely eroded, due to long-term failure in the supply of sediment, possibly aggravated by illegal gravel extraction near Carnsore Point.

Hydrology.
Lake water levels were measured monthly from 1976-1980 (Healy *et al.* 1982), irregularly from 1981-1984 (Healy, unpublished), and weekly from 1985 (Hurley unpublished).

Fluctuations in water level follow a regular seasonal pattern, rising in winter to reach a maximum in spring when the barrier is usually breached. In years when breaching is not carried out, the level starts to fall in early summer when evaporation and seepage through the barrier exceed inputs from groundwater, streams, drainage and runoff from surrounding land, and direct rainfall. Low summer levels expose rocks and areas of rock around the lake causing some mortality of fauna. The rise in water level starts in September-October and by the end of January water has usually covered most of Sgarbheen and part of the pilgrimage path which borders the Lady's Island peninsula. Inish is never completely covered but its stony beach, where Common and Arctic terns nest, becomes submerged. From about December, The pool at Bunargate in the southwest, which is isolated in summer, becomes joined to the lagoon allowing mixing of the waters and their fauna. From September to March the lagoon level normally rises a little over 2 m and, if the breach is not made, stabilises at between 5 and 6 m OD until the summer drop in level. A water level range of 3.02 m was recorded between 1976 and 1981.

Breaching of the barrier is carried out when the spring water level is high, usually in April, but it may be delayed until May, or considered unnecessary. In 1996 the cut was completed on 26 February and sealed naturally after 10 days. Following completion of the cut, the water flows out for several days until the lagoon level falls below high tide mark. The lagoon then becomes tidal until the opening seals as a result of onshore and longshore transport of beach sediment. During tidal periods, the water falls well below levels which would be reached as a result of loss by seepage and evaporation and large expanses of the substratum are exposed. The bar which forms across the sealed opening continues to build up gradually but finally stabilises. During the period 1975-1978, and in March 1989, the final level of the bar was 6.8 m OD which is nearly 3 m above extreme high water of spring tides although waves may wash over during storms. Landward seepage of saltwater is usually observed in late summer and early autumn, i.e. when the water level is low. The level in the lagoon usually remains above mean tide level, even in summer, so the amount of landward percolation is probably always small. It is not clear whether landward seepage would continue to take place if the water level in the lagoon were allowed to stabilise naturally.

Salinity and water quality
Seawater at approximately 34‰ enters the lagoon by seepage through the barrier, by salt spray being washed into the lagoon from the barrier, by occasional overwash of the entrance bar and, most importantly, by tidal flow following breaching. Salinities between 2 and 40‰ have been recorded in the lagoon as a whole. At most times when the lagoon was isolated, the salinity was 0.5-2.0‰ higher at the south end than at Lady's Island, showing direct influence of the sea, and lower in the extreme north where a small stream enters. The pool at Bunargate in the southwest also receives some freshwater and during its periods of isolation, which can last up to nine months, the salinity falls below that of the lagoon. Concentrations of 2-19‰ were recorded here between 1977 and 1991 but an exceptional level of 26‰ was reached in September 1990. All other point sources of freshwater are too small to have any significant effect and the main body of the lagoon has a more or less uniform salinity. Vertical stratification has been observed during calm weather in summer but has not been investigated.

Seasonal fluctuations in salinity correspond to changes in water level. In years when the breach sealed early before any significant tidal exchange could take place (e.g. in 1977, 1978 and 1979), the annual range was from 6-8‰ in winter to 12-16‰ in summer. In years when there is a major influx of tidal seawater (e.g. 1980, 1981, 1983), the salinity throughout most of the lagoon rises rapidly, and in 6 of the 17 years for which measurements are available, salinities in summer reached over 30‰. Variations from year to year are chiefly caused by differences in the proportion of lagoon water which is replaced by seawater during periods of tidal flow. This depends on the length of time the inlet remains open, which in turn depends on tides and weather, and the degree of mixing brought about by winds, conditions which are unpredictable. In calm weather, tidal water flows north through the centre of the lagoon and ebbs along the same route so that regions on either side are little affected (observed in 1979). However, even when the opening closes quickly, the salinity throughout the lagoon can rise rapidly, especially if there are strong cross winds during tidal flow (e.g. in 1980).

Changes in the salinity regime have occurred with high salinity, poly-euhaline phases in 1975-77, 1980-84 and 1988-90 alternating with low salinity oligo-mesohaline phases in 1977-79 and 1985-87. The reasons for this pattern of cyclical change are not known. During high salinity phases there were wide seasonal fluctuations in salinity while in low salinity phases differences between summer and winter were relatively small.

Eutrophication has increased since the early 1980s, due chiefly to nutrients from agricultural sources, and phytoplankton blooms have become more frequent. Some of the press reports about deteriorating conditions, however, have been misinterpretations of faunal mortality resulting from extensive tidal flow.

1.2 AQUATIC FAUNA

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1.2.1 Methods

Environmental variables

A profile of the barrier was obtained from previous studies (Fig 1.1.2).

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰. precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A, B, D and E in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by

inter- and intra-specific relationships of the fauna and non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists (Hemiptera and Coleoptera in particular). Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

1.2.2 Results

Environmental Variables

The lake was sampled on 1.vii.96 during the first part of the survey and from 1-3.x.96 during the more intensive survey.

Five sampling stations were selected in the lake to reflect the influences of substrate, freshwater and tidal inflows. Fig. 1.2.1 shows the position of these sampling stations in the lake.

Station A (OS 1046 0810) was located in the most northerly bay of the lake (Plate 2.2.2). Substrate consisted of gravel, sand and silt, water depth varied from 0 - 60 cms., and salinity measured 4 - 15 ‰.

Station B (OS 1069 0749) was located at the northern end of the lake, to the east of Lay's Island (Plate 1.2.3). Substrate consisted of gravel and stones along the shoreline, with finer sand and soft anoxic mud in deeper water. Water depth varied from 0 - 75 cms., and salinity measured up to 23 ‰.

Station C (OS 0894 0574) was located at the southwestern end of the lake in Bunargate Pool. Substrate consisted of fine sand, silt and anoxic mud; water depth varied from 10 - 50 cms., And salinity measured 6 - 10 ‰

Station D (OS 0834 0529) was located in the southwesterly corner of the lake close to the barrier (Plate 1.2..4). Substrate consisted mostly of sand with gravel and silts and occasional stones. Water depth varied from 0 - 1 m., and salinity measured 26 ‰.

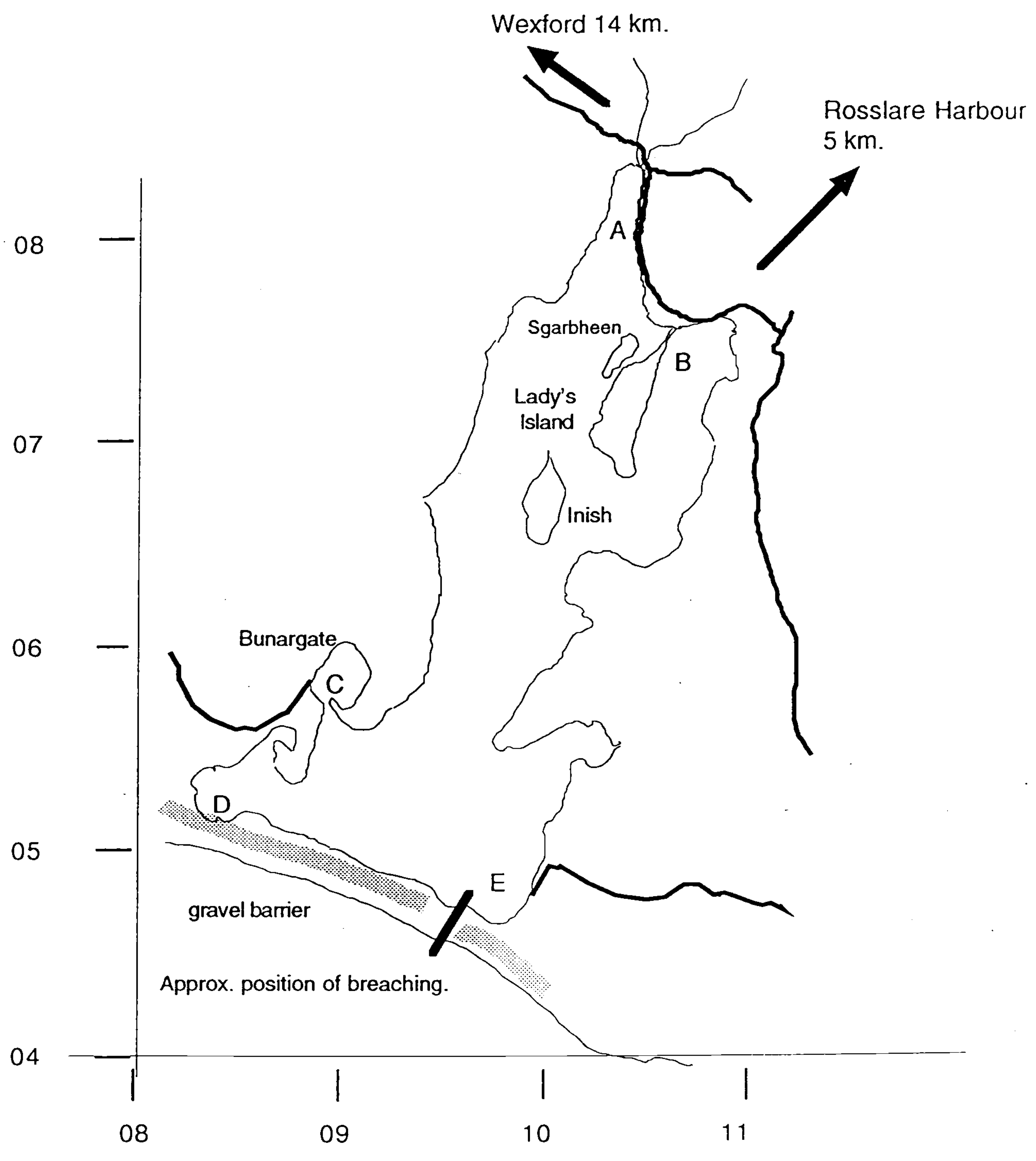

Fig 1.2.1 Location Map of Sampling Stations in Lady's Island Lake

Table 1.2.1. Fauna Recorded at Lady's Island Lake, Co. Wexford. July and October 1996.
( ) = records for July

Fauna		Stations (L.T. = light trap)									
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	L.T.E
Porifera											
Cnidaria											
Turbellaria											
Nemerteans											
Annelida	*Arenicola marina*			+				+			
	Hediste diversicolor	+		+						+	
Crustacea											
Ostracoda											
Cirripedia	*Balanus improvisus*	+		+				o		a	
Mysidacea	*Neomysis integer*			(a)		o	c100	o	c.100	o	31
	Praunus flexuosus			1						+	1
Isopoda	*Idotea chelipes*	c		o	4			o	1	+	9
	Lekanesphaera hookeri	a	>100	+	38	a	c300	+	75	+	1
Amphipoda	*Gammarus zaddachi*	+				+	+				
	Orchestia gammarella									+	
Decapoda	*Carcinus maenas*	F1,7		F2,7				F3,4		F4,3	
	Crangon crangon							3		1	
	Palaemonetes varians	a	>100	a	82	a	130	o	5	o	5
Arachnida							1				
Insecta											
Thysanura											
Ephemeroptera											
Odonata	*Ischnura elegans*	+				+					
Plecoptera											
Trichoptera											
Hemiptera	Corixidae	+	+	a	+	a	a				
	Corixa panzeri						+				
	Callicorixa praeusta						+				
	Sigara dorsalis	+									
	S. concinna	+				a	a				
	S. stagnalis	+	+	a	+	+					
	Notonecta viridis	+	+	+		+					
Coleoptera		+									
	**Colymbetes fuscus*										
	Enochrus bicolor	+									
	**Graptodytes granularis*										
	Noterus clavicornis					+					
Diptera	Chironomidae	+		a		+		o		o	
	Ephydridae pupa			1							

+ = present; o = occasional; c = common; a = abundant; F = fyke net.
* = Stations not known

Table 1.2.1. cont. Fauna Recorded at Lady's Island Lake, Co. Wexford. July and October 1996.
( ) = records for July

Fauna		Stations(L.T. = light trap)									
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	L.T.E
Mollusca											
Prosobranchia	*Hydrobiidae*	c	>100	o		+		o	c20	+	
	Hydrobia ventrosa	8		1				o	c20		
	Potamopyrgus antipodarum	12	+			+					
Pulmonata											
Opisthobranchia											
Bivalvia	*Cerastoderma glaucum*	shells		shells				shells			
Bryozoa	*Conopeum seurati*	+						+		+	
Echinodermata											
Tunicata											
Ascidia											
Teleostei	*Anguilla anguilla*	F, 5		F,13				F,5			
	Gasterosteus aculeatus	+	c50	o	1	o	a	o		+	
	Mugilidae	F1,17									
	Platichthys flesus	F1,7		F2,6				F3,6		F4,5	
	Pollachius pollachius							F,3			
	Pomatoschistus microps	a	>100	+	14			a		a	3
	Spinachia spinachia										
	Sprattus sprattus	F, 1									
	Syngnathus acus							1			

+ = present; o = occasional; c = common; a = abundant; F = fyke net.

Lady's Island Lake

Station E (OS 0989 0483) was located in the southeastern corner of the lake close to the barrier and the location of annual breaching. Substrate consisted of coarse sand with large granite boulders, water depth varied from 0-80 cm and salinity measured 25‰.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 1.2.1 Among 38 taxa recorded, 35 are identified to species. Four of the species are marine, 6 are poly-mesohaline, 13 are euryhaline, 4 are oligo-mesohaline, and 6 are limnic (Table 1.2.2). Eight of the species are listed as lagoonal specialists in Britain (Davidson *et al.* 1991). Benthic fauna was probably under sampled and rough weather during sampling of D and E may have made collecting less efficient than at A and B.

Differences between stations reflect a N-S gradient in marine influence which is also demonstrated by differences in salinity. Some limnic and low salinity (oligo-mesohaline) species such as *Sigara dorsalis, Sigara concinna, Notonecta viridis, Noterus clavicornis, Enochrus bicolor, Potamopyrgus antipodarum* and *Ischnura elegans* were confined to stations A and B at the north end of the lake and C (Bunargate Pool) but some others normally associated with low salinity were found near the barrier e.g. *Corixa panzeri and Callicorixa praeusta.* High salinity (poly-mesohaline) species e.g. *Praunus flexuosus* and *Crangon crangon,* were absent from A and C. Reasons for the absence of *Neomysis integer*, normally a euryhaline species, from A and B in October are not known. Several species which were widely distributed in the lake were absent from C, including *Balanus improvisus* and *Conopeum seurati* which were limited by the absence of rocks or other hard substrate, and *Idotea chelipes* and *Hydrobia ventrosa* which were probably limited by the low salinity. *Gammarus zaddachi* was the only completely aquatic amphipod present in the lake.

No live *Cerastoderma glaucum* were found although shells were plentiful. The species was recorded in 1971 by Boyden and Russell (1972) and in 1976-77 by Healy *et al.* (1982) and a thriving population has been observed on several occasions since e.g. in 1991 (Galvin 1992). The population is known to undergo wide fluctuations in density.

Table 1.2. 2 Ecological categories of the recorded taxa. L = lagoonal specialist according to (Davidson *et al.* (1991).

Marine	*Pollachius pollachius*	
	Spinachia spinachia	
	Sprattus sprattus	
	Syngnathus acus	
Poly-mesohaline	*Arenicola marina*	
	Balanus improvisus	
	Praunus flexuosus	
	Crangon crangon	
	Hydrobia ventrosa	L
	Mugilidae	
Euryhaline	*Hediste diversicolor*	
	Neomysis integer	
	Idotea chelipes	L

Table 1.2.2 (cont.)

	Lekanesphaera hookeri	L
	Gammarus zaddachi	
	Palaemonetes varians	L
	Carcinus maenas	
	Sigara stagnalis	L
	Conopeum seurati	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
	Platichthys flesus	
Oligo-mesohaline	*Potamopyrgus antipodarum*	
	Ischnura elegans	
	Sigara concinna	L
	Enochrus bicolor	L
Limnic	*Sigara dorsalis*	
	Corixa panzeri	
	Callicorixa praeusta	
	Colymbetes fuscus	
	Graptodytes granularis	
	Noterus clavicornis	

1.2.3 Discussion

A typical lagoonal fauna was present with elements of both low and high salinity faunas. There was little evidence of a recent invasion of marine species, suggesting that early closure of the breach this year may have limited the period of tidal flow sufficiently to prevent extensive colonisation. It is possible, too, that the unusually early date of breaching (April is the more usual month) meant that few individuals of marine species were present in inshore waters at the time, and almost no larval forms. Sprat, mullet, flounder and pollack breed in the open sea and must therefore have entered the lake as juveniles or adults during tidal periods following breaching. Many other fish species, including herring and dogfish have been taken in the past.

The lake fauna has, in the past, undergone wide fluctuations in populations according to the changing salinity regime with corixids and beetles becoming abundant and diverse when the salinity fell below 10‰ and fish and crustaceans replacing them during high salinity phases (Healy *et al.* 1982). When sampled this year, the fauna appeared to be in an intermediate phase and a strong N-S salinity gradient was evident. The fauna was poor by comparison with 1977-78 when more than 58 species were recorded (Healy *et al.* 1982). In that year, extensive tidal exchange brought in a wide range of marine species which coexisted with a low salinity fauna that had become established during the previous year. Galvin (1992) recorded 49 taxa in the lake (including the Bunargate Pool), including 9 lagoonal specialists. A total of 97 macrofaunal species has been recorded over 17 years of observations (unpublished).

According to Southwood and Leston (1959) *Notonecta viridis* was only reported for Wexford and north Kerry. It has since been recorded at this site by Healy *et al.* (1982)

and by Galvin (1992). It was found at Tacumshin L., Kilkeran L. and L. Donnell during this survey.

1.2.4 Threats

Land reclamation. Wexford County Council has granted planning permission for extension of a pitch and putt course which would encroach on an area subject to winter flooding. Development of the flood zone by importation of landfill will reduce the area of important shallow water habitats. As the area of Lady's Island Lake varies considerably according to season and rainfall, it is important that the boundary of any designated protection area be drawn to take this into account.

Pollution. Serious eutrophication was first noticed in the early 1980s when phytoplankton blooms became common. The main sources of nutrients are believed to be fertilizer, silage, and slurry runoff from surrounding land, and possibly sewage overflow from a new housing estate near the north end of the lake.

Gravel extraction. Illegal extraction of gravel from the barrier near Carnsore continued until quite recently. As the supply of sediment to the beach has been steadily diminishing, removal of existing material may add to erosion problems in the area and may also be responsible for the failure in recent years for the breach to seal as rapidly as it formerly did.

Breaching. Breaching is seen as a threat to the important tern colonies because when the outlet remains open for long periods the water level falls below a critical level allowing mammalian predators to reach the islands. Breaching is also seen by many as a threat to aquatic life because it can result in high mortalities of flora and fauna. The lake may even appear "dead" after an extended period of tidal flow. However, long-term studies (unpublished) have shown that the community recovers with no obvious loss of species

1.2.5 Evaluation

Lady's Island Lake is a large, **natural sedimentary lagoon** and is therefore of international importance based on geomorphology. It is one of the largest and possibly the best example of a true lagoon in the whole of Europe. It is also of international importance for its ornithological value as a breeding site for endangered tern species.

The site is rated as of international geomorphological importance and the sole surviving major example in Ireland of a back-barrier seepage lagoon. The sequence of back-barrier washover and seepage structures are among the best examples in Europe (Orford and Carter 1982).

The aquatic faunal community during stable periods comprises a characteristic assemblage of brackishwater species, a high proportion of which are specialist lagoonal species. A strong N-S salinity gradient and a wide range of substrate types explains the high level of species richness reported in this and other surveys. This is not always apparent, however, because the community undergoes wide fluctuations in species composition and abundance due to breaching.

Among other important features of Lady's Island Lake are its large size (few lagoons in Britain are more than 10 ha), its naturalness, and its long history of scientific investigations. This is the best documented lagoon in Ireland and scientific studies are ongoing. Of particular interest are local geomorphological processes and the effects of the fluctuating conditions on fauna and flora.

Current management practices are controversial and effective solutions to the conflicting interests are subject to financial constraints.

The lake is a Refuge for Fauna, an SPA and a proposed NHA (Site Code No. 704).

In conclusion, Lady's Island Lake is regarded as of exceptional conservation value and highly recommended as a proposed SAC.

1.2.6 References and Additional Sources

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Plate 1.2.1 View of the breach in the barrier of Lady's Island Lake, 1st July 1996.

Plate 1.2.2 View of the northern area of Lady's Island Lake, Station A.

Plate 1.2.3 View of the area to the east of Lady's Island Lake, Station B.

Plate 1.2.4 View of the southwest area of Lady's Island Lake, Station D.

Plate 12.5 View of the southeast area of Lady's Island Lake, Station E

Plate 12.6 Large granite boulder at Station E of Lady's Island Lake, showing dense zone of *Balanus improvisus*, taken in the 1980's.

1.3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

1.3.1 Site Description

This large lagoon is bordered by low-lying, predominantly pastoral farmland to the north, east and west. The barrier lies to the south. The major freshwater inflow joins the lake at its northern extent.

The main features of the shoreline, including marginal communities, are shown in Fig. 1.3.1. The slope of the shores is generally shallow. Marginal swamps occur in more or less sheltered areas with long stretches of open shore elsewhere. In these areas marginal vegetation forms a typically narrow strip. There is an area of open rocky shore in the south east. Extensive marshland occurs at Ring Marsh in the south eastern quarter.

There is a semi-isolated pool in the south west of the site fringed by emergent swamp species.

1.3.2 Methods

This site was surveyed using transects only. The locality of these is shown in Fig. 1.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

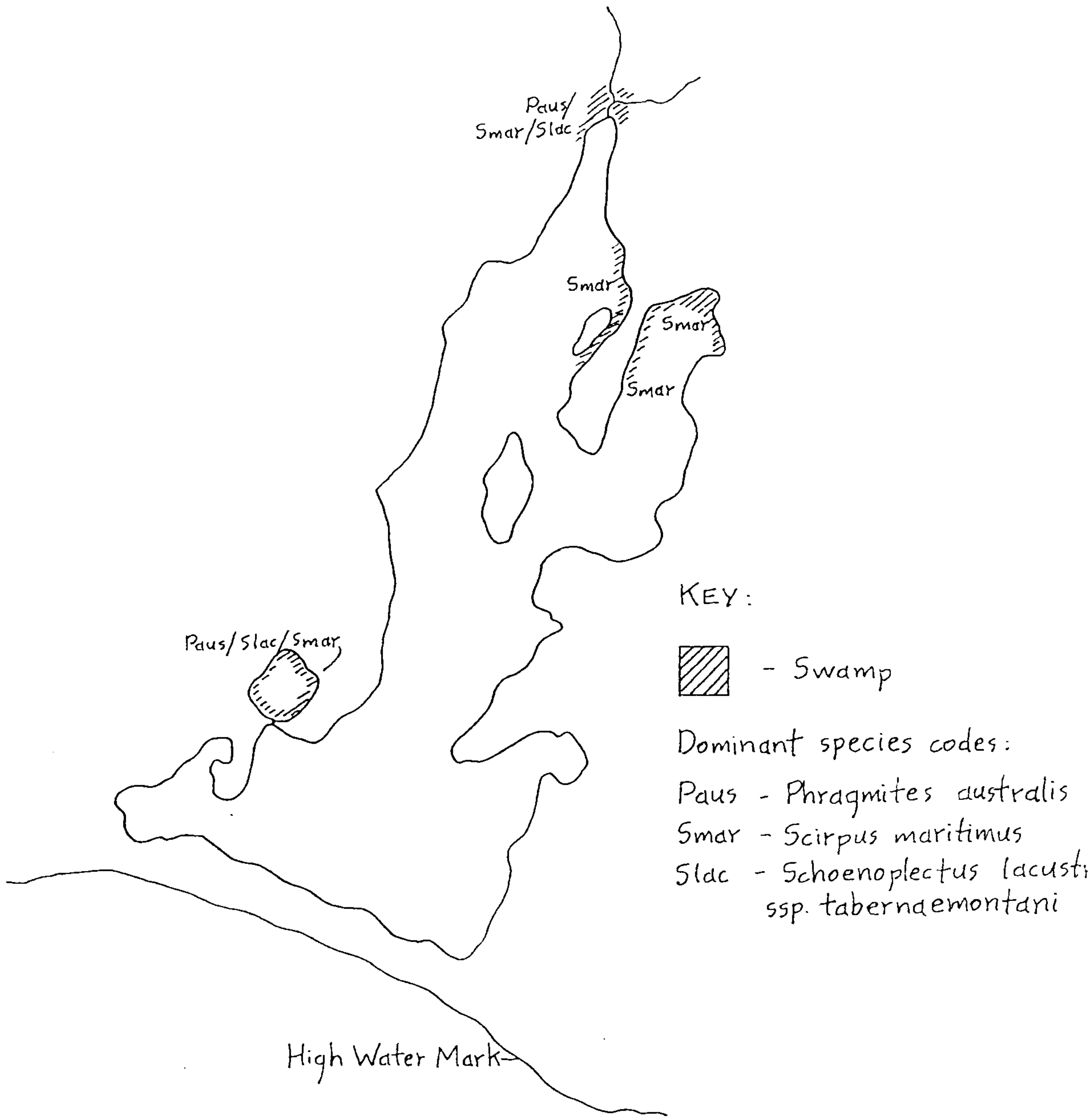

Fig. 1.3.1 Lady's Island Lake, Co. Wexford - Swamp Vegetation

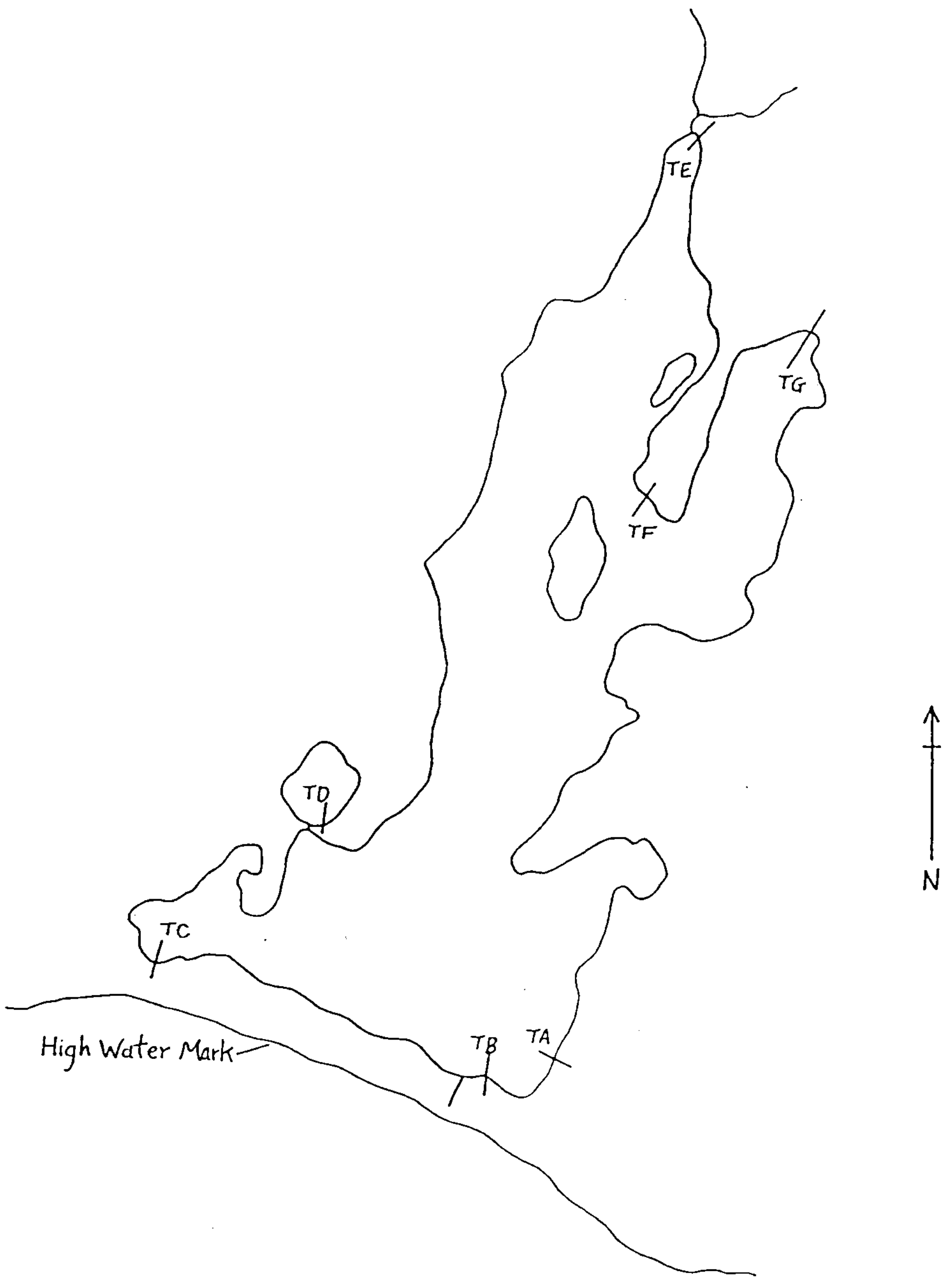

Fig. 1.3.2 Lady's Island Lake, Co.Wexford: Location of Transects

Lady's Island Lake

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin .	10	91-100 %	
	9	76-90 %	
	8	51-75 %	
	7	34-50 %	
	6	26-33 %	
	5	11-25 %	
	4	4-10 %	
	3	<4 %	- many individuals
	2	<4 %	- several individuals
	1	<4 %	- few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %

Lady's Island Lake

II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Lady's Island Lake

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

1.3.3 Results

Transect tables

Site: Lady's Island Lake	Transact code: A	
Location: Rocky shore near outlet	Sample point: 1 Aquatic - 10m out - granule	
Sample area: Granule only	Substrate: Sand, gravel, boulders	
Depth: 80 cm +	Salinity: 23 parts per thousand	
NBC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.	40 +	
Filamentous algae		
Description:		

Site: Lady's Island Lake	Transact code: A	
Location: Rocky shore near outlet	Sample point: 2 Aquatic - 3m out	
Sample area: 16m2 (4x4)	Substrate: Sand, gravel, boulders	
Depth: 50 cm	Salinity: 23 parts per thousand	
NBC community: -----		
	Height (cm)	Cover (%)
Total Plant		< 1
Ruppia sp.	15	< 1
Bare substrate		100
Sand and gravel		90
Boulders		10
Description: Very sparse low growing Ruppia only.		

Lady's Island Lake

Site: Lady's Island Lake	Transact code: A	
Location: Rocky shore near outlet	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand, gravel boulders	
Depth: 0 cm	Salinity: -----	
NBC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		75
Juncus Gerald	30	25
Agrostis stolonifera	20	25
Festuca rubra	20	5
Potentilla anserina	10	5
Glaux maritima	10	5
Aster tripolium	40	10
Spergularia marina	8	< 1
Atriplex hastata	4	< 1
Tripleurospermum maritimum	5	< 1
Plantago coronopus	4	< 1
Juncus bufonius	4	< 1
Isolepes cernua	5	< 1
Bare substrate		25
Sand and gravel		5
Boulders		20
Description: Juncus gerardii - Agrostis stolonifera dominated shore community forming 15m		
wide strip amongst scattered boulders.		
Grading to Dactylis glomerata - Festuca rubra grassland.		

Site: Lady's Island Lake	Transect code: B	
Location: Outlet to sea	Sample point: 1 Aquatic - 5m out - grapnel	
Sample area: Grapnel only	Substrate: Sand, gravel	
Depth: 80 cm +	Salinity: 23 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.	40 cm +	
Filamentous algae		
Description:		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: B	
Location: Outlet to sea	Sample point: 2 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Sand, gravel	
Depth: 80 cm	Salinity: 23 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		< 1
Enteromorpha		< 1
Description: Very sparse Enteromorpha only.		

Site: Lady's Island Lake	Transect code: B	
Location: Outlet to sea	Sample point: 3 Marginal	
Sample area: 16m2 (8x2)	Substrate: Sand, gravel	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		15
Atriplex hastata	2	5
Spergularia marina	6	< 5
Tripleurospermum maritimum	3	< 5
Senecio jacobaea	6	< 5
Atriplex patula	2	< 1
Description: Sparse community of mostly prostrate pioneer shore species forming 2m strip.		
Backing unvegetated sand and gravel for 20m.		
Backing to Ammophila arenaria dune grassland.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: C	
Location: Western end of barrier	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Sand and gravel	
Depth: 60 cm	Salinity: 23 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		75
Ruppia sp.	15	75
Algae		5
Lamprothamnium papulosum	10	5
Description: Extensive low growing Ruppia dominant. Lamprothamnium blackened and dead looking. Same species at more or less same cover from c.20m out to shore.		

Site: Lady's Island Lake	Transect code: C	
Location: Western end of barrier	Sample point: 2 Marginal	
Sample area: 10m2 (10x1)	Substrate: Sand and gravel	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		10
Atriplex hastata	5	5
Tripleurospermum maritimum	3	5
Salicornia agg.	6	< 1
Plantago maritima	4	< 1
Description: Im wide strip of sparse pioneer shore vegetation.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: C	
Location: Western end of barrier	Sample point: 3 Marginal	
Sample area: 10m2 (5x2)	Substrate: Sand, gravel	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		20
Suaeda maritima	10	5
Atriplex hastata	5	< 5
Tripleurospermum maritimum	3	< 5
Aster tripolium	10	< 1
Glaux maritima	5	< 1
Spergularia marina	6	< 1
Cochlearia anglica	4	< 1
Plantago coronopus	4	< 1
Description: Sparse cover of low growing salt-tolerant shore vegetation with Suaeda the		
dominant species. 3m strip.		
Grading through Tripleurospermum dominated community (10m) to		
Ammophila arenaria dunes (barrier).		

Site: Lady's Island Lake	Transect code: D	
Location: Semi-isolated pool	Sample point: 1 Aquatic - 3m out	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 50 cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Potamogeton pectinatus	30	80
Description: Dense Potamogeton pectinatus in single species stand.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: D	
Location: Semi-isolated pool	Sample point: 2 Marginal	
Sample area: 80m2 (10x8)	Substrate: Silt	
Depth: 0 - 40 cm	Salinity: 5 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Scirpus maritimus	130	90
Potamogeton pectinatus	30	< 1
Description: Dense Scirpus maritimus swamp with sparse Potamogeton pectinatus the only		
associated submergent species. 8m.		
(Scirpus lacustris ssp tabernaemontani and Phragmites australis also forming		
single species and mixed species swamps in marginal areas of pool).		

Site: Lady's Island Lake	Transect code: D	
Location: Semi-isolated pool	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate:	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus gerardii	25	20
Agrostis stolonifera	20	75
Festuca rubra	20	15
Potentilla anserina	10	15
Leontodon autumnalis	25	< 5
Glaux maritima	10	< 5
Oenanthe lachenalii	30	< 1
Description: Complete ground cover of Juncus gerardii - Agrostis stolonifera dominated		
community. 20m.		
Grading to A. stolonifera - Festuca rubra - Potentilla anserina grassland.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: E	
Location: Freshwater inflow	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Silt and sand	
Depth: 70 cm	Salinity: 14 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		60
Ruppia sp.	40	60
Algae		40
Filamentous algae		40
Description: Fairly dense Ruppia bed. More or less unchanging cover back to marginal zone.		
Approximately 80% of Ruppia plants in this sample were blackened and dead		
looking or partly so.		

Site: Lady's Island Lake	Transect code: E	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt and sand	
Depth: 40 cm	Salinity: 10 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		50
Higher Plant		40
Scirpus maritimus	70	40
Ruppia sp.	30	< 1
Algae		10
Enteromorpha		10
Description: Open Scirpus maritimus swamp with sparse Ruppia and Enteromorpha. 20m.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: E	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt (de-oxygenated)	
Depth: 30 cm	Salinity: 6 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		60
Schoenoplectus lacustris ssp tabernaemontani	100	40
Scirpus maritimus	70	20
Algae		< 5
Enteromorpha		< 5
Description: Fairly open swamp vegetation with Schoenoplectus dominant over S. maritimus. Sparse free-floating Enteromorpha. 30m.		

Site: Lady's Island Lake	Transect code: E	
Location: Freshwater inflow	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt (de-oxygenated)	
Depth: 15 cm	Salinity: 0 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Scirpus maritimus	160	95
Agrostis stolonifera	40	10
Apium nodiflorum	25	< 1
Lemna minor		< 1
Description: Tall dense Scirpus maritimus swamp with sparse Agrostis cover. 50m.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: E	
Location: Freshwater inflow	Sample point: 5 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 5 cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	300	100
Lemna minor		< 1
Description: Tall, very dense Phragmites swamp. 100m.		
Grading to willow carr strip of c.50m width.		
Backing pasture.		

Site: Lady's Island Lake	Transect code: F	
Location: Exposed promontory head	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Gravel, cobbles	
Depth: 70 cm	Salinity: 22 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Ruppia sp.	40	5
Substrate		
Cobbles		80
Gravel		20
Description: Sparse Ruppia only.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: F	
Location: Exposed promontory head	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus gerardii	30	80
Agrostis stolonifera	15	10
Festuca rubra	15	5
Potentilla anserina	10	5
Glaux maritima	10	5
Aster tripolium	30	< 1
Leontodon autumnalis	15	< 1
Tripleurospermum maritimum	15	< 1
Spergularia marina	10	< 1
Atriplex patula	8	< 1
Plantago major	6	< 1
Description: Extensive Juncus gerardii cover with Agrostis stolonifera and Festuca rubra locally co-dominant in small areas of more open Juncus cover. Associated species more or less sparse. 20m.		
Backing to Rubus fruticosus - Salix fragilis hedgerow.		
Backing arable farmland.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: G	
Location: Sheltered bay	Sample point: 1 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Silt, sand, gravel	
Depth: 50 cm	Salinity: 21 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		70
Higher Plant		60
Ruppia sp.	40	60
Algae		10
Filamentous algae		10
Lamprothamnium papulosum	8	< 1
Description: Patchy cover of dominant Ruppia with filamentous algae and sparse		
Lamprothamnium. Fruiting Ruppia plants present. Lamprothamnium blackened and dead-		
looking.		
Grapnel surveys from 5 - 50m out found no additional species.		

Site: Lady's Island Lake	Transect code: G	
Location: Sheltered bay	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 30 cm	Salinity: 18 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Scirpus maritimus	100	80
Description: Fairly dense single species Scirpus swamp. 45m.		

Lady's Island Lake

Site: Lady's Island Lake	Transect code: G	
Location: Sheltered bay	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 15 - 30 cm	Salinity: 10 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	300	100
Description: Tall dense single species Phragmites swamp. 30m.		

Site: Lady's Island Lake	Transect code: G	
Location: Sheltered bay	Sample point: 4 Marginal	
Sample area: 16m2 (4x4)	Substrate: Not known	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus gerardii	30	50
Agrostis stolonifera	25	40
Potentilla anserina	20	20
Aster tripolium	40	5
Leontodon autumnalis	20	< 1
Glaux maritima	20	< 1
Description: Juncus gerardii and Agrostis stolonifera co-dominant, each locally mono-		
dominant, among species-poor salt tolerant community. 20m.		
Grading to Agrostis stolonifera - Festuca rubra - Potentilla anserina grassland.		

1.3.4 Evaluation

'Valuable'

This large site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared with most other sites. Six transects were carried out at the lagoon and one in a semi-isolated pool in the south west of the site.

This is one of the three Irish sites at which Lamprothamnium papulosum had been recorded prior to this survey. This rare charophyte was found in the course of this survey at the western end of the barrier and in a sheltered bay in the north east corner. Its presence alone qualifies this as a valuable site.

Ruppia was found at all six lagoon transects, with a cover of 50% or more at three of these, one in each of the two northern bays and one at the west end of the barrier. It is notable that both Ruppia cirrhosa and R.maritima occur here.

Potamogeton pectinatus was not found in the lagoon but was abundant in the semi-isolated pool, which had a much lower salinity level (5 parts per thousand) than the lagoon itself (14-23 parts per thousand).

Marginal vegetation does not seem to be of particular interest here. Scirpus maritimus, Schoenoplectus lacustris ssp. tabernaemontani and Phragmites australis swamps all occur at this site, but are nowhere extensive. Juncus gerardii dominated salt tolerant community occurs on more open shores.

The basis for the designation of Lady's Island Lake as valuable is the presence of Lamprothamnium papulosum and both Ruppia species and the apparent wide distribution of all these species.

Further survey is recommended.

1.4 ECOTONAL COLEOPTERA

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1.4.1 Site Description

Large coastal brackish lake with sand/pebble dune barrier, opened almost annually by artificial excavation to permit drainage of the lake (Healy *et al.* 1982). Lake shore near barrier with coarse sand, pebbles, cobbles and boulders. Margins in places with nutrient and organic matter enrichment from breeding, roosting and loafing birds. Marginal vegetation includes *Scirpus maritimus, Juncus gerardi, Glaux maritima* and *Salicornia* sp. Margin of barrier and breach with dry coarse sand.

Subsites (see Fig. 1.4.1)

1. *Juncus gerardi* (East) (T 100049)

Dense to sparse zone of *Juncus gerardi, Glaux maritima*, etc., with some grass-dominated patches, c.1-4 m from water edge (summer) above emergent *Scirpus maritimus*, on coarse sand and pebbles with organic content. Soil moist; surface-dry soil (further up shore) avoided for sampling.

2. *Juncus gerardi* (West) (T 099053)

Zone of dense vegetation with *Juncus gerardi* near bare or sparsely vegetated zone behind emergent stand of *Scirpus maritimus*.

3. *Salicornia* / bare sand (T 082053)

Bare coarse sand area (c. 250 m^2), exposed during summer, with sparse growth of *Salicornia* and small patches of denser vegetation including *Juncus gerardi*.

1.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

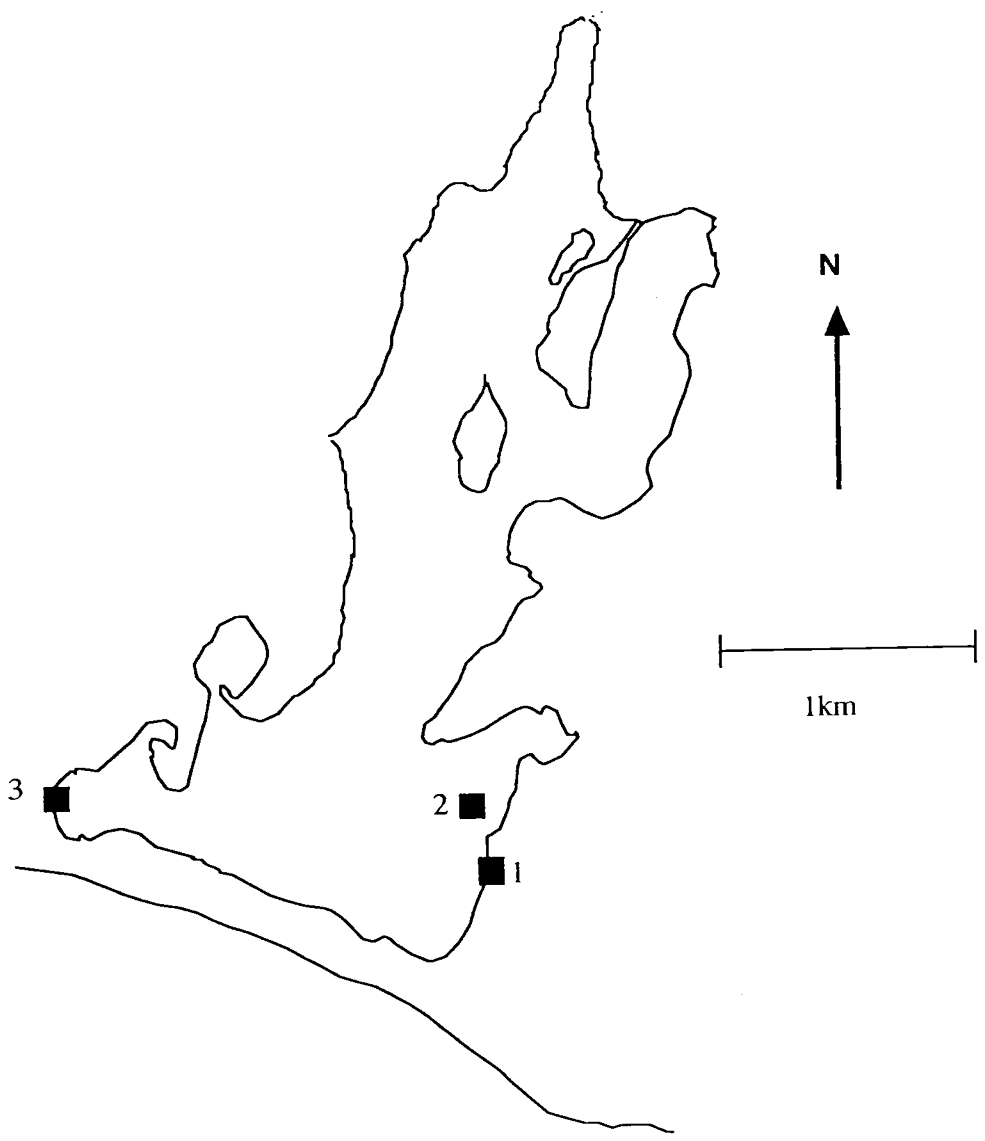

Fig. 1.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Lady's Island Lake, Co. Wexford

1 - Pitfall traps, S-vac
2 - Ground search
3 - Pitfall traps

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 1.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as

'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 1.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Juncus gerardi* (East) - S-vac suction sampler (part 17 vii 1996, part 12 ix 1996 (separate dates for subsamples due to engine fire on first date), c. 2 m^2;

(2) *Juncus gerardi* (East) - 6 plastic pitfall traps with funnels and ethylene glycol preservative (23 vi - 3 viii 1996);
(3) *Juncus gerardi* (West) - 6 pitfall traps (22 viii - 13 ix 1996);
(4) *Salicornia* / bare sand - 1h ground search (18 vii 1996).

No *Bledius* burrow casts were located, nor were *Bledius* found in 12 flotation subsamples, at the above sampled areas.

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

1.4.3 Results

Thirteen species of carabid and thirty-six species of staphylinid were recorded, three species of which are regarded as indicator species (Table 1.4.2).

Although *Atheta gyllenhali* is not listed by Hyman and Parsons (1994) as being rare or notable in Great Britain, it appears to be local or rare throughout Europe (Palm 1970, Benick and Lohse 1974). Johnson and Halbert (1902) cite two Irish records. The species is stenotopic, restricted to marshes, alder carr and bogs (Koch 1989).

There is only one previous Irish record of *Atheta liliputana* (Pollardstown Fen. Co. Kildare) which is cited as rare in Scandinavia and Central Europe (Good 1994). The species may be associated with birds (carrion, faeces, etc.), and is described as a stenoptopic woodland species by Koch (1989). However, it has been recorded from grassy salt meadow habitat by Hansen *et al.* (1991), and it is possible that it may be associated with the tern colony at this site.

Gabrius keysianus , also recorded from Kilkeran Lake, is a halobiont water margin species (Koch 1989), widespread but local in England and Wales (Hyman and Parsons 1994), and generally local and mostly rare in western Europe (Horion 1965). It has been previously recorded in Ireland (O'Mahony 1929).

TABLE 1.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Lady's Island Lake. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

Species	No. individuals
Carabidae	
Agonum marginatum (L.)	7
Bembidion varium (Ol.)	21
Bradycellus harpalinus (Serv.)	1
Broscus cephalotes (L.)	2
Calathus fuscipes (Goeze)	4
Dyschirius globosus (Hbst.)	60

TABLE 1 (cont.)

	Dyschirius luedersi Wagn.	7	
	Elaphrus cupreus Duft.	11	
	Harpalus rufipes (Geer)	1	
	Loricera pilicornis (F.)	5	
	Pterostichus diligens (Sturm)	2	
	Pterostichus niger (Schall.)	4	
	Pterostichus nigrita (Payk.)	1	
Staphylinidae			
	Alianta incana (Er.)	1	
	Aloconota gregaria (Er.)	29	
	Amischa decipiens (Sharp)	4	
	Astenus longelytratus Palm	1	
	Atheta amplicollis (Muls. Rey)	9	
	Atheta atramentaria (Gyll.)	5	
	Atheta elongatula (Grav.) 13		
	Atheta fungi (Grav.)	2	
	Atheta graminicola (Grav.)	19	
*	*Atheta gyllenhali* (Thoms.)	1	**Indicator species**
*	*Atheta liliputana* (Bris.)	1	**Indicator species**
	Atheta volans (Scriba)	15	
	Calodera aethiops Grav.	1	
	Carpelimus corticinus (Grav.)	1	
	Cypha laeviuscula (Mannh.)	1	
*	*Gabrius keysianus* Sharp	3	**Indicator species**
	Gabrius nigritulus (Grav.)	1	
	Gnypeta carbonaria (Mannh.)	8	
	Megarthrus depressus (Payk.)	1	
	Ocypus olens (Müll.)	5	
	Paederus fuscipes Curt.	13	
	Philonthus carbonarius (Grav.)	1	
	Philonthus cognatus (Steph.)	1	
	Philonthus laminatus (Creutz.)	5	
	Philonthus quisquiliarius (Gyll.)	1	
	Quedius tristis (Grav.)	1	
	Sepedophilus nigripennis (Steph.)	1	
	Stenus boops Ljungh	4	
	Stenus canaliculatus Gyll.	71	
	Stenus clavicornis (Scop.)	1	
	Stenus juno (Payk.)	32	
	Stenus melanopus (Marsh.)	3	
	Tachyporus chrysomelinus (L.)	6	
	Tachyporus hypnorum (F.)	1	
	Tachyporus nitidulus (F.) 21		
	Tachyporus pusillus Grav.	3	

1.4.4 Evaluation

Of <u>average</u> conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of three indicator species indicates an ecologically well developed site. However, further investigation of this large site is required before it can be rated as a whole.

1.4.5 References

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1.5 SUMMARY AND EVALUATION

Lady's Island Lake is a large (c. 450 ha), **natural sedimentary lagoon** and therefore qualifies for protection under the Habitats Directive. It is one of the largest and possibly the best example of a true lagoon in the whole of Europe. It is also of international importance for its ornithological value as a breeding site for endangered tern species.

The lake is a Refuge for Fauna, an SPA and a proposed NHA (Site Code No. 704).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	Exceptional
Aquatic Fauna	High
Vegetation	High
Ecotonal Coleoptera	Average

Geomorphology

Lady's Island Lake is a large, **natural sedimentary lagoon**, It is one of the largest and possibly the best example of a true lagoon in the whole of Europe

The sequence of back-barrier washover and seepage structures are among the best examples in Europe (Orford and Carter 1982).

The lake is rated as of exceptional conservation value as one of the best examples of its type in Europe and for its large size, relative naturalness and documentation.

Aquatic Fauna

A total of 38 species was recorded, of which 8 were lagoonal specialists, the highest number for any of the 20 selected sites. In addition to lagoonal specialists, a large number of both limnic and marine species were also present, despite the fact that the survey was carried out late in the season (October) and weather conditions were poor. Interesting species included *Notonecta viridis* and *Sigara concinna,* the latter only recorded from the south coast during this survey.

The large size of the lake (450 ha.), a strong N-S salinity gradient, regular breaching of the barrier and a wide range of substrate types explains the high level of species richness reported in this and other surveys. This is not always apparent, however, because the community undergoes wide fluctuations in species composition and abundance due to breaching.

Lady's Island Lake

The lake is rated as of high conservation value for its high diversity, high proportion of lagoonal species and documentation.

Vegetation

This large site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared with most other sites. Six transects were carried out at the lagoon and one in a semi-isolated pool in the south west of the site.

Ruppia was found at all six lagoon transects, with a cover of 50% or more at three of these. It is notable that both *Ruppia cirrhosa* and *R.maritima* occur here. This is one of the three Irish sites at which *Lamprothamnium papulosum* had been recorded prior to this survey. This rare charophyte was found in the course of this survey at the western end of the barrier and in a sheltered bay in the north east corner. Its presence alone qualifies this as a valuable site. Marginal vegetation does not seem to be of particular interest here. *Scirpus maritimus*, *Schoenoplectus lacustris ssp. tabernaemontani* and *Phragmites australis* swamps all occur at this site, but are nowhere extensive. *Juncus gerardii* dominated salt tolerant community occurs on more open shores.

The basis for the designation of Lady's Island Lake as valuable is the presence of *Lamprothamnium papulosum* and both *Ruppia* species and the apparent wide distribution of all these species.

Further survey is recommended

Ecotonal Coleoptera

Thirteen species of carabid and thirty-six species of staphylinid were recorded, three species of which are regarded as indicator species.

Although *Atheta gyllenhali* is not listed by Hyman and Parsons as being rare or notable in Great Britain, it appears to be local or rare throughout Europe. There are two Irish records. The species is stenotopic, restricted to marshes, alder carr and bogs. There is only one previous Irish record of *Atheta liliputana* (Pollardstown Fen. Co. Kildare) which is cited as rare in Scandinavia and Central Europe . The species may be associated with birds (carrion, faeces, etc.), and is described as a stenoptopic woodland species. However, it has been recorded from grassy salt meadow habitat and it is possible that it may be associated with the tern colony at this site. *Gabrius keysianus* , also recorded from Kilkeran Lake, is a halobiont water margin species, widespread but local in England and Wales, and generally local and mostly rare in western Europe. It has been previously recorded in Ireland.

The site is rated as of average conservation value for terrestrial ecotonal community, due to the fact that the presence of three indicator species indicates an ecologically well developed site. However, further investigation of this large site is required before it can be rated as a whole.

Lady's Island Lake

Summary

The lake is a very large, natural sedimentary lagoon, which is still largely natural, although current management practices are controversial and effective solutions to the conflicting interests are subject to financial constraints. The lagoon and barrier are good examples of geomorphological types and there is a long history of scientific investigations. The lagoon is the best documented in Ireland and scientific studies are ongoing. Of particular interest are local geomorphological processes and the effects of the fluctuating conditions on fauna and flora. No particularly rare species were recorded during this brief survey, but many are "interesting" lagoonal specialists.

The lake is of great local importance and is of immense scenic value

In conclusion, Lady's Island Lake is regarded as of exceptional conservation value and is highly recommended as a proposed SAC.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

2. TACUMSHIN LAKE

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

2. TACUMSHIN LAKE

CONTENTS

2. TACUMSHIN LAKE, Co. Wexford

OS Grid Reference: T 050065. 1:50 000 Sheet No: 77
Alternative names: Tacumshane Lake

2.1 STUDY AREA

General features

Tacumshin Lake is a natural, brackish, percolating lagoon, situated a little over 1 km west of Lady's Island Lake and 14 km southwest of Wexford (Fig. 2.1.1). It lies behind a sand and gravel barrier which is at present closed but geomorphological studies of the barrier, and a comparison of the 1840, 1925 and recent maps, indicate that an outlet has existed intermittently at the westward end but has shifted locality several times (Carter and Orford 1980, Ruz 1989). A natural outlet existed prior to 1972-73 when it became sealed by natural processes.

At least four artificial outlets have been cut in the past 100 years, all of which have been short-lived owing to rapid siltation by beach sand. In 1975, a pipeline was installed through the barrier and a series of drainage channels excavated in the lake bed. Until the pipe became blocked in the late 1980s, the lake was generally dry in summer and filled with water in winter. In the last five years, flooding of arable farmland has created a need for a more reliable method of water level control. In summer 1996, six pipes were installed which drained the lake exposing most of the substrate, but the pipes are not yet fully functional and at the time of faunal sampling (beginning of October) there was water to a depth of at least 1 m in the eastern sector.

The lake holds internationally important numbers of Brent geese (*Branta bernicla hrota*) and nationally important numbers of 11 waterfowl species. The low water levels attract a diverse assemblage of waders including many rare vagrants (Sheppard 1993, Hutchinson 1994). The maximum waterfowl count in the winter of 1994/5 was over 16,000 (Delany 1995). The lake is a proposed NHA (Site Code No.00709) and proposed SPA.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6.5°C in January and 15°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is around 10 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 900 mm, and the number of rain days (1 mm or more) is <150. Winds are mainly from the southwest. Mean annual hourly wind speeds are 5.9 m/s and a maximum wind speed of 47 m/s is estimated to occur once in 50 years. The mean annual number of hours of bright sunshine is 1700 which is the highest for the country. Mean relative humidity is around 85% as on all Irish coasts.

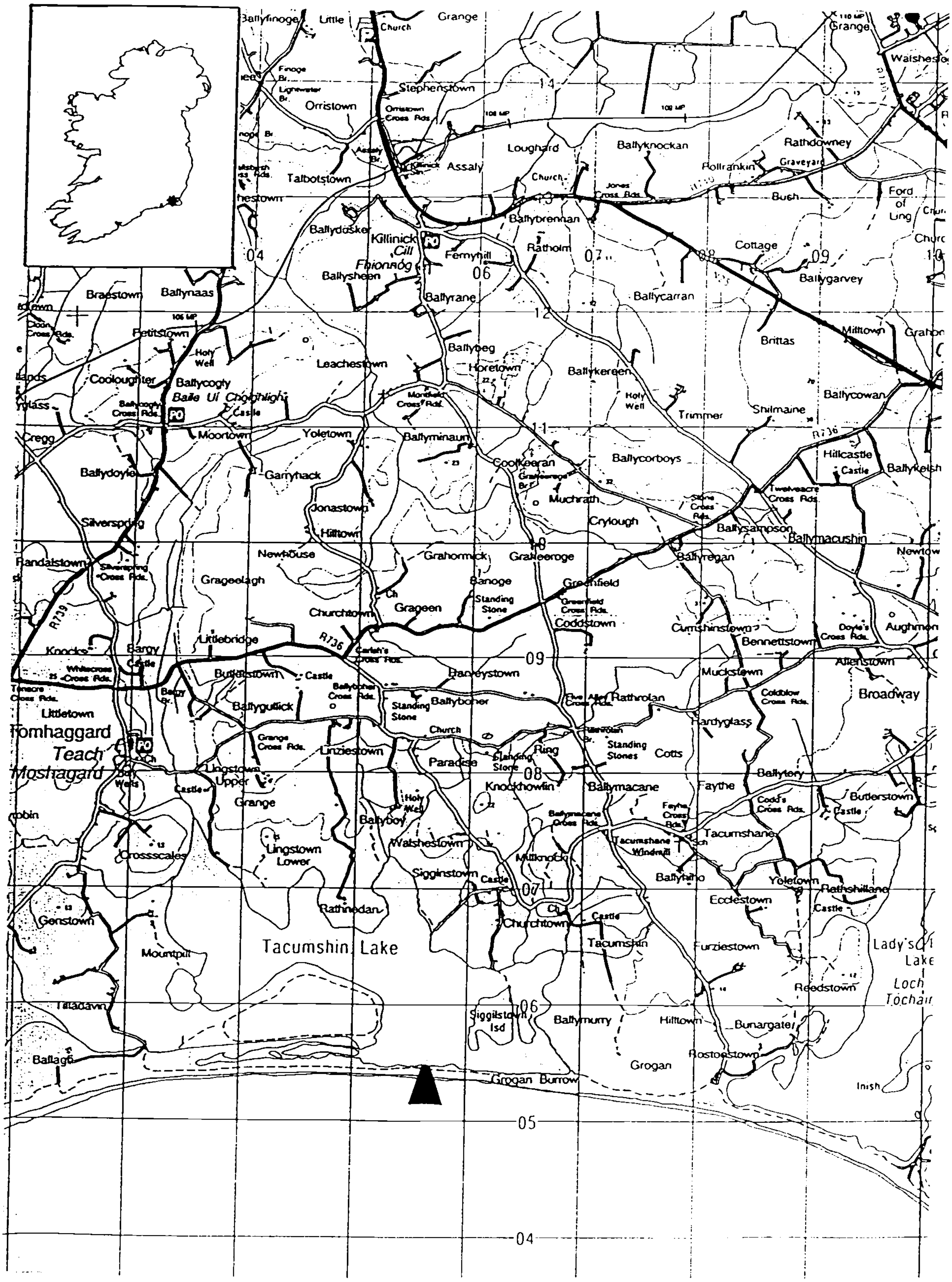

Fig. 2.1.1 Section of 1:50 000 map showing locality of Tacumshin Lake

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, but inshore breakers rarely exceed 4.5 m with extremes reaching 8.5 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 18-20 m (Couper 1984). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Rosslare is 3.1 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology
A complex series of glacial deposits overlies a relatively flat Lower Palaeozoic bedrock (Carter and Orford 1982). Surface geology consists largely of till derived from shales and slates, producing mostly wet mineral soils. Although situated close to Lady's Island L., the underlying geology of Tacumshin L. is quite different, producing a shallow lake of finer, softer sediments. The area surrounding the lake is flat, consisting almost entirely of grazing or arable land.

Lake topography
The lake is 3.5 km E-W by about 2 km N-S. The total area of the lake as shown on the 6" map is approximately 450 ha but much of the former bed is now taken over by reed beds and the area of open water, even in winter is much less. Sediments grade from soft sandy mud in the north to coarse, sandy gravel near the barrier. There are few stones and no conspicuous rocks.

Geomorphology of the barrier
Barrier systems extend uninterrupted for 12 km from Carnsore Point to near Kilmore Quay. Early explanations for lagoon formation in the area suggested that they became isolated by westward migrating spits (Lowry and Carter 1981), but later studies showed that the barrier on this part of the coast has been, and still is, moving onshore by a "rolling-over" process rather than extending alongshore (Orford and Carter 1982).

The gravel-dominated barrier at Tacumshin is overlain with small aeolian dunes. It is divided into two distinct parts: Grogan Burrow in the east is stable with a well-vegetated dune crest about 4 m high, while Mountpill Burrow in the west is lower with a sparsely vegetated crest of only 1-2 m (Orford and Carter 1984, Ruz 1989) (Fig. 2.1.2). A series of 53 washover fans has been identified west of the drainage pipe, at intervals of 30-40 m, becoming closer toward the western end of the spit. Those in the eastern sector were no longer active in the mid 1980s but overwash was frequent in the western sector (Orford and Carter 1984) (Fig. 2.1.2) Attempts to reduce overwash in this region by piling up beach sediments, planting marram grass and, more recently, by placing straw bales, have resulted in little accretion owing to the scarcity of beach sand.

Sediments grade from fine grit to coarse sand, becoming finer toward the west where the median grain size is 0.28 mm (2 ϕ) (Ruz 1989). The fine sediments are associated with a gentle foreshore slope, formed in response to the low wave energy of this sector. There appear to have been only short-term periods of net accretion on the western sector of the barrier and it has been suggested that its instability is due in part

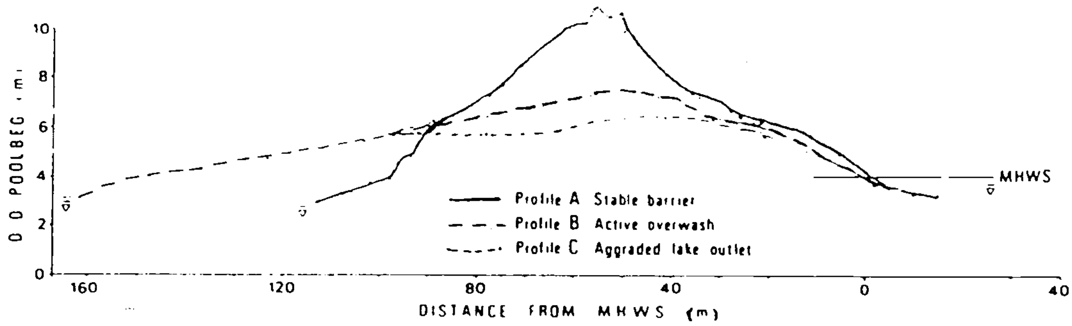

Fig. 2.1.2 (a) Tacumshin Lake barrier. Profiles at three different areas. (From Orford and Carter, 1984).

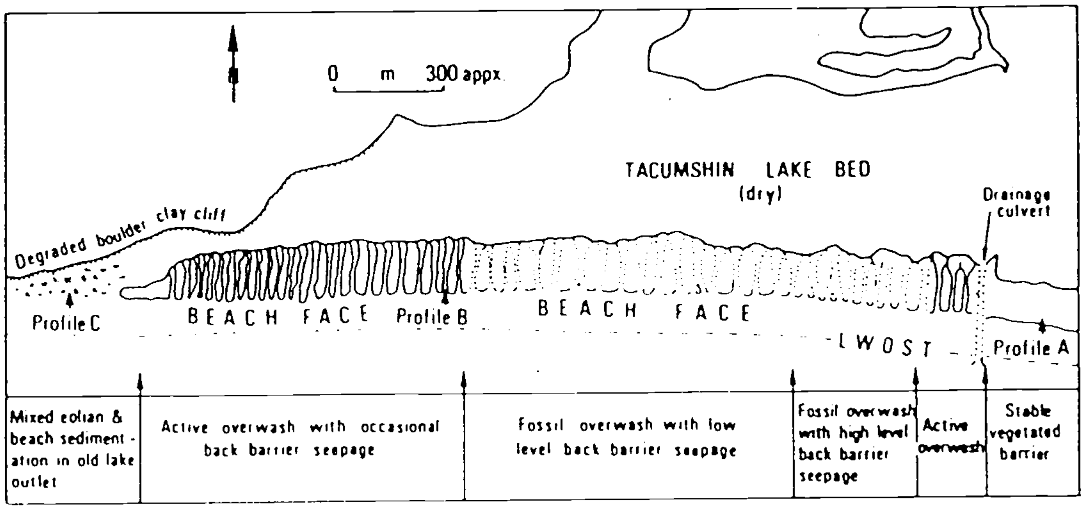

Fig. 2.1.2 (b) Tacumshin Lake barrier. Overwash sites along the western sector (Mountpill Burrow)., (From Orford and Carter, 1984).

to human activities which interfere with natural barrier processes (Carter and Orford 1980).

Hydrology.
The coarse sediments of the barrier allow extensive seaward seepage which is sufficient to prevent the formation of outlet streams. Their absence is said to be characteristic of percolation lagoons.

The hydrological regime of Tacumshin Lake, even in the absence of artificial drainage, is quite different from that of Lady's Island Lake because the geology is different. The average retention time for water is only 270 days compared with 2200 in Lady's Island Lake and the seepage potential of the barrier is sometimes unable to cope with this so that an outlet forms which may seal again during periods of drought (Orford and Carter 1982). In the absence of an outlet/inlet, seawater enters the lake by both washover and also landward seepage streams, both occurring in the western sector. Freshwater enters by a number of small streams in the north and west and as runoff from surrounding land.

Water depth is probably never more than a metre or so except in a few areas in the east and in old or recently cut artificial channels. At present, the water level in the lake depends on the efficiency of artificial drainage. The six pipes recently installed should allow sufficient water to accumulate in winter to support the important waterfowl population.

Salinity and water quality. Seawater at approximately 34‰ enters the lagoon by percolation through the barrier, by seepage streams, by washover, and by salt spray being washed into the lagoon from the barrier. Salinities between 0 and 26‰ have been recorded in the lagoon as a whole (Galvin 1991, Healy unpublished). Temporary algal blooms sometimes occur following flooding after a period of drought but these are probably natural.

2.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

2.2.1 Methods

Environmental variables

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K. ‰. precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling.

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988) Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

No fyke nets were used at this site as water levels were too low.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

2.2.2 Results

The lake was sampled on 1.vii.96 during the first part of the survey and from 1-3.x.96 during the more intensive survey.

Five sampling stations were selected in the lake to reflect the influences of substrate, freshwater and marine inflows. Positions of the sampling stations are shown in Fig. 2.2.1

Environmental Variables

Station A (OS 0569 0666) was located in the northern shore of the lake (Plate 2.2.3) where open water exists for much of the year. Substrate consisted of silty sand, organic mud and occasional stones; water depth varied from 0 - 60 cms., and salinity measured 8 ‰.

Station B (OS 0345 0565) was located at the southwestern end of the lake in a deep drainage channel (Plate 2.2.4). Water depth varied from 0 - 1.5 m in the area sampled, substrate was sand, gravel and organic mud and salinity measured 3-5 ‰..

Station C (OS 0295 0542) was located at the southwestern end of the lake close to the barrier in what appeared to be the channel of the old outlet (Plate 2.2.5). Substrate consisted of fine sand and silt with occasional smooth stones. water depth varied from 0 - 60 cms and salinity measured 18 ‰ .

Station D (OS 0599 0548) was located in the southeastern corner of the lake close to the barrier. Substrate consisted soft organic mud and fine silty sand. Water depth was extremely shallow (0 - 20 cms) and salinity measured 19‰.

Station E (OS 035 075 aprox.) was located in the northwest area of the lake where a road leads to the lagoon from Tomhaggard (Plate 2.2.6). This area was sampled during the first part of the survey (June) when salinity measured 0 ‰ but was dry in October.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 2.2.1. Among 40 taxa listed, 38 are identified to species. One of the species is poly-mesohaline, 7 are euryhaline, 8 are oligo-mesohaline, and 19 are limnic. No live marine species were recorded (Table 2.2.2). Six of the species are listed as lagoonal specialists in Britain (Davidson *et al.* 1991). Benthic species were probably undersampled and only small fish were collected because fyke nets were not used.

Differences between stations are explained by the wide variation in salinity and opportunities for colonisation from the sea. At C, where overwash and landward seepage streams are frequent, *Hydrobia ventrosa* was present and the presence of *Pomatocerus* tubes indicates direct colonisation from the sea in the recent past. However, corixids and notonectids were numerous at this site, including many limnic species suggests that salinity at this station is often much lower than 18‰. Both

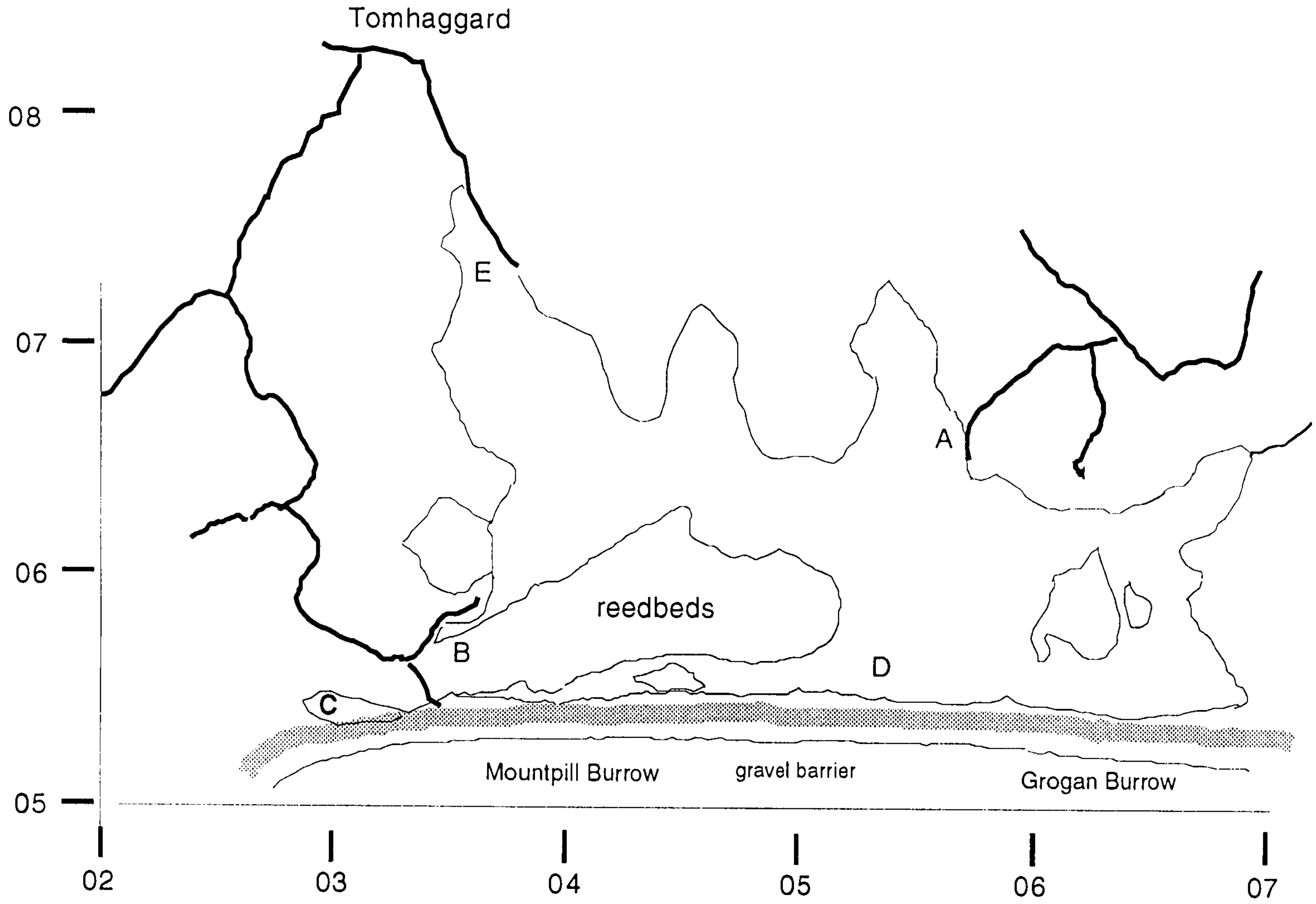

Fig. 2.2.1 Location Map of Sampling Stations in Tacumshin Lake, Co. Wexford

Table 2. 2.1. Fauna Recorded at Tacumshin Lake, Co. Wexford. July and October, 1996
( ) = records from July.

Fauna			Sampling Stations (L.T. = light-trap)						
		A	L.T.A	B	L.T.B	C	L.T.C	D	E
Porifera									
Cnidaria									
Turbellaria									
Nemertea									
Annelida	*Hediste diversicolor*	c				c		+	
	Pomatoceros triqueter					shells			
Crustacea									
Ostracoda									
Copepoda									
Cirripedia	*Balanus improvisus*					shells			
Mysidacea	*Neomysis integer*		1	1 (c)		1			
Isopoda	*Lekanesphaera hookeri*	c	>100	+	<100	c	2		(+)
	Asellus sp.								(+)
Amphipoda	*Gammarus salinus*	+	+	+		+	+		
Tanaidacea									
Decapoda	*Palaemonetes varians*	+	?	a	>100	c	2		
Arachnida						+			
Insecta									
Thysanura									
Ephemeroptera									
Odonata	*Ischnura elegans*	1		+		a			
Plecoptera									(+)
Trichoptera									
Hemiptera	*Gerris odontogaster*					+			
	G. thoracicus					+			
	Notonecta glaucum			+		+			
	N. viridis		+	+		a			
	Plea leachi			+		1			
	Corixidae	+		a	>100	a	c100		
	Callicorixa praeusta	+	+	+		c			(a)
	Corixa punctata			(+)					(a)
	C. panzeri		+	+		+	+		
	Hesperocorixa linnaei					+			
	Sigara dorsalis			a	+	+			(+)
	S. concinna					+	+		
	S. stagnalis	+		a	a	+	a		
Coleoptera				+		+			(+)
	Colymbetes fuscus			+					
	Enochrus halophilus	+							
	Gyrinus caspius			+					
	Hydrobius fuscipes								(+)
	Hydroporous planus			+					
	Hygrotus impressopunctatus	+							
	H. inaequalis			+					
	Laccophilus minutus			+					
	Noterus clavicornis	+		+					
	Rhantus frontalis	+		+			+		

+ = present; o = occasional; a = abundant.

Table 2. 2.1 cont.. Fauna Recorded at Tacumshin Lake, Co. Wexford. July and October, 1996
( ) = records from July.

Fauna			Sampling Stations (L.T. = light-trap)						
		A	L.T.A	B	L.T.B	C	L.T.C	D	E
Diptera	Chironomidae	c		+		a		+	(+)
Mollusca									
Prosobranchia	*Hydrobia ventrosa*					5			
	Potamopyrgus antipodarum	c		3		11			(+)
Pulmonata	*Lymnaea peregra*			+					(+)
	L. palustris			+					
	Planorbis leucostoma			+					(+)
Opisthobranchia									
Bivalvia	*Cerastoderma glaucum*	shells							
Bryozoa									
Echinodermata									
Tunicata									
Teleostei	*Gasterosteus aculeatus*	a	c100	+	15	a	>100	?	(+)
	Pungitius pungitius			1					

+ = present; o = occasional; a = abundant.

ragworm (*Hediste diversicolor*) and chironomid larvae were plentiful at A indicating that if summer drainage had exposed the lake bed at this station it was for a short period only. The presence of 12 limnic species at B, including 3 pulmonate snails and a fish, i.e. species with relatively low reproduction and dispersal rates, suggests that the salinity remains low at this station.

Shells of *Cerastoderma glaucum* were present at station A but no live specimens could be found. A thriving population was present in 1977 in an area of the southeast known locally as the "cockle lake", and live specimens were taken at station A in 1991 (Galvin 1992).

Table 2.2.2 Ecological categories of the recorded taxa in Tacumshin Lake L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	None	
Poly-mesohaline	*Hydrobia ventrosa*	L
Euryhaline	*Hediste diversicolor*	
	Neomysis integer	
	Lekanesphaera hookeri	L
	Gammarus zaddachi (salinus?)	
	Palaemonetes varians	L
	Sigara stagnalis	L
	Gasterosteus aculeatus	
Oligo-mesohaline	*Potamopyrgus antipodarum*	
	Ischnura elegans	
	Gerris thoracicus	
	Notonecta viridis	
	Sigara concinna	L
	Plea leachi	
	Enochrus halophilus	L
	Gyrinus caspius	
Limnic	*Gerris odontogaster*	
	Notonecta glaucum	
	Callocorixa praeusta	
	C. punctata	
	C. panzeri	
	Sigara dorsalis	
	Hesperocorixa linnaei	
	Colymbetes fuscus	
	Hydrobius fuscipes	
	Hydroporus planus	
	Hydrotus impressipunctatus	
	H. inaequalis	
	Laccophilus minutus	
	Noterus clavicornis	
	Rhantus frontalis	
	Lymnaea peregra	
	L. palustris	
	Planorbis leucostoma	
	Pungitius pungitius	

2.2.3 Discussion

The faunal assemblage of the lake as a whole is characteristic of lagoon waters with generally low to very low salinities but subject to occasional influxes of seawater in confined areas of the system. The fauna at A and B was dominated by insects with beetles especially diverse. Station E, which held a range of limnic species in July but was not intensively sampled, was completely dry at the beginning of October, thus the limnic element in the fauna may have been undersampled.

According to Southwood and Leston (1959) *Notonecta viridis* was only reported for Wexford and north Kerry. It has since been recorded at this site by Healy *et al.* (1982) and by Galvin (1992). It was found at Tacumshin L., Kilkeran L.and L. Donnell during this survey. *Plea leachi* and *Gerris thoracicus* were not recorded at any other site during this survey although both are regarded as slightly brackish species. *Sigara concinna* was described as rare in Ireland (Southwood and Leston 1959) but was found also at Lady's Island L. and Kilkeran L. during this survey.

Pungitius pungitius is listed in the Irish Red Data Book (Whilde 1993) as a "near threatened" species needing to be closely monitored.

2.2.4 Threats

The current flood-management scheme results in excessive drainage of the lake exposing extensive areas of the substrate, causing mortality of some fauna.

Attempts to limit overwash are considered to be inappropriate by geomorphologists.

2.2.5 Evaluation

Tacumshin Lake is a large, **natural sedimentary lagoon** and is therefore of international importance. It is one of the largest and possibly the best example of a true lagoon in the whole of Europe. It is also of international importance for Brent geese and nationally important for 11 waterfowl species.

The site is rated as of international geomorphological importance in spite of interference with natural processes. There is extensive documentation of the Tacumshin barrier morphology and processes.

The aquatic fauna was rich with 40 taxa recorded of which 7 are lagoonal specialists. Insects were abundant and Corixidae and Coleoptera were particularly diverse and include one rare backswimmer. The assemblage typifies a low salinity lagoon with a consistently high input of freshwater, and few opportunities for colonisation from the sea.

The lake is of outstanding ornithological interest and is a proposed SPA and a proposed NHA (Site Code 709).

In conclusion, Tacumshin Lake is regarded as of exceptional conservation value and highly recommended as a proposed SAC.

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Plate 2.2.1 View of seaward end of drainage pipe running through the barrier of Tacumshin Lake.

Plate 2,2.2 View of landward end of drainage pipe in the barrier of Tacumshin Lake, showing drainage channels.

Plate 2.2.3 View of the northeast area of Tacumshin Lake, Station A.

Plate 2,2.4 View of southwestern area of Tacumshin Lake, Station B.

Plate 2.2.5 View of southwestern area, near the barrier of Tacumshin Lake, Station C

Plate 2.2.6 View of northern area of Tacumshin Lake taken on 1st. July, Station E

2. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

2.3.1 Site description

The surrounding landscape is fairly low-lying with pastoral farmland to the north, east and west. The barrier lies to the south.

Several freshwater streams flow into the lagoon from the north.

The main features of the shoreline, including marginal vegetation, are shown in Fig. 2.3.1. Shores are generally shallow sloping and vegetated. Swamp vegetation occurs in extensive stands in sheltered bays. Two bays in the north west of the site are almost entirely filled with emergent swamps, predominantly of *Phragmites* and *Schoenoplectus lacustris*. More open shores occur on promontories in the north central area, the north east and east.

2.3.2 Methods

This site was surveyed using transects only. The locality of these is shown in Fig. 2.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

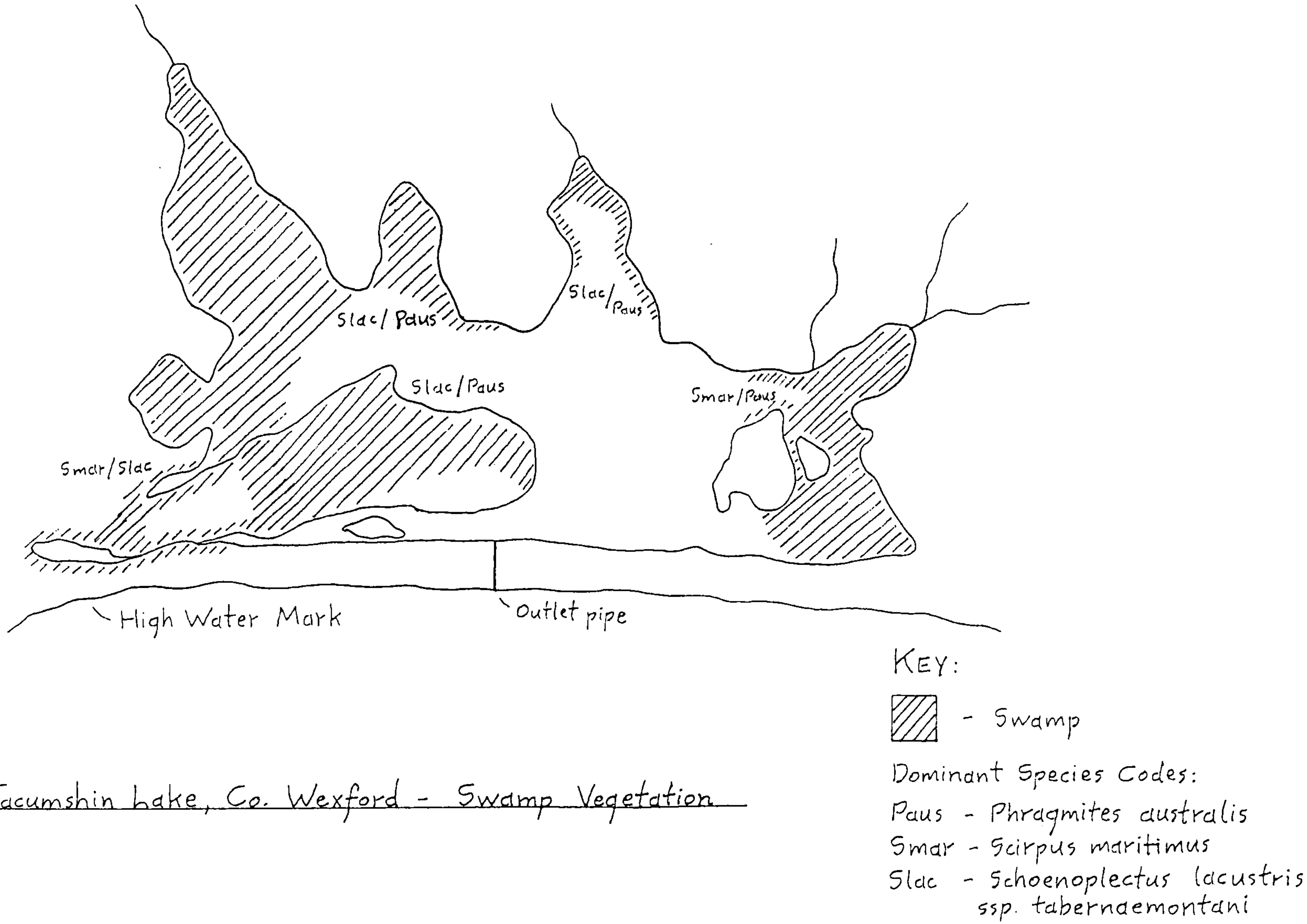

Fig. 2.3.1 Tacumshin Lake, Co. Wexford - Swamp Vegetation

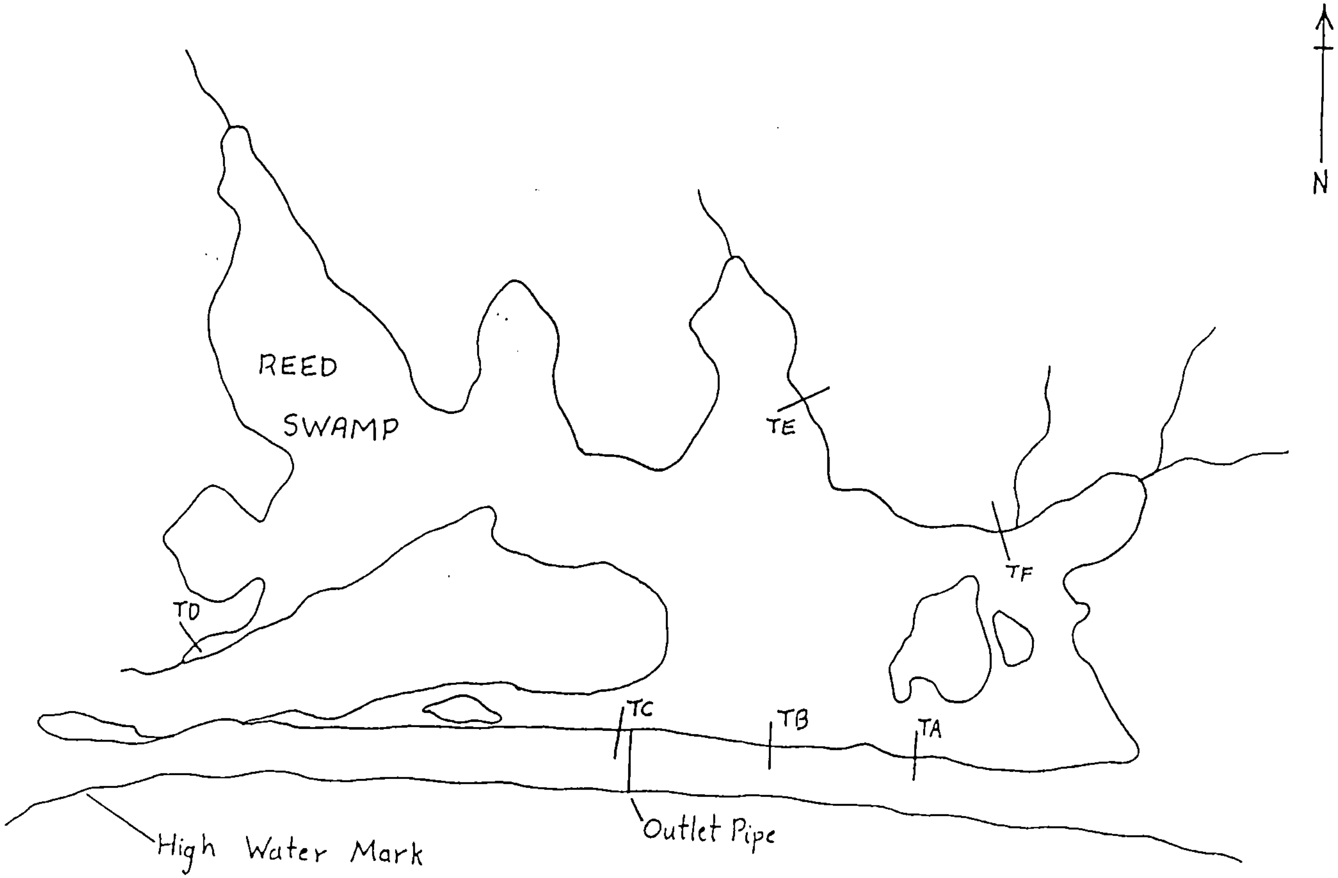

Fig. 2.3.2 Tacumshin Lake, Co.Wexford: Location of Transects

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

<u>Cover/Abundance Values</u>
Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

<u>Frequency Values</u>
Frequency of each species within the total number of samples is expressed as follows:

Frequency V	81-100 %
IV	61-80 %
III	41-60 %
II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

2.3.3 Results

Transect tables

Site: Tacumshin Lake	Transect code: A	
Location: Barrier - Eastern end	Sample point: 1 Aquatic - 20m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 30 cm	Salinity: 26 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Ruppia c.f. maritima	15	5
Description: Sparse low growing Ruppia only.		

Site: Tacumshin Lake	Transect code: A	
Location: Barrier - Eastern end	Sample point: 2 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 20cm	Salinity: 26 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		40
Ruppia c.f. maritima	30	40
Description: Patchy cover of Ruppia only.		

Site: Tacumshin Lake	Transect code: A	
Location: Barrier - Eastern end	Sample point: 3 Aquatic - 5m out	
Sample area: 25m (5x5)	Substrate: Silt, sand	
Depth: 10cm	Salinity: 26 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		70
Ruppia c.f. maritima	30	70
Description: Increasing patchy Ruppia cover.		

Site: Tacumshin Lake	Transect code: A	
Location: Barrier - Eastern end	Sample point: 4 Marginal	
Sample area: 16m2 (8x2)	Substrate: Sand	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		90
Juncus gerardii	50	90
Agrostis stolonifera	15	15
Glaux maritima	8	5
Aster tripolium	40	5
Triglochin maritima	20	< 1
Atriplex patula	4	< 1
Description: Tall dense cover of dominant Juncus gerardii with patchy Agrostis stolonifera		
among species-poor salt tolerant community. 6m.		
Backing open vegetation dominated by Tripleurospermum maritimum and		
Armeria maritima with sparse Plantago coronopus. 10m.		
Grading to Ammophila arenaria - Festuca rubra dune grassland (barrier).		

Site: Tacumshin Lake	Transect code: B	
Location: Barrier - Seawater seepage point	Sample point: 1 Aquatic - 30m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 40 cm	Salinity: 35 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Ruppia c.f. maritima	40	100
Description: Dense single species Ruppia bed. Some plants in bud. This stand extends		
20 - c.50m out.		

Tacumshin Lake

Site: Tacumshin Lake	Transect code: B	
Location: Barrier - Seawater seepage point	Sample point: 2 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 10 cm	Salinity: 35 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Ruppia c.f. maritima	10	5
Description: Ruppia now sparse and low growing. Same species at more or less same cover		
0 - 20m out.		

Site: Tacumshin Lake	Transect code: B	
Location: Barrier - Seawater seepage point	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand, gravel	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		50
Suaeda maritima	10	25
Glaux maritima	3	25
Salicornia agg.	2	< 1
Spergularia marina	3	< 1
Aster tripolium	6	< 1
Tripleurospermum maritimum	4	< 1
Description: Suaeda and Glaux co-dominant among open species-poor salt tolerant shore		
community. 18m.		
Backing Ammophila arenaria - Festuca rubra dune grassland (barrier).		

Site: Tacumshin Lake	Transect code: C	
Location: Barrier - Outlet pipe	Sample point: 1 Aquatic - 5m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 40 cm	Salinity: 30 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		< 1
Ruppia c.f. maritima	20	< 1
Description: Sparse fairly low growing Ruppia only.		

Site: Tacumshin Lake	Transect code: C	
Location: Barrier - Outlet pipe	Sample point: 2 Marginal	
Sample area: 20m2 (10x2)	Substrate: Silt	
Depth: 0 - 40cm	Salinity: 28 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Scirpus maritimus	160	100
Description: Tall dense single species Scirpus swamp forming 3m strip for 12m along shore.		

Site: Tacumshin Lake	Transect code: C	
Location: Barrier - Outlet pipe	Sample point: 3 Marginal	
Sample area: 20m2 (10x2)	Substrate: Sand, gravel	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Scirpus maritimus	90	20
Agrostis stolonifera	30	95
Glaux maritima	15	< 1
Description: Open Scirpus cover with dense Agrostis stolonifera dominant below and sparse		
Glaux the only associated species. 3m.		
Backing Ammophila arenaria dune grassland (barrier).		

Site: Tacumshin Lake	Transect code: D	
Location: Sheltered channel	Sample point: 1 Aquatic - 8m out	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 80 cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Potamogeton pectinatus	50	100
Description: Dense single species stand of Potamogeton pectinatus extending from 5 - 10m		
out.		
Width of channel c.40m.		

Site: Tacumshin Lake	Transect code: D	
Location: Sheltered channel	Sample point: 2 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 60 cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Potamogeton pectinatus	40	5
Description: Potamogeton pectinatus now sparse, remaining mono-dominant. Cover more or		
less constant 0 - 5m out.		

Site: Tacumshin Lake	Transect code: D	
Location: Sheltered channel	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 20 - 60 cm	Salinity: 3 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	140	100
Description: Dense single species S. lacustris swamp. 35m.		

Site: Tacumshin Lake	Transect code: D	
Location: Sheltered channel	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 20 cm	Salinity: 3 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	140	80
Scirpus maritimus	120	10
Agrostis stolonifera	40	50
Triglochin maritima	70	10
Description: Fairly dense Schoenoplectus dominated swamp with frequent Scirpus maritimus.		
Agrostis stolonifera patchy below with frequent Triglochin. 40m.		

Site: Tacumshin Lake	Transect code: D	
Location: Sheltered channel	Sample point: 5 Marginal	
Sample area: 16m2 (4x4)	Substrate: Not known	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus gerardii	40	50
Agrostis stolonifera	30	40
Potentilla anserina	25	15
Glaux maritima	10	< 1
Aster tripolium	40	< 1
Triglochin maritima	50	< 1
Oenanthe lachenalii	40	< 1
Description: Juncus gerardii and Agrostis stolonifera co-dominant with frequent Potentilla		
and a few sparse salt tolerant associates. 25m.		
Backing flood embankment (height 3m, slope 45 degrees) with Festuca rubra and		
Rubus fruticosus dominant.		
Backing low lying Lolium perenne pasture.		

Site: Tacumshin Lake	Transect code: E	
Location: Marginal swamp	Sample point: 1 Aquatic - 40m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 80 cm	Salinity: 18 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		100
Potamogeton pectinatus	80	100
Algae		10
Filamentous algae		10
Description: Dense bed of Potamogeton pectinatus with sparse filamentous algae. Same species at more or less same cover 20 - c.45m out.		

Site: Tacumshin Lake	Transect code: E	
Location: Marginal swamp	Sample point: 2 Aquatic - 15m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 50 cm	Salinity: 18 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		40
Higher Plant		35
Ruppia c.f. maritima	6	30
Potamogeton pectinatus	25	5
Algae		10
Filamentous algae		10
Chara canescens	8	< 1
Description: Open cover of low growing Ruppia dominant with sparse Potamogeton and filamentous algae. Chara canescens very sparse. Same species at more or less same cover 8 - 20m out.		

Site: Tacumshin Lake	Transect code: E	
Location: Marginal swamp	Sample point: 3 Aquatic - 5m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 30 cm	Salinity: 18 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		80
Potamogeton pectinatus	50	75
Ruppia c.f. maritima	20	5
Algae		5
Filamentous algae		5
Description: Potamogeton pectinatus dominant in fairly dense stand with sparse Ruppia and		
filamentous algae. Same species at more or less same cover 0 - 8m out.		

Site: Tacumshin Lake	Transect code: E	
Location: Marginal swamp	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 30 cm	Salinity: 14 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	130	100
Agrostis stolonifera	40	5
Description: Dense S. lacustris swamp with sparse Agrostis cover increasing to landward.		
10m.		

Site: Tacumshin Lake	Transect code: E	
Location: Marginal swamp	Sample point: 5 Marginal	
Sample area: 100m2 (20x5)	Substrate: Not known	
Depth: 0 cm	Salinity: -----	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	100	30
Scirpus maritimus	80	20
Agrostis stolonifera	30	90
Glaux maritima	15	< 1
Description: Open cover of dominant Schoenoplectus lacustris with abundant Scirpus		
maritimus. Agrostis stolonifera forming dense ground cover. 8m.		

Site: Tacumshin Lake	Transect code: E	
Location: Marginal swamp	Sample point: 6 Marginal	
Sample area: 16m2 (4x4)	Substrate: Not known	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Agrostis stolonifera	40	80
Juncus gerardii	40	20
Festuca rubra	30	10
Potentilla anserina	15	10
Description: Agrostis dominant in dense cover with patchy Juncus gerardii and frequent		
Festuca rubra and Potentilla anserina. 15m.		
Backing arable farmland.		

Site: Tacumshin Lake	Transect code: F	
Location: Freshwater inflow	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 60 cm	Salinity: 13 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Potamogeton pectinatus	50	80
Description: Fairly dense single species Potamogeton pectinatus bed. Same species at more or less same cover 0 - 12m.		

Site: Tacumshin Lake	Transect code: F	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 40 cm	Salinity: 10 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Scirpus maritimus	120	90
Description: Dense single species Scirpus swamp. 120m.		

Site: Tacumshin Lake	Transect code: F	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 20 cm	Salinity: 4 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Scirpus maritimus	140	75
Schoenoplectus lacustris ssp tabernaemontani	160	< 1
Agrostis stolonifera	30	30
Description: Scirpus maritimus swamp with patchy ground cover of Agrostis stolonifera. 30m		

Site: Tacumshin Lake	Transect code: F	
Location: Freshwater inflow	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 20 cm	Salinity: 2 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	260	100
Description: Dense single species Phragmites swamp. 30m.		
Backing Agrostis stolonifera dominated community with frequent Ranunculus		
acris and Mentha aquatica. 5m.		
Grading to Lolium perenne - Dactylis glomerata pasture.		

2.3.4 Evaluation

<u>'Valuable'</u>

This large site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared with most other sites. Five transects were carried out at the lagoon itself and one at a channel at the western end of the site.

This is one of six Irish sites at which *Chara canescens* has been recorded since 1970. This rare charophyte was found on this occasion growing sparsely in a northern bay. It was also found in a western channel during a previous site visit. Its presence alone is reason enough to regard Tacumshin Lake as a valuable site.

Ruppia c.f. *maritima* was found at four out of five lagoon transects. It grows in occasional dense beds within 50 metres of the barrier shore.

Potamogeton pectinatus was found at the two northern transects and in a western channel, forming more or less dense beds at all of these.

A previous site visit found *Potamogeton pusillus, Zannichellia palustris, Myriophyllum spicatum* and *Ranunculus baudotii* at low salinities (0-4 parts per thousand) in western and north western channels amongst swamp vegetation.

Salinity range was great at time of survey (13-35 parts per thousand in the main body of the lagoon and 4 -35 parts per thousand taking the surveyed western channel into account). This variation is reflected in the relatively high degree of species diversity found at the site.

The most notable feature of the marginal vegetation is the extent of swamp species. *Phragmites* and *Schoenoplectus* beds fill the two north western bays and much of the south western area. These species and *Scirpus maritimus* fringe much of the north shore and are again extensive in the north central and the north eastern bayheads.

Tacumshin Lake is considered valuable for its species diversity and spatial salinity variation, for its extensive swamps and for the presence of *Chara canescens*.

Further survey is recommended.

2.4 ECOTONAL COLEOPTERA

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2.4.1 Site Description

Large coastal brackish lake with sand barrier with inflow percolation springs, overtopping, and a recently rebuilt artificial pipe, as sources of seawater. South-western dune breach has been closed for some years. Lake shore with medium-textured sand near coastal dune barrier, with sandflats which were exposed during late summer opening of pipe blockages (Plates 1 and 2). Marginal vegetation near barrier includes *Scirpus maritimus* and *Agrostis stolonifera;* also halophytic vegetation near percolation springs. *Phragmites communis* beds and other marsh vegetation with deep organic layer on interior inlet shores.

Subsites (see Fig. 2.4.1)

1. *Agrostis stolonifera* (T 033054)

Agrostis stolonifera with *Potentilla anserina* grading into *Scirpus maritimus* on sand. Sampled during rapid groundwater drawdown.

2. Percolation spring (T 056054)

Shallow banks of percolation spring with halophytic vegetation. Saline spring inflowing during high spring tide after heavy rain event (22 August 1996, salinity 9‰).

3. Bare sand near old breach (T 028053)

Bare sand (created by plough furrows) behind dunes of old breach area, flooded by water in winter.

2.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon

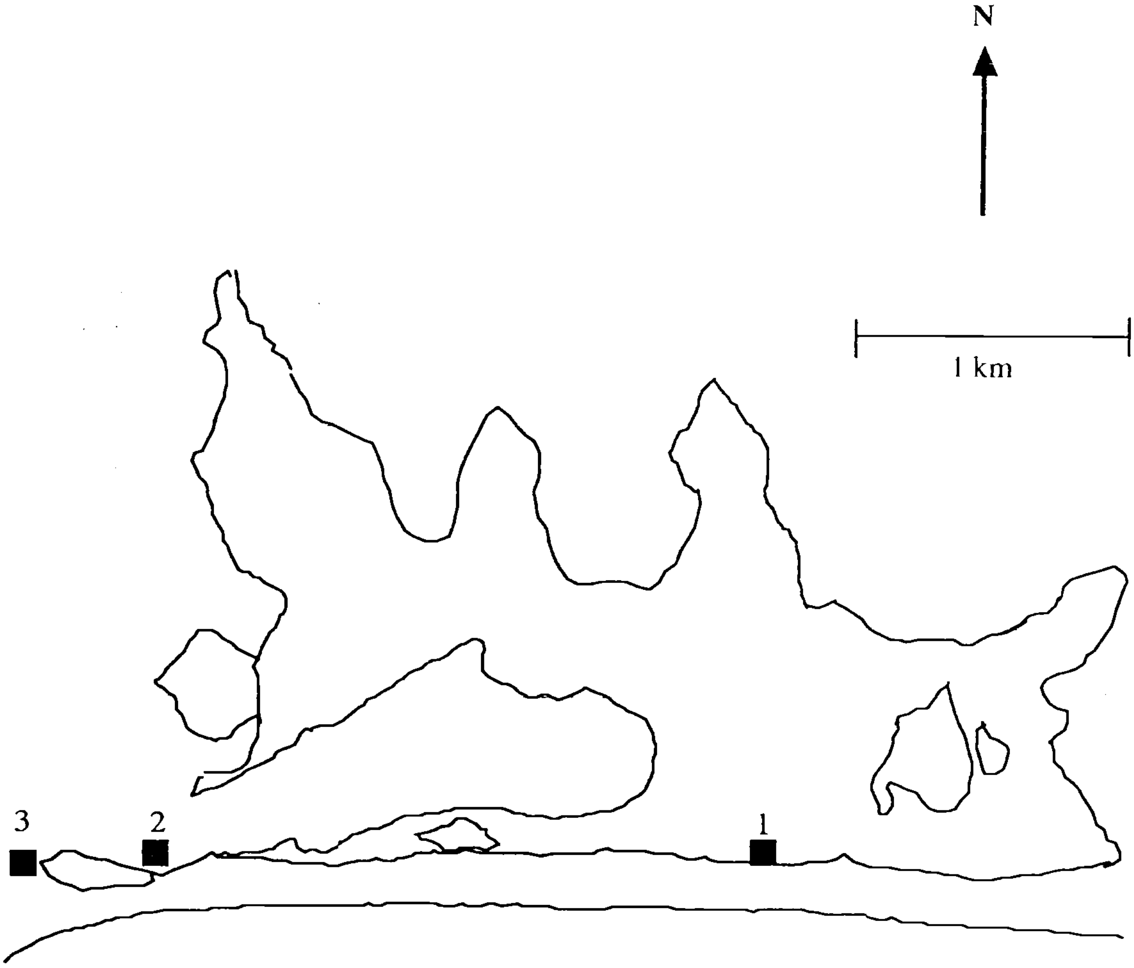

Fig. 2.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Tacumshin Lake, Co. Wexford

1 - Pitfall traps
2 - Pitfall traps, S-vac
3 - Ground search, Flotation

margins; <u>and</u>, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 2.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species

expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 2.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References

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Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Agrostis stolonifera* area - S-vac suction sampler (13 ix 1996), c. 2 m^2;
(2) *Agrostis stolonifera* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (13 ix - 8 x 1996);
(3) Percolation spring - 6 pitfall traps (23 viii - 13 x 1996);
(4) Bare sand near old breach - 1h ground search with flotation of *Bledius* burrows (18 vii 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

2.4.3 Survey Results

TABLE 2.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Tacumshin Lake. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

	Species	No. individuals	
Carabidae			
	Acupalpus parvulus (Sturm)	1	
	Agonum marginatum (L.)	8	
	Agonum pelidnum (Payk.)	14	
	Bembidion assimile Gyll.	4	
	Bembidion guttula (F.)	1	
	Bembidion varium (Ol.)	29	
	Dyschirius globosus (Hbst.)	4	
	Dyschirius luedersi Wagn.	11	
	Elaphrus cupreus Duft.	1	
	Pterostichus melanarius (Ill.)	1	
	Pterostichus niger (Schall.)	1	
Staphylinidae			
	Aleochara bipustulata (L.)	3	
	Aloconota gregaria (Er.)	1	
	Atheta amplicollis (Muls. Rey)	18	
	Atheta fungi (Grav.)	3	
	Atheta graminicola (Grav.)	43	
	Atheta melanocera (Thoms.)	4	
	Atheta volans (Scriba)	11	
	Bledius gallicus (Grav.)	6	
	Gabrius pennatus Sharp	1	
	Gabrius subnigritulus (Reitt.)	1	
	Gnypeta carbonaria (Mannh.)	3	
	Ischnopoda atra (Grav.)	2	
	Ocypus olens (Müll.)	6	
	Paederus fuscipes Curt.	18	
	Philonthus carbonarius (Grav.)	1	
	Philonthus micans (Grav.)	3	
	Philonthus quisquiliarius (Gyll.)	2	
	Philonthus varians (Payk.)	1	
	Stenus boops Ljungh	16	
	Stenus canaliculatus Gyll.	3	
	Stenus clavicornis (Scop.)	1	
	Stenus juno (Payk.)	10	
	Stenus melanopus (Marsh.)	4	
*	*Stenus nigritulus* Gyll.	1	**Indicator species**
	Tachyporus chrysomelinus (L.)	29	
	Tachyporus hypnorum (F.)	5	
	Tachyporus pusillus Grav.	2	

Eleven species of carabid and twenty-seven species of staphylinid were recorded, one species of which is regarded as an indicator species (Table 2.4.2).

A single individual of *Stenus nitidulus* was recorded from bare sand near the previous south-western breach area. The species is only known in Ireland from one record (1910) from Lough Neagh (Anderson 1984), although it was also found at Lough Murree (Co. Clare) during this survey. It is very local and declining in Britain (Hyman & Parsons 1994), and scattered and rare in France (Horion 1963). However, it is not rare in Fennoscandia, and is common in eastern Central Europe (Horion 1963). The species is restricted to marshy shores, including flooded meadows (Horion 1963), riverbanks and salt-marshes (Hyman & Parsons 1994), but also on sea shores (Koch 1989).

2.4.4 Evaluation

Coastal barrier area of <u>low</u> conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of only one individual of one indicator species indicates low conservation interest for the coastal barrier area. However, this is a large site, and priority was given to the coastal barrier. The interior redbeds and marshes may have a higher value. The large amount of disturbance due to dewatering (Plate 1) may render the coastal barrier part an unsuitable habitat, and the indicator species (*Stenus nigritulus*) may have its core population in the more marshy interior parts of the site.

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2.5 SUMMARY AND EVALUATION

Tacumshin Lake is a large (c. 450 ha), **natural sedimentary lagoon** and is therefore of international importance based on the Habitats Directive.

The lake is of outstanding ornithological interest, of international importance for Brent geese and nationally important for 11 waterfowl species. It is a proposed SPA and a proposed NHA (Site Code 709).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	Exceptional
Aquatic Fauna	High
Vegetation	High
Ecotonal Coleoptera	Low

Geomorphology

Tacumshin is one of the largest and best examples of a true lagoon in the whole of Europe. It is a large natural sedimentary lagoon with extensive documentation of the barrier morphology and processes. The lagoon has suffered from drainage attempts, water levels in the lagoon have been lowered by the installation of pipes through the barrier and excavation of drainage channels in the bed of the lake, but the lagoon and barrier itself are still of exceptional conservation value and merit better protection.

The site is rated as of exceptional conservation value for its size and special interest of the barrier which is well documented.

Aquatic Fauna

The aquatic fauna was rich with 40 taxa recorded of which 6 are lagoonal specialists. Insects were abundant and Corixidae and Coleoptera were particularly diverse and include one rare backswimmer (*Notonecta viridis*). The assemblage typifies a low salinity lagoon with a consistently high input of freshwater, and few opportunities for colonisation from the sea.

Plea leachi and *Gerris thoracicus* were not recorded at any other site during this survey although both are regarded as slightly brackish species. *Sigara concinna* was described as rare in Ireland but was found also at Lady's Island L. and Kilkeran L. during this survey. *Pungitius pungitius* is listed in the Irish Red Data Book as a "near threatened" species needing to be closely monitored.

Despite the fact that water levels are generally very low during the summer months, a surprisingly high number of species, including lagoonal specialists were recorded.

The lake is rated as of high conservation value for aquatic fauna on the basis of high diversity and the presence of somewhat rare species.

Vegetation

This large site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared with most other sites.

This is one of six Irish sites at which *Chara canescens* has been recorded since 1970. Its presence alone is reason enough to regard Tacumshin Lake as a valuable site. *Ruppia* c.f. *maritima* was found at four out of five lagoon transects. *Potamogeton pectinatus* was found at the two northern transects and in a western channel, forming more or less dense beds at all of these. A previous site visit found *Potamogeton pusillus, Zannichellia palustris, Myriophyllum spicatum* and *Ranunculus baudotii* at low salinities (0-4 parts per thousand) in north western channels amongst swamp vegetation.

Salinity range was great at time of survey (13-35 ‰ in the main body of the lagoon and 4 -35 ‰ taking the surveyed western channel into account). This variation is reflected in the relatively high degree of species diversity found at the site.

The most notable feature of the marginal vegetation is the extent of swamp species. *Phragmites* and *Schoenoplectus* beds fill the two north western bays and much of the south western area. These species and *Scirpus maritimus* fringe much of the north shore and are again extensive in the north central and the north eastern bayheads.

Tacumshin Lake is considered valuable for its species diversity and spatial salinity variation, for its extensive swamps and for the presence of *Chara canescens*.

Further survey is recommended.

Ecotonal Coleoptera

Eleven species of carabid and twenty-seven species of staphylinid were recorded, one species of which is regarded as an indicator species.

A single individual of *Stenus nitidulus* was recorded from bare sand near the previous south-western breach area. The species is only known in Ireland from one record (1910) from Lough Neagh, although it was also found at Lough Murree (Co. Clare) during this survey. It is very local and declining in Britain, and scattered and rare in France. However, it is not rare in Fennoscandia, and is common in eastern Central Europe. The species is restricted to marshy shores, including flooded meadows, riverbanks and salt-marshes, but also on sea shores.

The presence of only one individual of one indicator species indicates low conservation interest for the coastal barrier area. However, this is a large site, and priority was given to the coastal barrier. The interior reedbeds and marshes may have a higher value. The large amount of disturbance due to drainage may render the coastal barrier part an unsuitable habitat, and the indicator species (*Stenus nigritulus*) may have its core population in the more marshy interior parts of the site.

For the above reasons, the coastal barrier area is considered of <u>low</u> conservation interest for terrestrial ecotonal community.

Summary

Tacumshin Lake is a very large **natural sedimentary lagoon.** Despite drainage attempts, it is still largely natural, although current management practices are controversial and effective solutions to the conflicting interests are subject to financial constraints.

The lagoon and barrier are good examples of geomorphological types and there is a long history of scientific investigations. Together with Lady's Island Lake, the lagoon is one of the two best documented in Ireland. Of particular interest are local geomorphological processes.

Several rare species were recorded during this brief survey, and many are "interesting" lagoonal specialists.

The lake is of great local importance and is of high scenic value

In conclusion, based on geomorphology, fauna and vegetation, Tacumshin Lake is regarded as of exceptional conservation value and highly recommended as a proposed SAC.

Plate 1 Exposed sandflats at Tacumshin Lake, Co. Wexford

Plate 2 Recently opened pipe outlet at Tacumshin Lake, Co. Wexford

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

3. KILKERAN LAKE

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

3. KILKERAN LAKE

CONTENTS

3. KILKERAN LAKE, Co. Cork.

OS Grid Reference: W 338 344, 1:50,000 Sheet No. 89

Alternative names: Kilkern Lake, Kilkieran Lake, Kilkerran Lake

3.1 STUDY AREA

General features

Kilkeran Lake is a natural lagoon, lying behind sand hills on the south coast of Co. Cork, about 5 km east of the town of Roscarberry and 2 km north of Galley Head (Fig. 3.1.1). A channel leads from the lagoon 400 m to the shoreline where the water of the lake is impounded for most of the year by a short, coarse sand barrier. It appears that the County Council periodically breach the shingle barrier (8/10/92) but that it also opens naturally, mainly in the winter when water levels rise. The barrier closes again naturally, generally within a few weeks. According to local information the area between the lake and the coast was previously a marsh, and when a road was built along the coast, a channel was dug from the lake. A bridge carrying the road now crosses this channel. The lake is included in a proposed NHA. (Site Code 01061) which includes the lake itself together with Castlefreke dunes, partly owned by the NPWS. The site is of high scenic value with the lake lying in a hollow between the dunes and wooded hills. The woods themselves are plantation conifers but the dunes are natural and relatively unchanged.

The lake has suffered from eutrophication, and the once thriving trout fishery has now gone. A water quality and phytoplankton survey was carried out on behalf of the NPWS in 1993-94.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 7°C in January and 15.5°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 11 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1000 mm, and the number of rain days (1 mm or more) is 150-175. Prevailing winds are from the south and southwest. Mean annual hourly wind speeds are 5.5 m/s and a maximum wind speed of 49-50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, (Carter 1992). Maximum wave heights (averaging once in 50 years) are 20-25 m (Couper 1984). Tides are semi-diurnal and the tidal range (MHWS-MLWS) in Clonakilty Bay is 3.5 m (Admiralty Tide Tables).

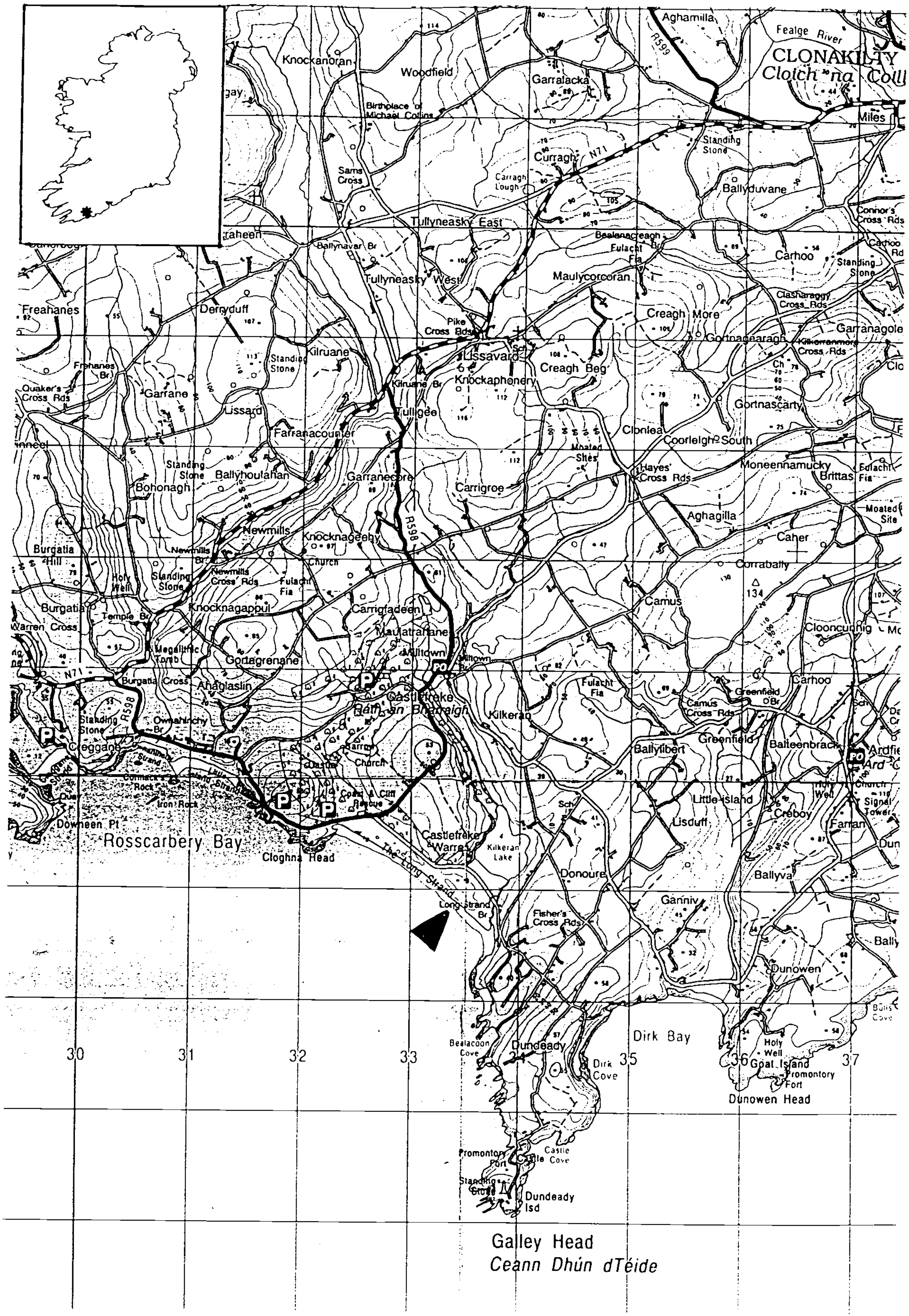

Fig. 3.1.1 Section of 1:50 000 map showing locality of Kilkeran Lake

Landscape and Geology Bedrock is Devonian and soils are brown podsols and dry mineral soils, producing relatively good agricultural land. Land surrounding the lake comprises dunes, coniferous woodland and pastureland.

Lake Topography The lake is approximately 600m from north to south, 400 m across, and covers about 16 ha. The lake is shallow (<3 m) and most of the bed of the lake is sand with a deep layer of organic mud in the deeper areas, and stony patches along parts of the shoreline.

Hydrology A channel leads from the lagoon 400m to the shoreline where the water of the lake is impounded by a short coarse sand and gravel barrier. It appears that the County Council periodically breach the shingle barrier (8/10/92) but that it also opens naturally, mainly in the winter when water levels rise. The barrier closes again naturally, generally within a few weeks. A limited amount of seawater enters while the outlet is open and also by overtopping the barrier when it is closed. There are no tidal fluctuations in water level, but the seasonal variation may be up to a metre. The outlet channel appears to be eroding its eastern bank near the barrier which poses a threat to houses close to the shore.

Salinity and water quality A limited amount of seawater enters while the outlet is open and also by overtopping the barrier when it is closed, but the volume of freshwater flowing from the lake ensures a low salinity for most of the year. Galvin measured 6 ‰ in 1991 and during a water quality survey, carried out on behalf of the OPW. from June 1993 to May 1994, an annual range of 0.2 - 4.4 ‰ was recorded.

There have been considerable problems with eutrophication of the lake caused by a nearby piggery, milk unit and runoff from surrounding fields. The situation seems to have improved somewhat, although SW Regional Fishery considered restocking of the lake with trout a waste of time and money.

3.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver, Dept. of Zoology, University College Dublin

3.2.1. Methods

Environmental variables

A transverse profile of the barrier was drawn using heights measured with a builders level and staff. Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. maps and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰ precision). A photographic record was made of the site and local information sought concerning background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A, B, D and E in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of

the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

3.2.2 Results

Kilkeran Lake was sampled on 4.vii.96 during the first part of the survey, and from 25-27.vii.96 during the more intensive survey.

Sampling stations were selected in the lake to reflect the influences of substrate, freshwater and tidal inflows. Positions of the sampling stations are shown in Fig. 3.2.1. Further details are given in the Results section.

Environmental Variables

Figure 3.2.2 shows a profile of the barrier.

Station A (OS 3360 3426) was located on the southwest shore of the lake, close to the access road and an area where small boats are launched. Substrate varied from gravel and sand to soft organic mud with occasional stones. Water depth was 0-1 m and salinity measured 1‰ (Plate 3.2.2).

Station B (OS 3389 3404) was located in the southern part of the lake where the outlet channel leaves the lake. Water depth was 0 - 2m, substrate varied from sand to soft organic mud and salinity measured 2‰ (Plate 3.2.2).

Station C (OS 3379 3454) was located in the northwest part of the lake close to where a freshwater stream enters the lake. Substrate consisted largely of stones of various sizes with patches of sand or silty mud. Water depth varied from 15 - 100 cm and salinity measured 2‰ (Plate 3.2.1).

Station D (OS 3407 3425) was located on the eastern shore of the lake. Substrate was shaly stone along the shore with soft organic mud in deeper areas. Water depth was 15 - 100 cms and salinity measured 1-2‰ (Plate 3.2.1).

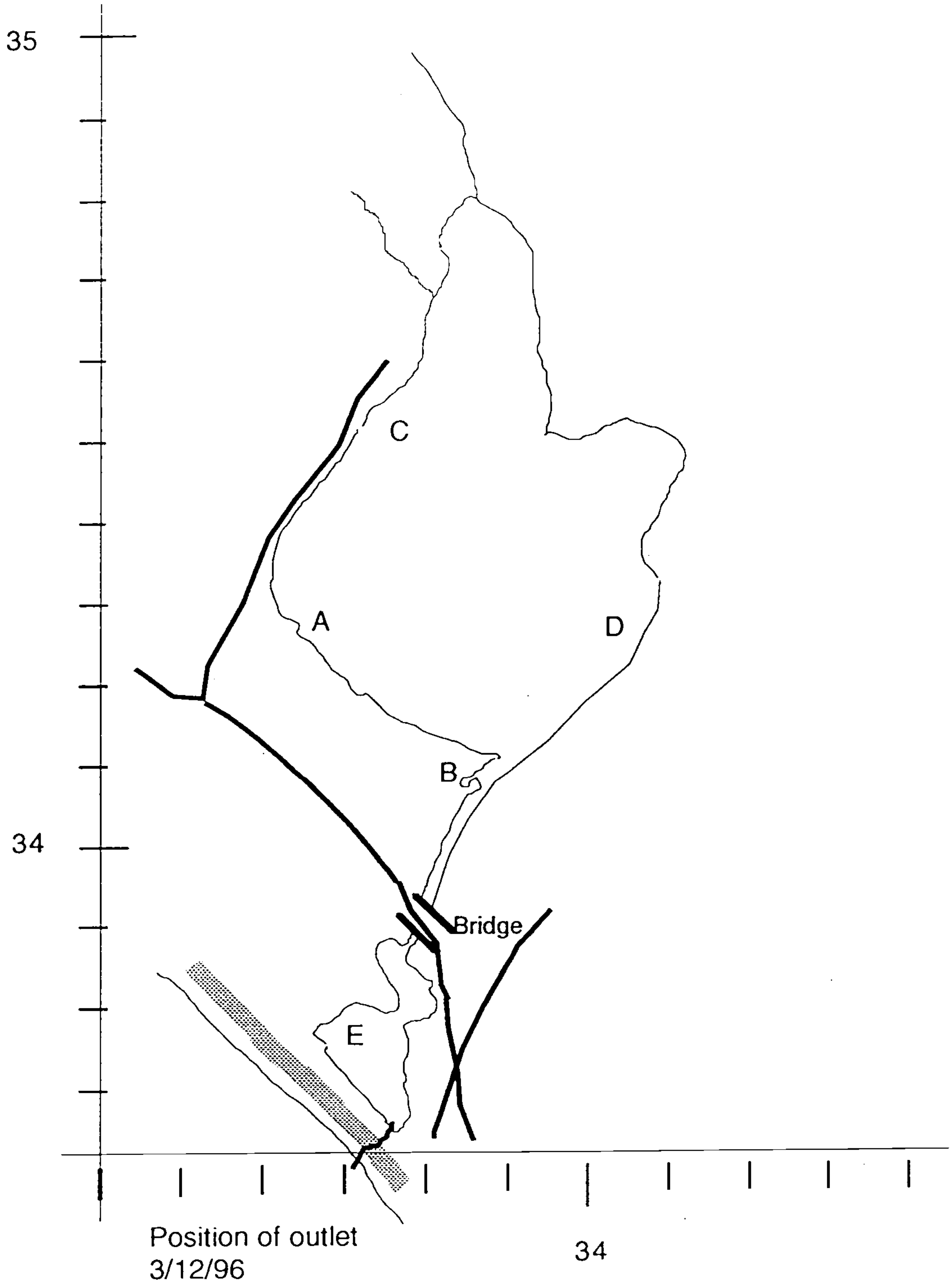

Fig. 3.2.1 Location Map of Sampling Stations in Kilkeran Lake, Co. Cork

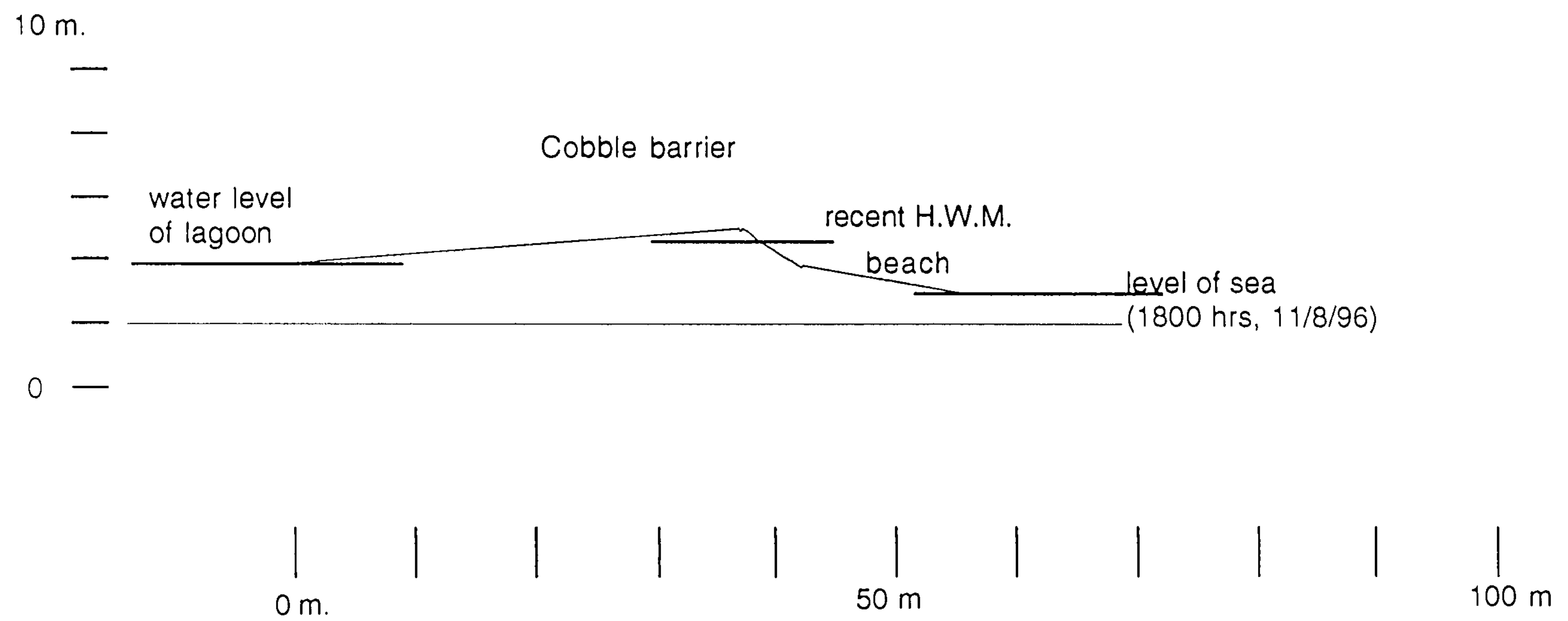

Fig. 3.2.2 Profile of Barrier at Kilkeran Lake, Co. Cork.

Table 3.2.1 Fauna Recorded at Kilkeran Lake, Co. Cork. June July 1996.
( ) = records from July

			Sampling Stations (L.T. = light-trap)							
		A	L.T.A	B	L.T.B.	C	L.T.C	D	L.T.D	E
Porifera										
Cnidaria										
Turbellaria										
Nemertea										
Annelida										
Crustacea										
Ostracoda										
Copepoda										
Cirripedia										
Mysidacea	*Neomysis integer*	c	c100	a	>100	a	c750	o	33	+
Isopoda										
Amphipoda	*Allomelita pellucida*			+						
	Gammarus duebeni			+		+		+		
	Orchestia gammarella					+				
Tanaidacea										
Decapoda	*Palaemonetes varians*	c	5	a	59	o	4	c		+
Arachnida										
Insecta										
Thysanura										
Ephemeroptera	*Cloeon dipterum*			+				+		
Odonata	*Ischnura elegans*	(+)								
Plecoptera								+		
Trichoptera										
Diptera	Chironomidae	a	3	c		c		c	1	c
Hemiptera	Corixidae	a	1500	a	1000	c	250	c	150	c
	Corixa panzeri	+	1	+	+	+				
	Sigara concinna	+	a	+	+	+	+	+	+	+
	S. dorsalis		2			+		+		+
	S. stagnalis			1						
	Notonecta glaucum					+				
	N. viridis					+				
	**Hydrometra gracilenta*									
	H. stagnorum					+				
Coleoptera	(incl. larvae)	a	a			+		+		
	Anacaena lutescens					+				
	Cercyon marinus					+				
	Coccidula rufa	+								
	Gyrinus caspius					+				
	Helophorus brevipalpis	+								
	***Hydroporus angustatus*									
	H. palustris	+								

+ = present; o = occasional; c= common; a = abundant;
* = recorded by Galvin, 1992 - see text; ** = Sample Station not known.

Table 3.2.1 cont.. Fauna Recorded at Kilkeran Lake, Co. Cork. June July 1996.
( ) = records from July

		Sampling Stations (L.T. = light-trap)								
		A	L.T.A	B	L.T.B.	C	L.T.C	D	L.T.D	E
Mollusca										
Prosobranchia	*Potamopyrgus antipodarum*	+		+		c		+		?
Pulmonata										
Opisthobranchia										
Bivalvia										
Bryozoa	*Plumatella repens*	+				+				
	? Fredericella sultana			+						
Echinodermata										
Tunicata										
Teleostei	*Anguilla anguilla*	+		+		+		+		
	Gasterosteus aculeatus	+	2	a	2	a	1	+		+
	Pomatoschistus microps			+	2					
	Platichthys flesus	+		+				+		

+ = present; o = occasional; a = abundant; F = fyke net

Station E (OS 3374 3356) was located in the ponded area inside the barrier. Substrate consisted of sand and gravel, water depth was 0 - 1 m and salinity measured 2‰ despite the close proximity of the sea (Plate 3.2.3).

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 3.2.1. Among 30 taxa listed, 29 are identified to species. The bryozoans await confirmation. Eight of the species are euryhaline, 6 are oligo-mesohaline, and 15 are limnic; no marine or poly-mesohaline species were recorded (Table 3.2.2). Three species are listed as lagoonal specialists in Britain (Davidson *et al.* 1991).

Neomysis integer and Corixidae were extremely abundant at all stations in the main body of the lake and large numbers were taken in light traps. The fauna was similar throughout the lake, reflecting the absence of salinity variation. No species was confined to E, which suggests that barrier overwash and the presence of an occasional seawater incursion does not introduce marine colonists. The low salinity at this station also indicates that effects on the fauna of seawater incursions would be small. The benthic fauna throughout the lake was particularly poor and only larvae of chironomidae were found in soft sediments.

Table 3.2.2 Ecological categories of the recorded taxa in Kilkeran Lake (L = lagoonal specialist according to (Davidson *et al.* 1991).

Marine	None	
Poly-mesohaline	None	
Euryhaline	*Neomysis integer*	
	Gammarus duebeni	
	Palaemonetes varians	L
	Sigara stagnalis	L
	Gasterosteus aculeatus	
	Anguilla anguilla	
	Pomatoschistus microps	
	Platichthys flesus	
Oligo-mesohaline	*Potamopyrgus antipodarum*	
	Ischnura elegans	
	Sigara concinna	L
	Notonecta viridis	
	Gyrinus caspius	
	*Allomelita pellucida**	
Limnic	*Cloeon dipterum*	
	Hydrometra gracilenta	
	H. stagnorum	
	Notonecta glauca	
	Corixa panzeri	
	Sigara dorsalis	
	Plecoptera	
	Anacaena lutescens	
	Cercyon marinus	
	Coccidula rufa	
	Hydroporus angustatus	

H. palustris
Helophorus brevipalpis
Plumatella repens
Fredericella sultana (?)

* The full range of this species is not known

3.2.3 Discussion

The faunal assemblage is typical of a lagoon without a sea inlet where a low salinity persists and marine influence is small. Although occasional breaching of the barrier may introduce species more characteristic of higher salinity, these probably do not survive for long after the sea inlet reseals.

Hydrometra gracilenta was identified from specimens collected by Galvin (1992). This is a first record for Ireland and was not found at any other site.

According to Southwood and Leston (1959) *Notonecta viridis* was only reported for Wexford and north Kerry. It has since been recorded at Lady's Island L. by Healy *et al.* (1982) and at Lady's Island L. and the North Slob by Galvin (1992). It was found at Lady's Island L., Tacumshin L., and L. Donnell and the North Slob during this survey. *Sigara concinna* was described as rare in Ireland (Southwood and Leston 1959) but was found also at Lady's Island L. and Tacumshin L. during this survey and in Kilkeran L. was extremely abundant and the dominant species. Both *Neomysis integer* and corixids were more abundant in this lake than at any other site sampled during the survey.

This is the only site at which the beetles *Anacaena lutescens, Cercyon marinus* and *Coccidula rufa* were recorded but details of their distribution in Ireland are not known at present..

Galvin (1992) recorded 44 species of aquatic fauna in 1991, including the rare lagoonal bryozoan *Victorella pavida* which may have been misidentified. Other interesting species include the two freshwater bryozoans, one of which may be new to Ireland.

3.2.4 Threats

High nutrient levels from agricultural sources may be having an adverse effect on fauna.

There is some recreational use of the lake but this does not appear to be a threat.

The outlet channel appears to be eroding its eastern bank near the barrier which poses a threat to houses close to the shore.

3.2.5 Evaluation

Kilkeran Lake is a **natural sedimentary lagoon** and is therefore of international importance based on geomorphology alone.

The site lies within an area of relatively unspoilt sand dunes and, although small, is probably the best example in the southwest of Ireland of a lagoon with a sand/gravel barrier.

Barrier morphology is well documented and studies of its history are ongoing.

For such a small lake, the aquatic fauna appears to be diverse. One skater is a new Irish record, a backswimmer is rare in Ireland, and a bryozoan may be new for Ireland.

The lake lies within a proposed NHA (Site Code No. 1061).

The lake is high conservation value for its interesting geomorphology, and aquatic faunal analyses to date indicate that this fauna comprises some rare species which also deserve protection. Its designation as a proposed SAC is recommended.

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Plate 3.2.1 View of Kilkeran Lake looking north, Station C (on the left) and D (on the right)

Plate 3.2.2 View of Kilkeran Lake looking east, Station A (foreground) and B (distance)

Plate 3.2.3 View of the outlet channel looking south toward the barrier of Kilkeran Lake, Station E.

Plate 3.2.4 View of the barrier of Kilkeran Lake looking east from the sand dunes.

3. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

3.3.1 Site Description (Fig. 3 3 1)

Kilkeran Lake is set amongst low hills with predominantly pastoral farmland to the north, east, south east and west. A conifer plantation lies close to the mid-western shore and another, now partly derelict, to the south west. The dune barrier lies to the south west, through which the outlet to the sea runs from the southern point of the lake.

A public road passes between the lake and the dunes and a track runs along the western shore.

The major freshwater inflows (two) join the lake at its northern point, where an extensive *Phragmites* bed fringes the lake and extends back up the inflow valley.

A more or less narrow band of swamp vegetation fringes the lake along all but the north eastern shores, which are more open. Exposed bedrock forms the shore on a promontory in this area. Elsewhere the shore is gently sloping.

3.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

1. <u>Transects:</u>

The locality of these is shown in Fig. 3.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage

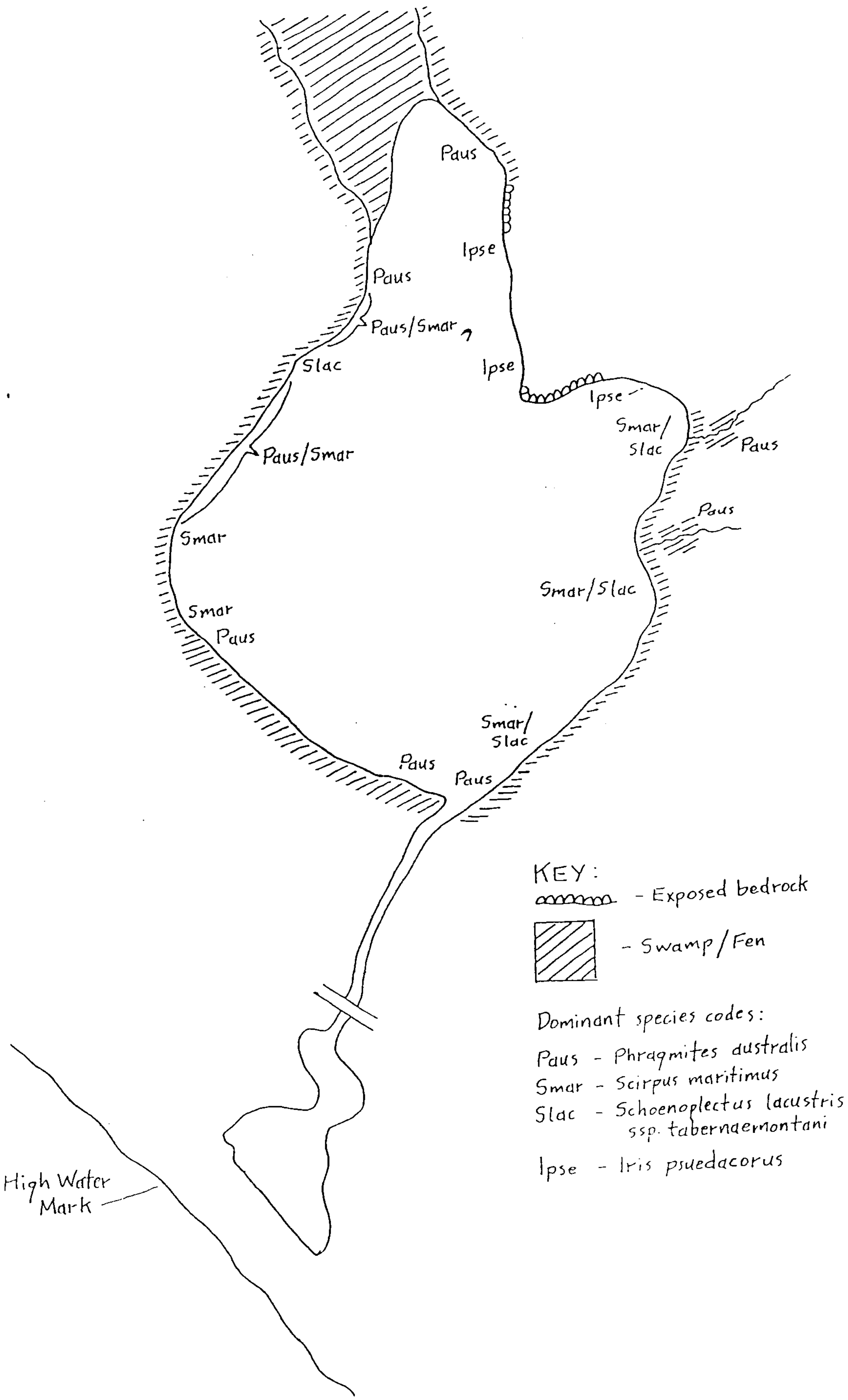

Fig. 3.3.1 Kilkeran Lake, Co. Cork - Marginal Vegetation

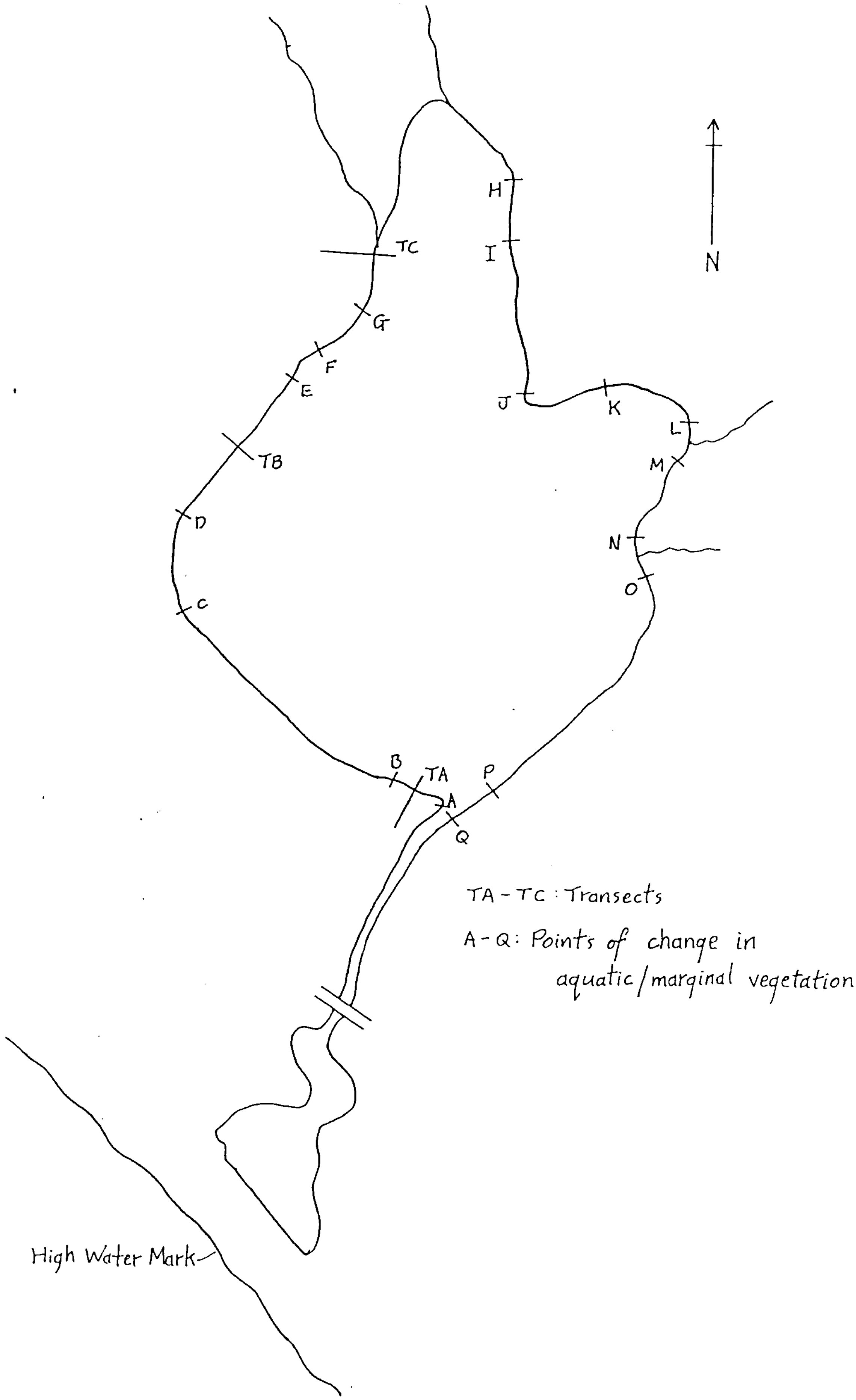

Fig. 3.3.2 Kilkeran Lake, Co.Cork: Location of Transects and Shore-based Survey Sections

cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals

1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

3.3.3 Results

1. Shore-based survey

Section A-B (Transect A)

Aquatic: Ruppia maritima
Potamogeton pectinatus
Chara aspera var. aspera

Sand and silt substrate

Marginal: Dense single species Phragmites swamp. 25-35m

Adjacent: Grading to dune grassland with Elymus farsctus, Potentilla anserina, Trifolium repens, Lotus corniculatus, Plantago lanceolata, Galium verum.

Section B-C

Aquatic: Potamogeton pectinatus
Marginal: Unchanged

Adjacent: Agrostis stolonifera - Potentilla anserina dominated grassland. 10-20m
Arrenatherum elatius and Pteridium aquilinum dominant with sparse and partly derelict conifer plantation on dune grassland

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Section C-D

Aquatic: Potamogeton pectinatus - dense bed to c.5m out
Enteromorpha

Marginal: Single species Scirpus maritimus swamp. 2-3m

Adjacent: Agrostis stolonifera - Potentilla anserina dominated grassland. 5-20m
Backing to public road and conifer plantation

Section D-E (Transect B)

Aquatic: Potamogeton pectinatus - dense bed to c.5-10m out
Polygonum amphibium - occasional
Enteromorpha - sparse

Marginal: Swamp vegetation. Single species Phragmites stands alternating with Scirpus
maritimus dominated stands with sparse Schoenoplectus lacustris ssp tabernaemontani. 3-6m
Grading to narrow strip of freshwater species. 1-3m. Iris psuedacorus, Filipendula ulmaria, Lythrum salicaria, Stachys palustris typically frequent with Agrostis stolonifera and Potentilla anserina locally dominant

Adjacent: Public road
Conifer plantation

Section E-F

Aquatic: Potamogeton pectinatus - dense bed to c.15m out
Enteromorpha

Marginal: Schoenoplectus dominated swamp with frequent Scirpus maritimus. 2-4m
Grading as D-E

Adjacent: Public track
Lolium perenne pasture

Section F-G

Aquatic: Potamogeton pectinatus - as E-F
Polygonum amphibium - occasional
Enteromorpha

Marginal: Phragmites and Schoenoplectus swamps as D-E. 4-10m
Grading as D-E

Adjacent: Unchanged

Section G-H (Transect C)

Aquatic: Potamogeton pectinatus - no longer in dense beds

Marginal: Single species Phragmites australis swamp extending back along freshwater inflows

Adjacent: Pasture and meadows

Section H-M - Access refused by landowner. Surveyed from western shore and from Section M-N. Accounts of the following five sections are therefore incomplete

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Section H-I

Aquatic: Unknown

Marginal: Bedrock shore. No emergents

Adjacent: Narrow strip of Rubus fruticosus and Ulex sp. on steep bank
Backing to pasture

Section I-J

Aquatic: Unknown

Marginal: Iris psuedacorus locally dominant. Narrow shore backing to steep slope

Adjacent: Pasture

Section J-K

Aquatic: Potamogeton pectinatus - dense bed to c.10-20m out

Marginal: As H-I

Adjacent: As H-I

Section K-L

Aquatic: Potamogeton pectinatus - dense bed to c.20-30m out
Polygonum amphibium - occasional <1m out

Marginal: Sparse Iris psuedacorus with Eleocharis sp., Agrostis stolonifera. 3-5m strip

Adjacent: Unchange

Section L-M

Aquatic: Unchanged

Marginal: Mixed Schoenoplectus - Scirpus maritimus swamp. c.3m
Grading to Phragmites stand associated with small freshwater inflow

Adjacent: Pasture

Section M-N

Aquatic: Potamogeton pectinatus - dense bed to c.15-20m out

Marginal: Schoenoplectus, Scirpus maritimus and Eleocharis palustris swamps, each species locally dominant. 1-3m
Grading to Iris psuedacorus dominated strip with frequent Epilobium hirsutum,
Filipendula ulmaria, Lythrum salicaria, Stachys palustris, Urtica dioica. 2-4m

Adjacent: c.45 degree bank to c.5m height with Rubus fruticosus, Ulex europaeus and
Pteridium aquilinum dominant
Backing to Lolium perenne pasture

Section N-O

Aquatic: Potamogeton pectinatus - dense bed to c.10m out

Marginal: Swamp as M-N
Grading to Phragmites dominated fen vegetation on small freshwater inflow
stream. Frequent Iris psuedacorus, Epilobium hirsutum, Filipendula ulmaria,
Lythrum salicaria, Angelica sylvestris, Urtica dioica. c. 60m

Adjacent: Lolium pasture and arable land

Section O-P

Aquatic: Unchanged

Marginal: As M-N

Adjacent: Steep bank as M-N with frequent Alnus glutinosa and Sambucus nigra
Backing to pasture and arable land

Section P-Q

Aquatic: Potamogeton pectinatus - dense bed narrowing to c.3m out

Marginal: Dense single species Phragmites swamp. 20-25m
Grading to Phragmites dominated stand with frequent Urtica dioica. 2-5m

Adjacent: As M-N

2. Transects

Site: Kilkeran Lake	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - 1m out - grapnel	
Sample area: Grapnel only	Substrate: Sand, silt	
Depth: 80 cm +	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Potamogeton pectinatus		
Ruppia maritima		
Chara aspera var. aspera		
Description: Some Ruppia plants in fruit.		

Site: Kilkeran Lake	Transect code: A	
Location: Outlet to sea	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 60 cm	Salinity: 2 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	230	100
Description: Dense single species Phragmites swamp. 25m.		
Grading to dune grassland with Elymus farctus, Potentilla anserina, Trifolium		
repens, Lotus corniculatus, Plantago lanceolata, Galium verum.		

Site: Kilkeran Lake	Transect code: B	
Location: Marginal swamp	Sample point: 1 Aquatic - 5m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 70 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		100
Potamogeton pectinatus	70	100
Algae		5
Enteromorpha		5
Description: Dense Potamogeton pectinatus bed extending from 1 - 10m out.		

Site: Kilkeran Lake	Transect code: B	
Location: Marginal swamp	Sample point: 2 Marginal	
Sample area: 10m2 (10x2)	Substrate: Silt, sand	
Depth: 0 - 40 cm	Salinity: 2 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Scirpus maritimus	100	80
Schoenoplectus lacustris ssp tabernaemontani	120	< 1
Description: Fairly dense Scirpus maritimus swamp with sparse Schoenoplectus. 4m.		

Site: Kilkeran Lake	Transect code: B	
Location: Marginal swamp	Sample point: 3 Marginal	
Sample area: 10m2 (10x1)	Substrate: Not known	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Iris psuedacorus	100	10
Agrostis stolonifera	20	80
Potentilla anserina	10	10
Filipendula ulmaria	70	5
Lythrum salicaria	40	5
Rumex crispus	40	< 1
Carex otrubae	40	< 1
Description: Open, fairly patchy Iris cover with species-poor freshwater vegetation. 2m.		
Backing public road.		
Backing coniferous plantation.		

Site: Kilkeran Lake	Transect code: C	
Location: Freshwater inflow	Sample point: 1 Aquatic - 1m out - grapnel	
Sample area: Grapnel only	Substrate: Silt	
Depth: 80 cm +	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Potamogeton pectinatus		
Description:		

Site: Kilkeran Lake	Transect code: C	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 10 - 50 cm	Salinity: 2 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	230	100
Description: Dense single species Phragmites swamp. 30m.		

Site: Kilkeran Lake	Transect code: C	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 20m2 (20x1)	Substrate: Silt	
Depth: 0 - 10 cm	Salinity: 0 parts per thousand	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Alnus glutinosa	500	10
Phalaris arundinacea	200	75
Agrostis stolonifera	20	70
Potentilla anserina	15	10
Filipendula ulmaria	70	< 1
Lythrum salicaria	50	< 1
Galium palustre	20	< 1
Description: 1m strip of Phalaris dominated vegetation with Agrostis dominant amongst a		
species-poor understorey of freshwater plants. Occasional Alnus glutinosa.		
Backing footpath.		
Backing Lolium perenne pasture.		

3.3.4 Evaluation

'Potentially Valuable'

Kilkeran is a medium-sized lagoon, mildly brackish at time of survey (2 parts per thousand), with an interesting species composition.

Potamogeton pectinatus is abundant, occurring in extensive, dense beds to 5-15 metres out from most of the eastern and western shores and covering the entire water surface of the eastern bay.

Ruppia maritima occurs here but was found by grapnel survey near the mouth of the outlet channel only. Its abundance and distribution is unknown.

A small amount of *Chara aspera var. aspera* was found at the same location. Its abundance and distribution is also unkown.

Polygonum amphibium is occasional along the western shore.

Marginal vegetation comprises a narrow fringing strip of *Scirpus maritimus*, *Schoenoplectus* and *Phragmites*, each locally dominant along the eastern and western shores, with a broader band of *Phragmites* along the southern shore and an extensive Phragmites bed associated with the freshwater inflows in the north.

Kilkeran Lake presents a good, though seemingly species-poor example of mildly brackish conditions. It is interesting to note the presence of *Ruppia maritima* and *Polygonum amphibium* in the same environment.

Further aquatic survey is recommended.

Plate 3.2.1 View of Kilkeran Lake looking north, Station C (on the left) and D (on the right)

Plate 3.2.2 View of Kilkeran Lake looking east, Station A (foreground) and B (distance)

Plate 3.2.3 View of the outlet channel looking south toward the barrier of Kilkeran Lake, Station E.

Plate 3.2.4 View of the barrier of Kilkeran Lake looking east from the sand dunes.

3.4 ECOTONAL COLEOPTERA

J.A. Good Ph.D MIEEM FRES,
Terrascope Environmental Consultancy, Riverstick, Co. Cork.

3.4.1 Site Description

Coastal brackish lake with road-bridge and inlet channel leading to coarse sand beach barrier (Plate 1), with seawater incursion at high spring tide, and outflow percolation at low tide (Plate 2). Lake shore with *Phragmites communis* and *Schoenoplectus lacustris* stands, with virtually no unvegetated margin uncovered by water on southern shore, leading into extensive valley marsh. Small stands of *Scirpus maritimus* on sand behind dunes seaward of road, flooded during high spring tide.

Subsites (Fig. 3.4.1)

1. <u>*Scirpus maritimus*</u> (W 337339) (Plate 3)

Small area (c. 100 m^2) of *Scirpus maritimus* with *Triglochin maritima* grading into *Potentilla anserina* and grass, on sand immediately behind stable dune. *Scirpus* flooded at high spring tide. Salinity of near-shore water in adjacent channel was 2‰ on 11 ix 1996.

2. <u>*Phragmites communis*</u> (L 368878)

Lake shore beds of *Phragmites communis* on sand with litter and organic layer near lake outflow. Grading into area of *Elymus athericus* dominated vegetation on sand on floodplain.

3.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; <u>and</u>, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

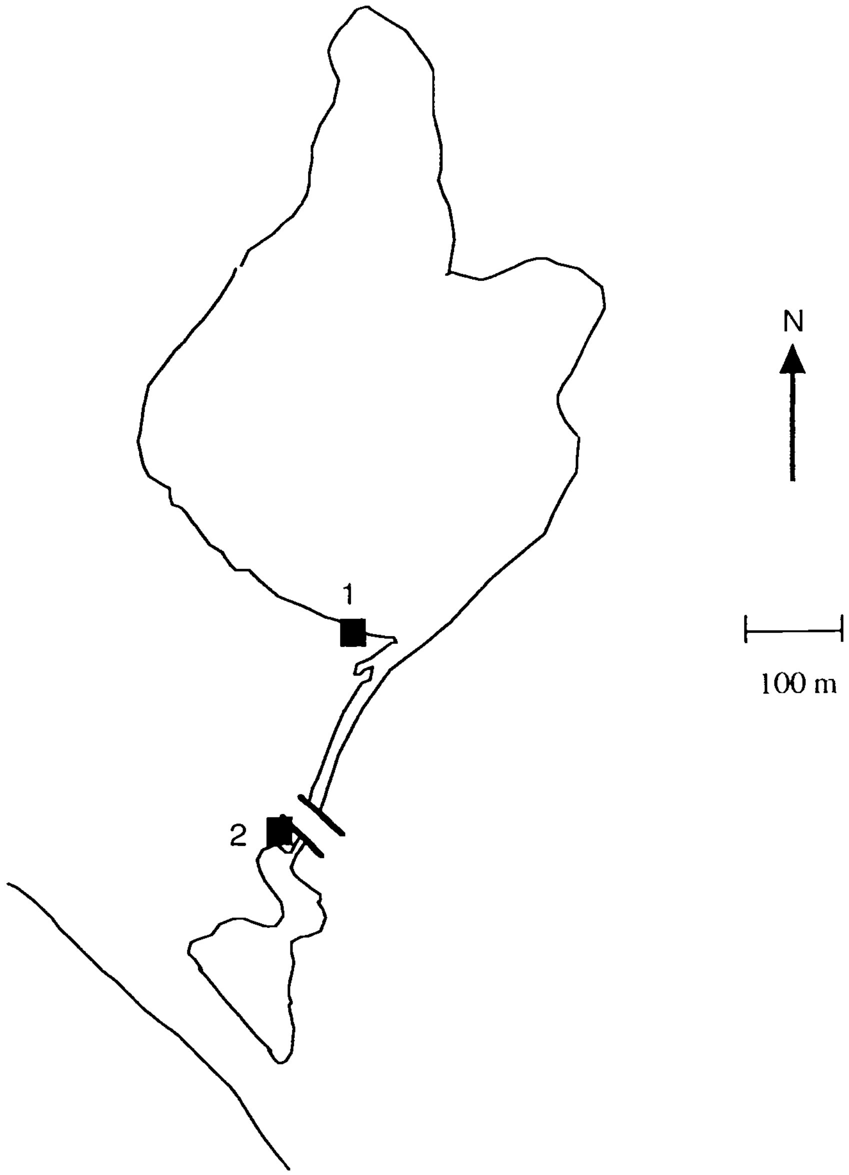

Fig. 3.4.1. Map of sampling sites (Carabidae and Staphylinidae) at Kilkeran Lake, Co. Cork

1 - Pitfall traps
2 - Pitfall traps, S-vac

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 3.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 3.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References

Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Scirpus maritimus* area - S-vac suction sampler (11 ix 1996), c. 2 m^2;

(2) *Scirpus maritimus* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (18 viii - 11 ix 1996);

(3) *Phragmites communis* area - 6 pitfall traps (11 ix - 5 x 1996);

No *Bledius* burrow casts were observed on the sandy margins of the channel behind the sand barrier.

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

3.4.3 Survey Results

Nine species of carabid and seventeen species of staphylinid were recorded, three species of which are regarded as indicator species (Table 3.4.2).

TABLE 3.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Kilkeran Lake. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), and Booth (1988) for *Tachyporus dispar*.

	Species	No. individuals	
Carabidae			
	Abax parallelipedus (Pill.Mitt.)	3	
	Agonum pelidnum (Payk.)	2	
	Bembidion assimile Gyll.	12	
*	*Blethsia multipunctata* (L.)	1	**Indicator species**
	Bradycellus harpalinus (Serv.)	1	
	Carabus granulatus L.	1	
	Dromius linearis (Ol.)	3	
	Pterostichus niger (Schall.)	124	
	Pterostichus nigrita (Payk.)	1	
Staphylinidae			
	Anotylus rugosus (F.)	1	
	Atheta amplicollis (Muls. Rey)	13	
	Atheta clientula (Er.)	1	
	Atheta fungi (Grav.)	1	
	Atheta graminicola (Grav.)	6	
*	*Gabrius keysianus* Sharp	1	**Indicator species**
*	*Philonthus fumarius* (Grav.)	6	**Indicator species**
	Philonthus micans (Grav.)	1	
	Sepedophilus nigripennis (Steph.)	4	
	Stenus cicindeloides (Schall.)	2	
	Stenus juno (Payk.)	5	
	Stenus picipennis Er.	1	
	Tachinus signatus Grav.	1	
	Tachyporus chrysomelinus (L.)	1	
	Tachyporus dispar (Payk.)	2	
	Tachyporus pusillus Grav.	3	
	Xantholinus longiventris Heer	1	

Blethsia multipunctata appears to be local in Ireland: It is listed without annotation by Speight *et al.* (1982); there are recent records from turloughs in south Galway (Lott and Bilton 1991, J.A. Good unpublished). It occurs in fens and lake margins (Hyman and Parsons 1992), especially on shores of slow-moving and still water (Koch 1989). The species is widespread but local and possibly declining in Great Britain, according to Hyman and Parsons (1992), and very rare in Central Europe (Freude 1976).

Gabrius keysianus is a halobiont ripicolous species (Koch 1989), widespread but local in England and Wales (Hyman and Parsons 1994), and generally local and mostly rare in western Europe (Horion 1965). It has been previously recorded in Ireland (O'Mahony 1929), and was found at three other sites during this survey, which would be expected given its habitat.

Philonthus fumarius appears to be widespread but local in Ireland (Johnson and Halbert 1902, Lott and Bilton 1991) and Great Britain (Hyman and Parsons 1994). It is not rare in Central Europe, but rather rare eslewhere (Horion 1965). The species occurs in marshes including muddy and marshy freshwater shores (Horion 1965, Koch 1989) and especially on coastal marshes (Hyman and Parsons 1994).

3.4.4 Evaluation

Of average conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of three indicator species indicates conservation interest.

3.4.5 References

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Plate 1 Sand beach barrier at Kilkeran Lake, Co. Cork

Plate 2 Outflow percolation at Kilkeran Lake, Co. Cork

Plate 3 Subsite 1 - Scirpus matitima area at Kilkeran Lake, Co. Cork

3.5 SUMMARY AND EVALUATION

Kilkeran Lake is a medium-sized (16 ha) **natural sedimentary lagoon** and is therefore of international importance based on the Habitats Directive.

The lake lies within a proposed NHA (Site Code No. 1061).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	High
Aquatic Fauna	High
Vegetation	Potentially High
Ecotonal Coleoptera	Average

Geomorphology

Kilkeran Lake is a medium-sized natural sedimentary lagoon. Barrier morphology is well documented and studies of its history are ongoing.

The lagoon lies within an area of relatively unspoilt sand dunes and, although small (c.16 ha.) is probably the best example in the southwest of Ireland of a lagoon with a sand/gravel barrier.

The lake is rated as of <u>high</u> conservation value as a good example of sedimentary lagoon with a sand/gravel barrier in an almost natural state.

Aquatic Fauna

A total of 31 taxa including 6 lagoonal specialists was recorded. For such a relatively small lake, the aquatic fauna appears to be diverse and interesting.

Hydrometra gracilenta was identified from specimens collected by Galvin (1992). This is a first record for Ireland and was not found at any other site.Other interesting species include *Notonecta viridis*, and *Sigara concinna* which is described as rare in Ireland but was found also at Lady's Island L. and Tacumshin L. during this survey and in Kilkeran L. was extremely abundant and the dominant species. Both *Neomysis integer* and corixids were more abundant in this lake than at any other site sampled during the survey. This is the only site at which the beetles *Anacaena lutescens, Cercyon marinus* and *Coccidula rufa* were recorded but details of their distribution in Ireland are not known at present. Galvin (1992) recorded 44 species of aquatic fauna in 1991, including the rare lagoonal bryozoan *Victorella pavida* which may have been misidentified. Other interesting species include the two freshwater bryozoans, one of which may be new to Ireland.

Kilkeran Lake

The lake is regarded as of high conservation value for its relatively high species richness and high proportion of lagoonal specialists and the presence of some rare species

Vegetation

Potamogeton pectinatus is abundant, occurring in extensive, dense beds to 5-15 metres out from most of the eastern and western shores and covering the entire water surface of the eastern bay. *Ruppia maritima* occurs here but was found by grapnel survey near the mouth of the outlet channel only. Its abundance and distribution is unknown. A small amount of *Chara aspera var. aspera* was found at the same location. Its abundance and distribution are also unkown. *Polygonum amphibium* is occasional along the western shore.

Marginal vegetation comprises a narrow fringing strip of *Scirpus maritimus*, *Schoenoplectus* and *Phragmites*, each locally dominant along the eastern and western shores, with a broader band of *Phragmites* along the southern shore and an extensive *Phragmites* bed associated with the freshwater inflows in the north.

Kilkeran Lake presents a good, though seemingly species-poor example of mildly brackish conditions. It is interesting to note the presence of *Ruppia maritima* and *Polygonum amphibium* in the same environment.

The lagoon is regarded as "potentially valuable" as a full survey of aquatics was not possible. Further aquatic survey is recommended.

Ecotonal Coleoptera

Nine species of carabid and seventeen species of staphylinid were recorded, three species of which are regarded as indicator species

Blethsia multipunctata appears to be local in Ireland, although there are recent records from turloughs in south Galway. It occurs in fens and lake margins, especially on shores of slow-moving and still water. The species is widespread but local and possibly declining in Great Britain, and very rare in Central Europe.

Gabrius keysianus is a halobiont ripicolous species, widespread but local in England and Wales, and generally local and mostly rare in western Europe . It has been previously recorded in Ireland, and was found at three other sites during this survey, which would be expected given its habitat.

Philonthus fumarius appears to be widespread but local in Ireland and Great Britain. It is not rare in Central Europe, but rather rare eslewhere. The species occurs in marshes including muddy and marshy freshwater shores and especially on coastal marshes.

The presence of three indicator species indicates average conservation interest for terrestrial ecotonal community.

Summary

Kilkeran Lake is a **natural sedimentary lagoon** lying within an area of relatively unspoilt sand dunes and, although small is probably the best example in the southwest of Ireland of a lagoon with a sand/gravel barrier.

For such a relatively small lake, the aquatic fauna appears to be diverse and includes several rare or interesting species.

In conclusion, based on geomorphology and aquatic fauna, and potentially on vegetation, the lagoon is of <u>high</u> conservation value and recommended as a proposed SAC.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

4. LISSAGRIFFIN LAKE

Brenda Healy
Geoff Oliver
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Jervis Good

February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

4. LISSAGRIFFIN LAKE

CONTENTS

4. LISSAGRIFFIN LAKE, Co. Cork.

OS Grid Reference: V 775 265, 1:50,000 Sheet No. 88
Alternative names: Lissagriffin Lough

4.1 STUDY AREA

General features

Lissagriffin Lake is situated at the western end of the Mizen peninsula, 5 km west of Crookhaven (Fig. 4.1.1). The lake lies at the landward end of a long sinuous tidal inlet and is partly artificial in that it now lies behind a causeway, but at the mouth of the inlet is a dune barrier through which the combined action of river and sea has cut a channel. The lake is very shallow and seawater enters on all tides but a relatively large amount of fresh water also flows through the lake.

The lake is of great ornithological interest for the number of vagrant American waders that are recorded but it is also of value as a feeding area for small numbers of waders and wildfowl, including Whoopers and Bewick's swans, especially during hard weather (Hutchinson 1994).

The lake is part of a proposed NHA (Site Code No. 1040) which includes the coastal dunes and rocky hillsides.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is >7°C in January and 15-15.5°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 11 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1200 mm, and the number of rain days (1 mm or more) is approximately 175. Winds are mainly from the south and southwest. Mean annual hourly wind speeds are between 5 and 6 m/s and a maximum wind speed of 49-50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 25-30 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Bearhaven is 3.1 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology Bedrock is Old Red Sandstone with outcrops of slate and shale. To the west of the lake are lime-rich dune grasslands but on the other three sides land is a mixture of rocky hillside, small peat bogs, wet heath and small fields of pastureland. Soils are generally acidic and mostly peaty podzols and acid brown earths

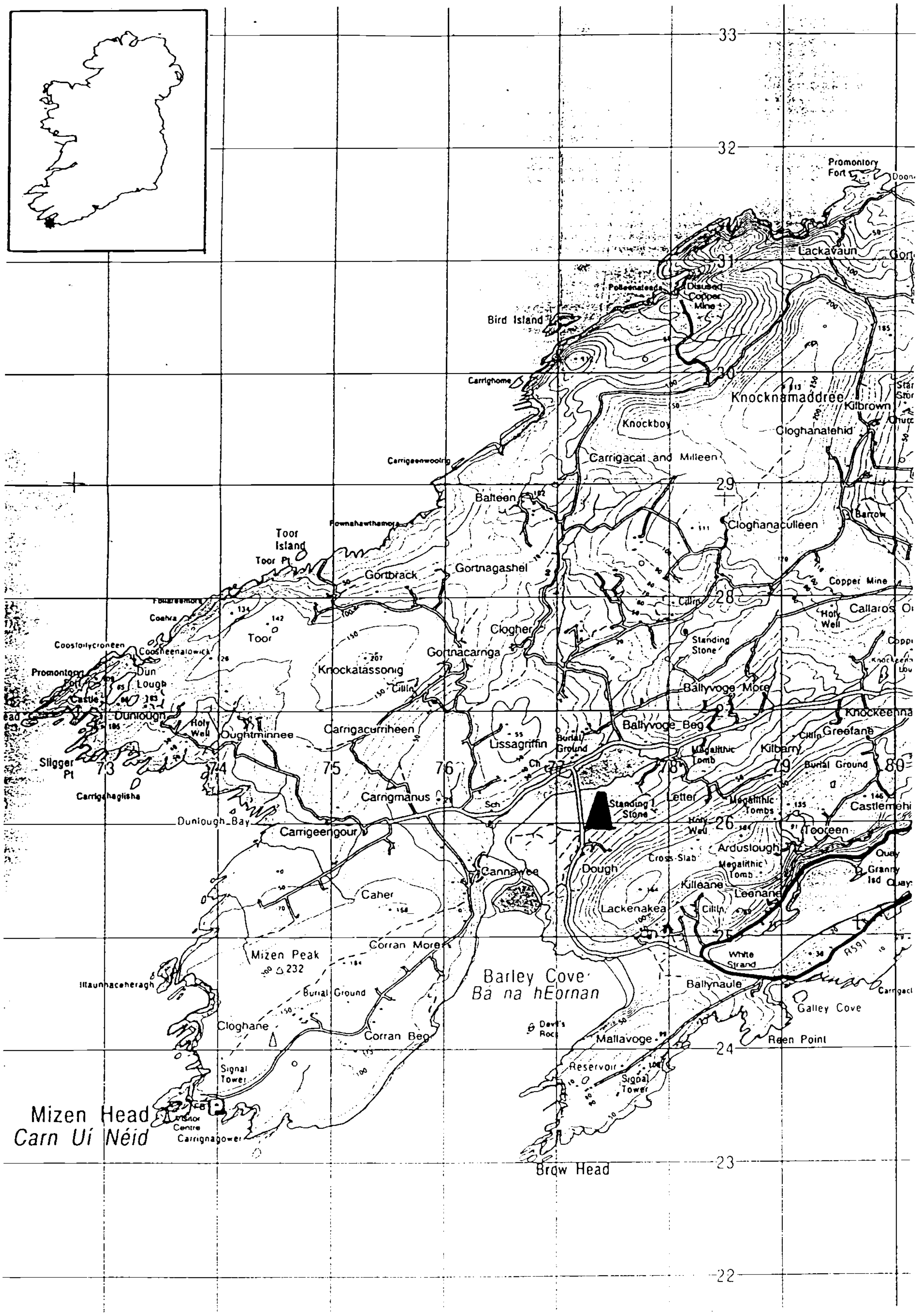

Fig. 4.1.1 Section of 1:50 000 map showing locality of Lissagriffin Lake

(Royal Irish Academy 1979). Agricultural use of the land has declined and many of the fields have reverted to heath.

Lake Topography The area of the lake above the causeway is roughly 600 m from southwest to northeast, width varies from 200 to 300 m, and area is approximately 12 ha. The lake is very shallow, mostly less than 1 m and most of the bed of the lake is sand with softer organic muds away from the main river and tidal channel which runs through the lake.

Hydrology Two small streams enter the lake from the east and seawater appears to enter on every tide through a bridge in the causeway which carries the road and on higher tides through a series of pipes along the causeway. There is a tidal variation in water level of the lake of about 30 cms on neap tides, measured at the bridge. Unlike on the open shore where spring tides produce extremes of high and low water, a time lag at the head of the inlet means that at spring tides the water level in the lake remains at a higher level during both high and low tide but with a similar tidal variation in height.

Salinity and water quality Seawater at approximately 34 ‰ enters the lake twice daily but most of it also leaves again leaving parts of the substrate exposed. Fresh water enters from two streams in the east and the volume of fresh water entering appears to keep salinities relatively low except during spring tides.

The only major source of nutrients to the lake is agricultural. The amount is likely to be low in this area and regular flushing by seawater is likely to prevent any eutrophication problems.

4.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver, Dept. of Zoology, University College Dublin

4.2.1. Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰. precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling.

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988) Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and B in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of

the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (eg *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

4.2.2 Results

Lissagriffin Lake was sampled on 4.vii.96 during the first part of the survey, and from 29-31.vii.96 during the more intensive survey. Positions of the sampling stations are shown in Fig. 4.2.2.

Environmental Variables

Station A (OS 7720 2642) was located at the southwest end of the lake, east of the bridge in the causeway. Substrate consisted entirely of sand, water depth varied from 0 - 2 m and salinity measured 28 ‰ on the flood tide and 6 ‰ during low tide.

Station B (OS 7734 2631) was located at the southwest end of the lake but at the southern end of the causeway (Plate 4.2.2). Substrate consisted of fine sand and organic mud, water depth varied from 0 - 25 cm and salinity measured 8 ‰ (Plate 4.2.3)

Station C (OS 7748 2628) was located along the southern shore of the lake where a small stream enters. Substrate was fine sand and organic mud with scattered stones, water depth was 0 - 10 cm and salinity measured 6 ‰.

Station D: (OS 7760 2636) was located along the southern shoreline where a rocky outcrop extends into the lake. Substrate consisted of shaly rocks and stones of various sizes and soft mud, depth varied from 0 -10 cm and salinity measured 8‰

Station E (OS 7740 2663) was located midway along the northern shore where a fresh water stream enters. Substrate consisted rock, stones and gravel with soft organic mud. Water depth varied from 0 - 40 cm and salinity measured 4 ‰.

Station F (OS 7767 2661) was located in the northeast of the lake among *Phragmites*. Substrate consisted of peat on sand, water depth varied from 20 - 80 cm and salinity measured 6 ‰.

Station G (OS 7779 2656) was located in the most easterly part of the lake where a freshwater stream enters. Substrate was gravel and sand with peat and soft mud, water depth varied from 20 - 80 cm, and salinity measured 8 ‰.

Plate 1 Upper lake - Lisagriffin, Co. Cork

Plate 4.2.1 View of Lissagriffin Lake looking east.

Plate 4.2.2 View of the tidal inlet below the causeway of Lissagriffin Lake, Station H

Plate 4.2.3 View of one of the pipes leading through the causeway of Lissagriffin Lake, Station B

Plate 4.2.4 View of the sandhills at the mouth of the inlet Lissagriffin Lake.

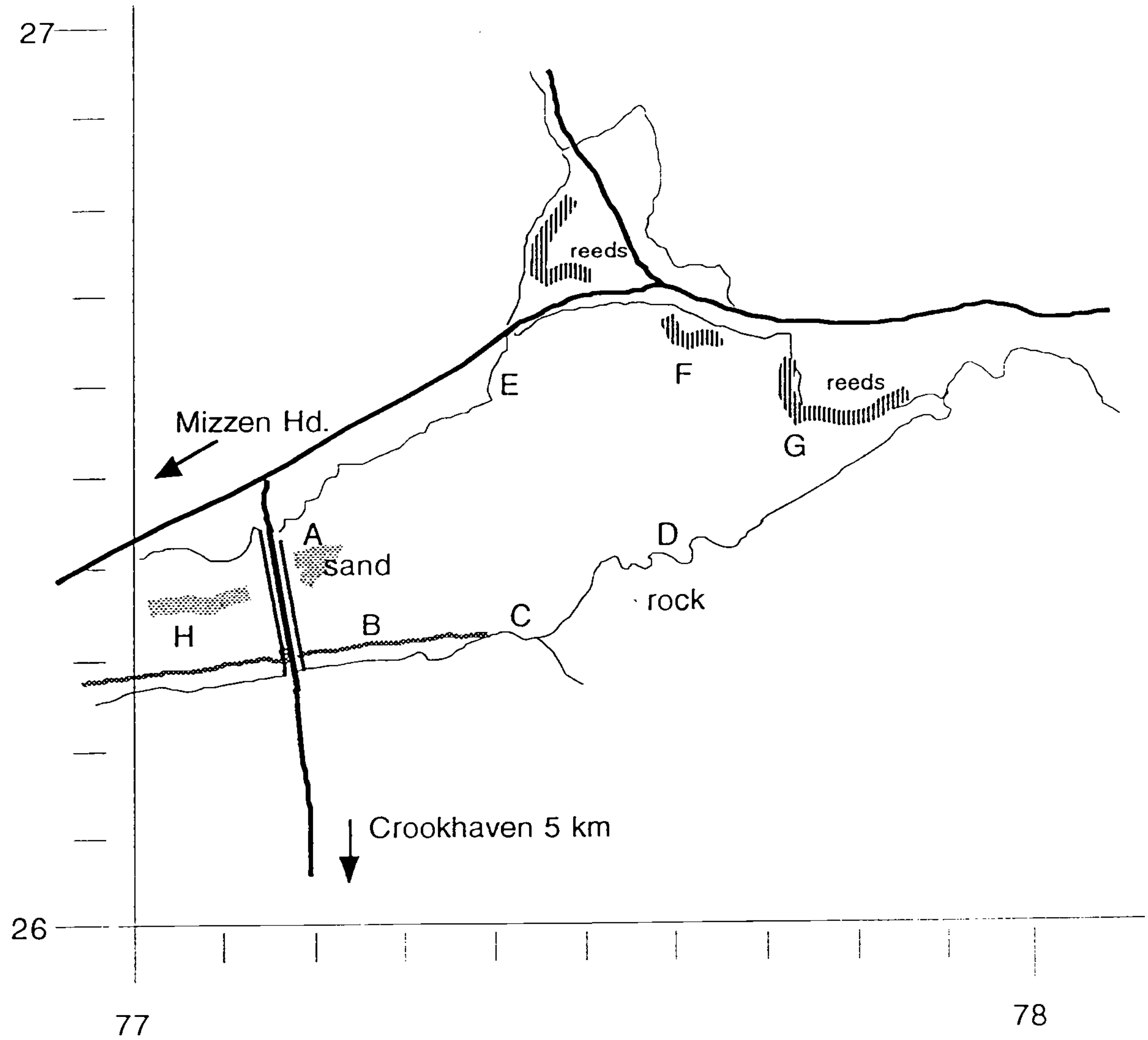

Fig. 4.2.1. Location Map of Sampling Stations in Lissagriffin Lake, Co. Cork

Table 4.2.1 Fauna Recorded at Lissagriffin Lake, Co Cork. July and August 1996.

		Sampling Stations (L.T. = light-trap)												
		A	L.T.A	B	C	L.T.C	D	L.T.D	E	L.T.E	F	L.T.F	G	H
Porifera														
Cnidaria														
Turbellaria														
Nemertea														
Annelida	*Hediste diversicolor*	a		a			a		+		+			a
Crustacea														
Ostracoda							?							
Cirripedia														
Mysidacea	*Neomysis integer*	c	>100	c	o	75	o		o	5	c	75	c	c
Isopoda	*Jaera nordmanni*								+					
	Ligia oceanica	+												
Amphipoda	*Allomelita pellucida*			+										
	Gammarus duebeni	+												c
	Melita palmata								+					+
	Orchestia gammarella						+		+					+
Tanaidacea														
Decapoda	*Carcinus maenas*	c		c			c		+				c	c
	Crangon crangon													a
	Palaemonetes varians	c	2	c						1				a
	Palaemon elegans		2											c
	P. serratus													a
Arachnida														
Insecta														
Thysanura	*Petrobius sp.*								+					
Ephemeroptera														
Odonata														
Plecoptera														
Trichoptera														
Hemiptera	*Sigara stagnalis*												+	
Coleoptera														
Diptera	Chironomidae										+		+	
Mollusca														
Prosobranchia	Hydrobiidae	shells		shells			shells		+		o			o
	Hydrobia ulvae	shells												+
	Potamopyrgus antipodarum			shells			shells		+		+			
pisthobranchia														
Pulmonata														
Bivalvia	*Ceastoderma edule*	shells												shells
	Macoma baltica	shells												shells
	Scrobicularia plana	shells												shells
Bryozoa	*? Plumatella repens*								+					
Echinodermata														
Tunicata														
Teleostei	*Anguilla anguilla*	F, 1		+									+	
	Gasterosteus aculeatus	+		o	+		+		o	4	+		+	c
	Mugilidae			F, 1					+					+
	Pomatoschistus microps													+
	Platichthys flesus	+		+									c	c

+ = present; o = occasional; a = abundant; F = fyke net

Station H (OS 7715 2633) was an additional sampling station in the tidal inlet west of the causeway (Plate 4.2.2). Substrate was sand, grading to fine silt and organic mud. Water depth varied from 0 - 25 cm and salinity measured 25 ‰. on the flood tide.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 4.2.1. Among 24 taxa listed, 21 are identified to species. Three of the species are marine, 3 are poly-mesohaline, 11 are euryhaline, 1 is oligo-mesohaline and one is limnic (Table 4.2.2). Two species (*Sigara stagnalis* and *Palaemoetes varians*) are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Marine species were only present in the tidal inlet (station H). Landward of the causeway, species occurrence was similar at all stations but some species e.g. prawns and mysids, were most abundant at A and B i.e. near the causeway. Corixids, chironomid larvae and *Potamopyrgus antipodarum* were only found at E, F and G, the most inland stations, although the salinity was not significantly lower at these stations than elsewhere at the time of sampling.

Although no light traps were set at H, 17 species were recorded here compared with 11 at A, 9 at B and 2-6 at other stations, showing that diversity increases with increasing marine influence.

Table 4.2.2 Ecological categories of the recorded taxa in Lissagriffin Lake (marginal species omitted). L = lagoonal specialist (Davidson *et al.* (1991)

Marine	*Hydrobia ulvae*	
	Palaemon elegans	
	P. serratus	
Poly-mesohaline	*Crangon crangon*	
	Melita palmata	
	Mugilidae	
Euryhaline	*Hediste diversicolor*	
	Neomysis integer	
	Jaera nordmanni	
	Gammarus duebeni	
	Palaemonetes varians	L
	Sigara stagnalis	L
	Carcinus maenas	
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
	Platichthys flesus	
Oligo-mesohaline	*Potamopyrgus antipodarum*	
Limnic	?*Plumatella repens*	

4.2.3 Discussion

Despite the low salinities recorded at the time of sampling in August, the fauna typifies a brackishwater of medium to high salinity with open access to the sea. The poor representation of oligohaline species, even at the stations furthest from the sea, may be due to poor growth of submerged macrophytes caused by overheating in shallow water and possibly tidal scouring. However, the frequency of ragworms throughout the lake suggests that the lake bed is not exposed or overheated for long periods. When the presence of a sea inlet is taken into account, the lake may be described as poor in species.

None of the recorded species can be described as rare in Ireland

4.2.4 Threats

There appear to be no major threats to this lake at present. The amount of nutrients from agricultural sources is likely to be low in this area and regular flushing by seawater could prevent any eutrophication problems. However, there are holiday homes on land surrounding the lake and uncontrolled camping and caravanning has caused some problems. The County Council has recently acquired part of the dunes by compulsory purchase.

The lake is subject to changes from natural processes, especially from colmatisation, and is likely to become increasingly shallow.

4.2.5 Evaluation

Lissagriffin Lake is an **artificial saline lake** created by construction of a causeway at the head of a tidal inlet.

Geomorphologically and ornithologically the area is great interest. However the lake is largely artificial and the aquatic fauna recorded in the survey is relatively poor and of little interest.

The lake and tidal inlet are likely to be protected for their ornithological value. Hides could be built to reduce disturbance and traffic congestion on the causeway.

The lake lies within a proposed NHA (Site Code No. 1040).

In conclusion, based on the aquatic fauna, Lissagriffin is not of high conservation value.

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4. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

4.3.1 Site Description (Fig. 4.3.1)

This is a long narrow shallow lagoon bordered by fairly high ground to the north, east, south east and west. This is an area of rough pasture with occasional heath vegetation. The outlet to the sea lies at the western end of the site and runs through dune grassland.

The major freshwater inflows discharge into the lake at the eastern end from the north and east. The associated *Phragmites* beds are the only areas of extensive swamp vegetation. Elsewhere, shores are generally rocky and more or less steeply sloping with occasional narrow strips of emergents to the north and open and very shallow of slope to the south. Heath vegetation occurs above much of the northern shore and saltmarsh occurs along most of the lower lying, sandy southern shore.

A causeway carries a public road across the lake about mid-way along its length and another borders the north eastern corner, with the road continuing along above the north shore.

4.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

1. <u>Transects:</u>

The locality of these is shown in Fig. 4.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

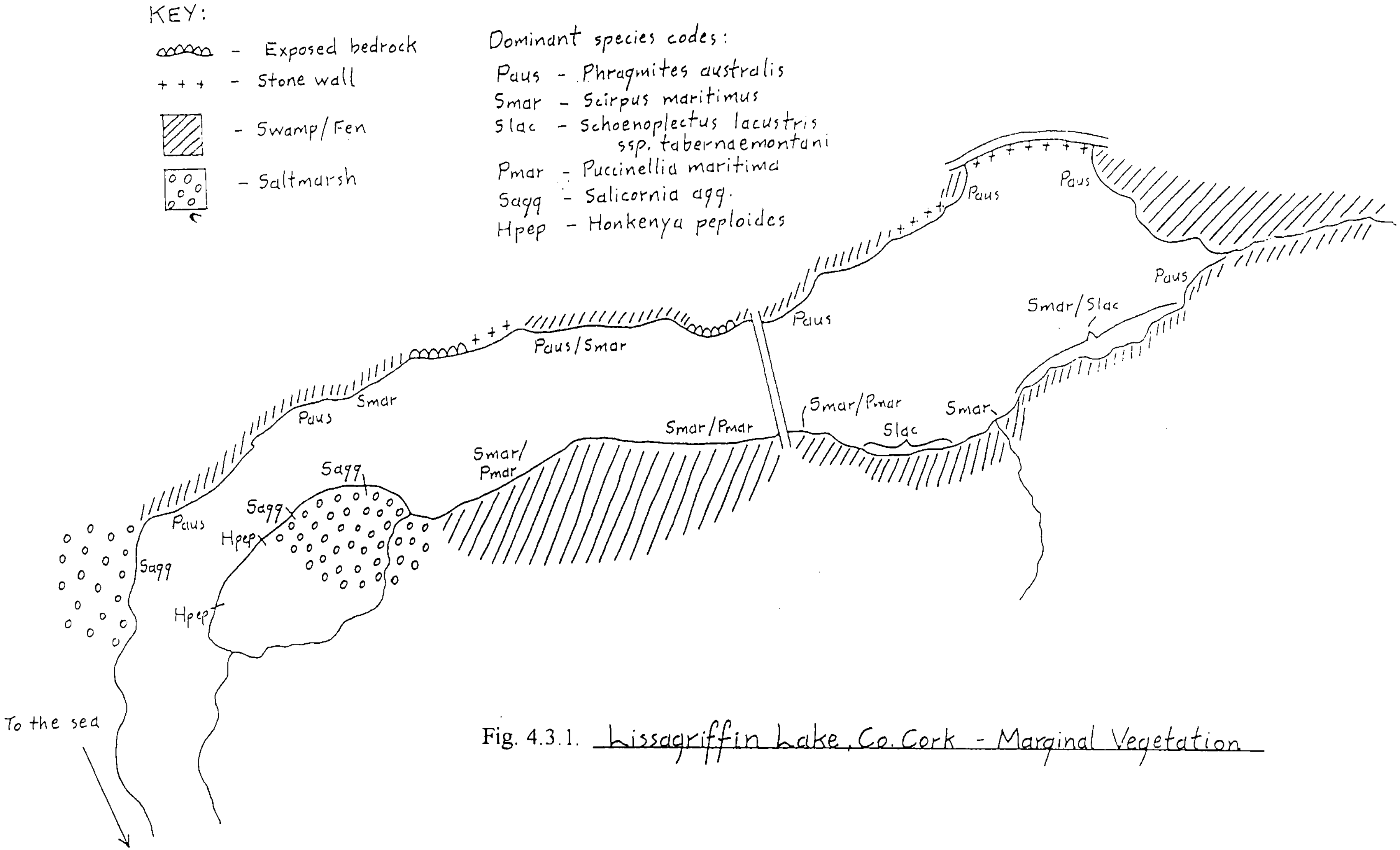

Fig. 4.3.1. Lissagriffin Lake, Co. Cork - Marginal Vegetation

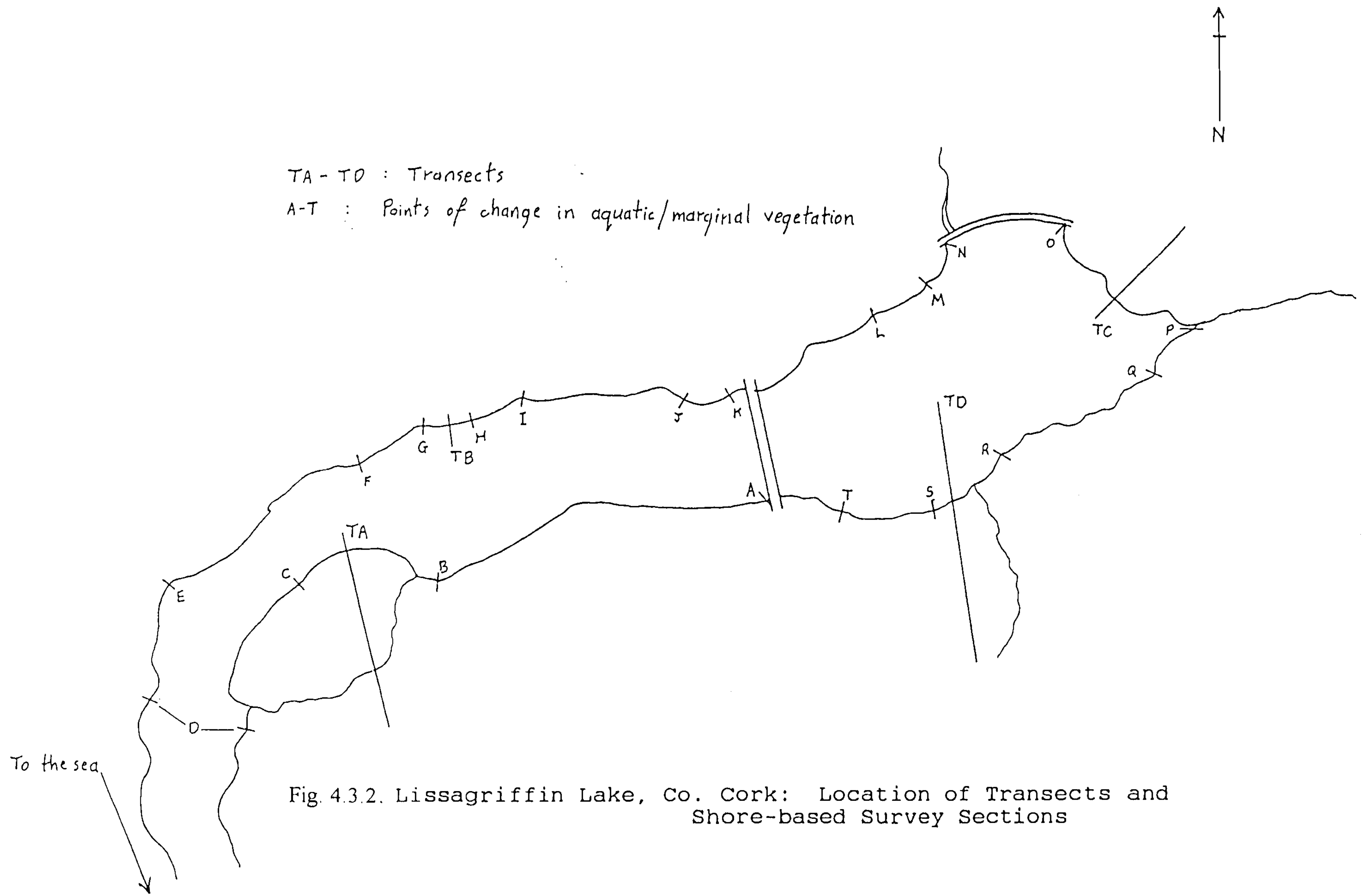

Fig. 4.3.2. Lissagriffin Lake, Co. Cork: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

<u>Cover/Abundance Values</u>
Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

4.3.3 Results

1.Shore-based survey

Section A-B

Aquatic: No aquatic vegetation to at least 20m out

Sand substrate

Marginal: Open Scirpus maritimus cover with salt tolerant vegetation dominated by Puccinellia maritima and Glaux maritima. c.100m. Poached and grazed Grading to salt tolerant community dominated by Festuca rubra, Juncus gerardii and Agrostis stolonifera with sparse Scirpus maritimus and Juncus maritimus. c.2-300m. Poached and grazed

Adjacent: Dune grassland dominated by Festuca rubra, Trifolium repens, Plantago lanceolata, Galium verum

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Section B-C (Transect A)

Aquatic: Unchanged

Marginal: Salicornia dominant with patchy Puccinellia maritima in species-poor salt tolerant community on sandy substrate. 40-50m
Festuca rubra dominant with Glaux maritima locally co-dominant in species-poor
salt tolerant community on sandy substrate. 30-40m

Adjacent: Dune grassland dominated by Ammophila arenaria and Festuca rubra

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Section C-D

Aquatic: Ulva lactuca - sparse

Marginal: 1-2m strip of open Honkenya peploides cover on sand
Backing to Festuca rubra - Glaux maritima dominated community as B-C. 5-70m

Adjacent: Unchanged

Section D-E

Aquatic: Unchanged

Marginal: As B-C

Adjacent: 2.5m earth cliff
Backing to pasture

Section E-F

Aquatic: Enteromorpha
Ulva lactuca

Marginal: Single species Phragmites australis swamp. 3-20m

Adjacent: Heath vegetation dominated by Ulex europaeus, Pteridium aquilinum and Erica cinerea on 45 degree slope to public road

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Section F-G

Aquatic: Enteromorpha - patchy
Ulva lactuca - patchy
Fucus c.f. spiralis - patchy

Sand substrate with occasional cobbles

Marginal: Single species Scirpus maritimus swamp. 3m

Adjacent: 3m stone wall backing to public road

Section G-H (Transect B)

Aquatic: Unchanged

Marginal: Bedrock shore with sparse salt tolerant vegetation dominated by Festuca rubra

Adjacent: As E-F

Section H-I

Aquatic: Enteromorpha - patchy
Ulva lactuca - patchy

Marginal: 5m concrete wall

Adjacent: Public road

Section I-J

Aquatic: Unchanged

Marginal: Scirpus maritimus and Phragmites swamp vegetation with each species locally dominant in small single species stands. c.5m

Adjacent: As E-F

Section J-K

As G-H

Section K-L

Aquatic: No aquatic vegetation to at least 15m out

Marginal: Single species Phragmites swamp. 15-20m

Adjacent: As E-F

Section L-M

Aquatic: Unchanged

Marginal: 1m stone wall

Adjacent: Amenity grassland (private garden)

Section M-N

Aquatic: Unchanged

Marginal: Single species Phragmites swamp. 15-20m

Adjacent: Unchanged

Section N-O

Aquatic: Unchanged

Marginal: 2m stone causeway wall

Adjacent: Public road on causeway backing to extensive Phragmites bed associated with freshwater inflow

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Section O-P (Transect C)

Aquatic: Filamentous algae - patchy
Enteromorpha - very sparse

Silt and sand substrate

Marginal: Dense single species Phragmites swamp. c.50-60m
Grading to dense Phragmites dominated fen community with sparse species-poor understorey of freshwater species associated with freshwater inflow. c.2-300m

Adjacent: Public road to north, heath as E-F and pasture to south and east

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Section P-Q

Aquatic: Ruppia sp. - sparse and low growing to at least 20m out
Filamentous algae - sparse
Enteromorpha - sparse

Marginal: Dense single species Phragmites swamp. 25-30m
Backing to 45 degree bedrock shore

Adjacent: Heath as E-F

Section Q-R

Aquatic: Unchanged

Marginal: Scirpus maritimus and Schoenoplectus lacustris ssp tabernaemontani swamp with
each species locally dominant. c.10m
Grading to 1-2m Agrostis stolonifera dominated strip with frequent Eleocharis
palustris, Glaux maritima, Atriplex hastata

Adjacent: 1.5m stone wall backing to rough pasture

Section R-S (Transect D)

Aquatic: Ruppia sp. - sparse and low growing from c.50m to at least 100m out
Enteromorpha - very sparse

Sand substrate

Marginal: Open Scirpus maritimus cover with frequent Phragmites shoots over salt tolerant community with occasional Juncus maritimus tussocks. Agrostis stolonifera and Eleocharis palustris patchy and locally dominant among otherwise sparse understorey species. Poached and grazed. 20-40m
Grading to fairly dense Schoenoplectus cover with frequent Phragmites and Scirpus maritimus over species-poor salt tolerant community. Agrostis and Eleocharis as above. Poached and grazed. 10-20m
Grading to open Schoenoplectus cover over sparse freshwater species on heavily poached substrate. Grazed. 40-50m

Adjacent: Phragmites fen associated with freshwater stream. c.20m
Backing to rough pasture

Section S-T

Aquatic: Unchanged

Marginal: Fairly open Schoenoplectus cover with sparse Phragmites shoots over species-poor salt tolerant community. Abundant Glaux maritima dominant below with patchy Agrostis stolonifera and Eleocharis palustris locally co-dominant among sparse understorey. 30-50m
Grading to Iris psuedacorus dominated community of sparse freshwater species on heavily poached substrate. Grazed. c.70m

Adjacent: Rough pasture

Section T-A

Aquatic: Unchanged

Marginal: As A-B

Adjacent: Unchanged

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1. Transects

Site: Lissagriffin Lake	Transect code: A	
Location: Saltmarsh bordering outlet channel	Sample point: 1 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 70 cm	Salinity: 19 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Description: No aquatic vegetation.		

Site: Lissagriffin Lake	Transect code: A	
Location: Saltmarsh bordering outlet to sea	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Salicornia agg.	8	80
Puccinellia maritima	5	20
Plantago maritima	8	< 1
Spergularia marina	6	< 1
Juncus maritimus	70	< 1
Description: Salicornia dominant with open patchy cover of Puccinellia in species-poor		
salt tolerant community. 50m.		

Site: Lissagriffin Lake	Transect code: A	
Location: Saltmarsh bordering outlet channel	Sample point: 3 Marginal	
Sample area: 100m2 (4x4)	Substrate: Sand	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		75
Festuca rubra	10	50
Glaux maritima	8	20
Agrostis stolonifera	8	5
Carex extensa	15	5
Plantago maritima	6	< 1
Plantago coronopus	2	< 1
Description: Species-poor salt tolerant community with Festuca rubra dominant and Glaux widespread and locally co-dominant. 40m. A small outflow channel (average width 4m) passes through this community and connects with the main outflow.		
Grading to Ammophila arenaria - Festuca rubra dune grassland (barrier).		

Site: Lissagriffin Lake	Transect code: B	
Location: Open rocky shore	Sample point: 1 Aquatic - 5m out	
Sample area: 25m2 (5x5)	Substrate: Sand, cobbles	
Depth: 80 cm	Salinity: 19 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		70
Fucus c.f. spiralis	25	30
Enteromorpha	20	20
Ulva lactuca	30	20
Description: Patchy algal cover growing on submerged rocks.		
Backing rocky shore with sparse vegetation. Festuca rubra dominant with sparse Armeria maritima, Plantago maritima, Glaux maritima on exposed bedrock (slope c.45 degrees).		
Grading to heath vegetation dominated by Ulex europaeus and Pteridium aquilinum.		

Site: Lissagriffin Lake	Transect code: C	
Location: Freshwater inflow	Sample point: 1 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 20 cm	Salinity: 8 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Filamentous algae		5
Enteromorpha		< 1
Description: Sparse cover of filamentous algae and Enteromorpha. Same species at more or less same cover 0-15m out.		

Site: Lissagriffin Lake	Transect code: C	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		100
Phragmites australis	230	100
Algae		10
Enteromorpha		10
Description: Dense single species Phragmites swamp with open ground cover of washed up Enteromorpha. 60m.		

Site: Lissagriffin Lake	Transect code: C	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Galium palustre sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	230	100
Mentha aquatica	30	< 1
Lythrum salicaria	40	< 1
Galium palustre	20	< 1
Nasturtium officinale	15	< 1
Description: Dense Phragmites fen with sparse understorey of freshwater species. c.100m		
Backing to heath vegetation with Ulex europaeus and Pteridium aquilinum		

Site: Lissagriffin Lake	Transect code: D	
Location: Marginal swamp	Sample point: 1 Aquatic - 100m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 20 cm	Salinity: 6 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Higher Plant		5
Ruppia sp.	8	5
Algae		< 1
Filamentous algae		< 1
Description: Sparse low growing Ruppia with very sparse filamentous algae. Same species at		
more or less same cover 60 - 100m out.		

Site: Lissagriffin Lake	Transect code: D	
Location: Marginal swamp	Sample point: 2 Aquatic - 50m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 15 cm	Salinity: 6 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Filamentous algae		5
Description: Sparse filamentous algae only.		

Site: Lissagriffin Lake	Transect code: D	
Location: Marginal swamp	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		75
Scirpus maritimus	100	60
Phragmites australis	80	5
Eleocharis palustris	15	5
Glaux maritima	8	5
Agrostis stolonifera	15	5
Juncus maritimus	70	< 1
Juncus gerardii	20	< 1
Triglochin maritima	15	< 1
Aster tripolium	25	< 1
Samolus valerandi	10	< 1
Salicornia agg.	8	< 1
Carex serotina	15	< 1
Description: Open Scirpus cover with frequent Phragmites shoots over salt tolerant community with occasional Juncus maritimus tussocks. Eleocharis and Agrostis patchy and locally dominant among otherwise sparse understorey species on poached substrate. 30m.		

Site: Lissagriffin Lake	Transect code: D	
Location: Marginal swamp	Sample point: 4 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Schoenoplectus lacustris ssp tabernaemontani	100	75
Phragmites australis	80	5
Scirpus maritimus	80	5
Eleocharis palustris	20	5
Agrostis stolonifera	15	5
Glaux maritima	10	< 1
Samolus valerandi	10	< 1
Oenanthe lachenalii	20	< 1
Description: Fairly dense Schoenoplectus with sparse Scirpus maritimus and Phragmites shoots. Patchy Eleocharis and Agrostis dominant among species-poor understorey of sparse salt tolerant species. 20m.		

Site: Lissagriffin Lake	Transect code: D	
Location: Marginal swamp	Sample point: 5 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - sub-community undetermined		
	Height (cm)	Cover (%)
Total Plant		50
Schoenoplectus lacustris ssp tabernaemontani	100	30
Agrostis stolonifera	15	5
Pedicularis palustris	30	5
Hydrocotyle vulgaris	4	5
Apium nodiflorum	10	< 5
Mentha aquatica	15	< 5
Ranunculus flammula	15	< 1
Samolus valerandi	8	< 1
Triglochin palustris	10	< 1
Baldellia ranunculoides	15	< 1
Anagallis tenella	2	< 1
Juncus articulatus	25	< 1
Carex nigra	15	< 1
Description: Open cover of Schoenoplectus with Agrostis stolonifera locally dominant		
amongst open ground cover of freshwater species on heavily poached substrate. 50m.		
Backing freshwater Phragmites fen. c.20m.		
Backing pasture on rising ground.		

4.3.4 Evaluation

'Not Valuable'

This is a shallow sandy lagoon. Salinity was 0-20 parts per thousand at time of survey over the site as a whole, 0-6 parts per thousand within the eastern section landward of the causeway. The whole eastern section and most of the western section were surveyed by means of wading.

Ruppia is the only aquatic higher plant. It is confined to the southern half of the eastern section and occurs at a sparse to patchy cover. It is low-growing here. It was not possible to identify this *Ruppia* to species.

Ulva lactuca and a *Fucus* species are occasional in the western section of the site, where no higher plant species occur.

Marginal communities are fairly diverse. *Phragmites* is extensive around the freshwater inflows at the eastern end and fringes the north eastern shore. *Scirpus maritimus* and *Schoenoplectus lacustris* ssp. *tabernaemontani* occur in single species swamps along south eastern shores and with saltmarsh species along southern shores. *Puccinellia maritima* dominated saltmarsh occurs at the western end on either side of the mouth of the outlet channel.

Lissagriffin Lake is a very species-poor site with no species or communities of notable interest.

Further survey is not recommended.

4.4 ECOTONAL COLEOPTERA

J.A. Good Ph.D MIEEM FRES,
Terrascope Environmental Consultancy, Riverstick, Co. Cork.

4.4.1 Site Description

Coastal brackish lake in two sections (Plate 1) divided by causeway bridge (3 outflow/inflow c. 0.7m open pipes) with inlet channel through sand dunes, sea apparently entering only at high tide. Much of upper and lower lake shores with mostly anaerobic sand-flat margins, covered at high spring tides and probably during winter. Marginal vegetation dominated by *Phragmites communis*, *Scirpus maritimus* and *Schoenoplectus lacustris*, grading into dune pasture (lower channel and lake), and marshy pasture (upper lake). Salinity higher in lower lake (above and below causeway, 30 viii 1996: 27‰ and 32‰, respectively). Margins grazed by cattle, with moderate soil poaching in occasional patches.

Subsites (Fig. 4.4.1)

1. Marshy pasture (V 772262)

Marshy pasture with *Agrostis*, *Juncus*, carices, etc. near *Schoenoplectus* and dense *Phragmites* stands, grazed by cattle, and flooded during winter at least.

2. *Phragmites* /grass (V 772265)

Sparse *Phragmites commnis* in grass c. 1m from dense *Phragmites* beds on lake margin.

3. Bridge sandy margin (V 772263)

Silty sand with bridge cobble stones below causeway, covered at high spring tide.

4. *Scirpus maritimus* (V 774263)

Sparse *Scirpus maritimus* with *Schoenoplectus lacustris* and *Glaux maritima* on partially aerobic sandflat, flooded at high spring tide and during winter. Vegetation cover from c.20-80%.

4. Sandflat (V 766260)

Sandflat aerobic, covered at high spring tide, in broad tidal channel.

4.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

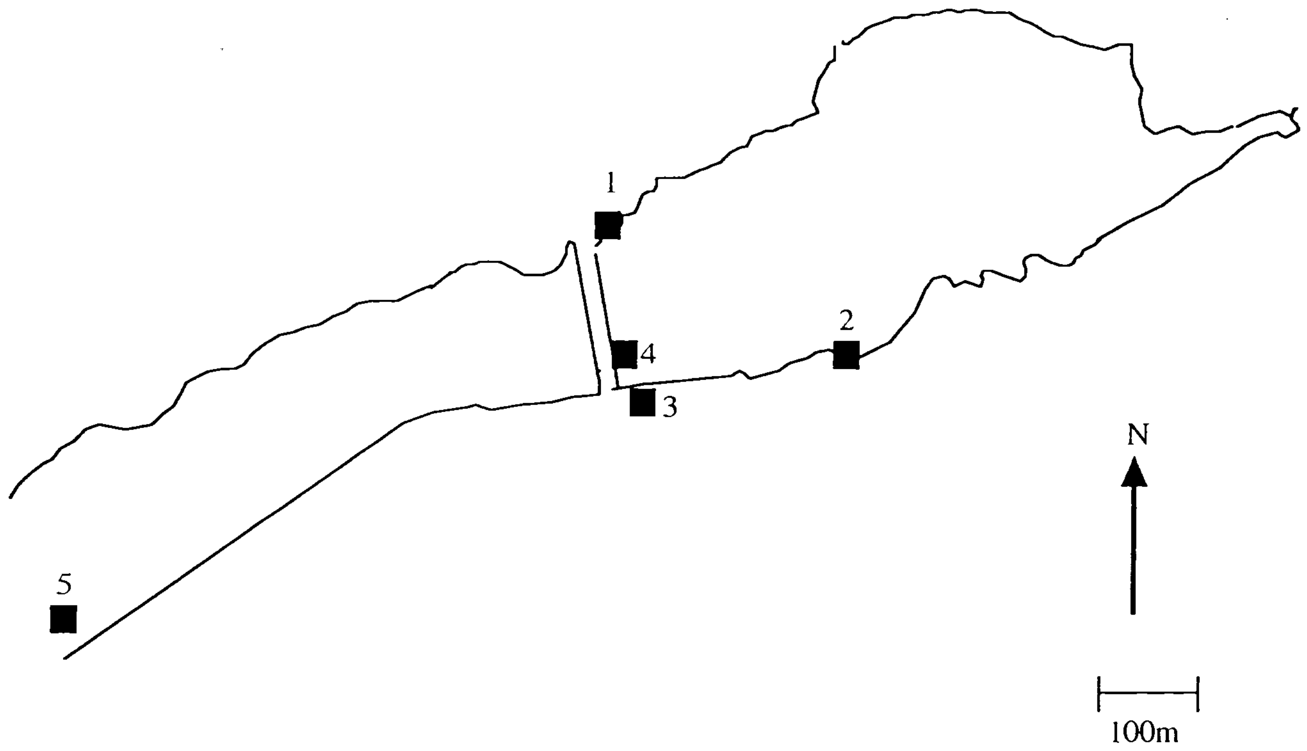

Fig. 4.4.1. Map of sampling sites (Carabidae and Staphylinidae) at Lissagriffin Lake, Co. Cork

1 - Pitfall traps
2 - Ground search
3 - Pitfall traps, S-vac
4 - Cobble search
5 - Flotation

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 4.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as

'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 4.4.1. Details of sampling methods.

Method	**Details**	**No. replicates per unit sample**	**Sampling period, etc.**
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References

Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) Marshy pasture - S-vac suction sampler (30 viii 1996), c. 2 m^2;
(2) Marshy pasture - 6 plastic pitfall traps with funnels and ethylene glycol preservative (30 viii - 3 x 1996);
(3) *Phragmites* /grass - 6 pitfall traps (30 viii - 3 x 1996);
(4) Bridge sandy margin - cobble search (n=30, 13 vii 1996);
(5) *Scirpus maritimus* area - 1h ground search (13 vii 1996);
(6) Sandflat - flotation from incoming spring tide (30 viii 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

4.4.3 Survey Results

Five species of carabid and seventeen species of staphylinid were recorded, one of which is regarded as an indicator species (Table 4.4.2).

Carabus clathratus is a stenotopic species occurring in dense vegetation on peat soils, from bogs, lake shores and also salt-meadows (Koch 1989, Hyman and Parsons 1992). It occurs across the Palaeartic (Freude 1976), but is very local in Great Britain (Hyman and Parsons 1992), and appears the be local in Ireland. The single individual was recorded from the marshy meadow, but probably orginated in the nearby reedbeds.

The staphylinid assemblage recorded from the marshy meadow was low in diversity, with most species being eurytopic or tolerant of disturbance (Table 4.4.3).

TABLE 4.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Lissagriffin Lake. Nomenclature follows Lucht (1987) and Lohse and Lucht (1989), with the exception of *Diglotta* which follows Good (in preparation), and *Tachyporus* which follow Booth (1988).

	Species	No. individuals	
Carabidae			
	Agonum marginatum (L.)	1	
	Agonum pelidnum (Payk.)	1	
	Amara ovata (F.)	1	
*	*Carabus clathratus* L.	1	**Indicator species**
	Pterostichus niger (Schall.)	1	

Lissagriffin Lake

Staphylinidae

Atheta amplicollis (Muls. Rey)	8
Atheta elongatula (Grav.)	3
Atheta graminicola (Grav.)	8
Atheta vestita (Grav.)	2
Bledius subniger Schneid.	18
Carpelimus corticinus (Grav.)	1
Diglotta mersa (Hal.)	4
Drusilla canaliculata (F.)	141
Gabrius pennatus Sharp	3
Lathrobium quadratum (Payk.)	2
Othius laeviusculus Steph.	1
Philonthus addendus Sharp	1
Quedius nigriceps Kr.	1
Stenus bimaculatus Gyll.	1
Stenus boops Ljungh	15
Tachinus signatus Grav.	1
Tachyporus dispar (Payk.)	1

TABLE 4.4.3. Staphylinid assemblage from lake margin marshy pasture, Lissagriffin Lake (suction sample and pitfall traps combined).

Abund. Cat.	Species	No.	Main biotope
Dominant	*Stenus boops*	15	Eurytopic, incl. marshy meadows
Intermediate	*Atheta amplicollis*	4	Eurytopic, incl. disturbed soil
	Atheta graminicola	2	Eurytopic, incl. marshy meadows
	Gabrius pennatus	3	Eurytopic, incl. disturbed soil
	Lathrobium quadratum	2	Marshes, and muddy shores
Present	*Carpelimus corticinus*	1	Eurytopic, including marshy shores
	Tachyporus dispar	1	Eurytopic, esp. grassland

4.4.4 Evaluation

Of low conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

Only one wetland indicator species was recorded. The staphylinid assemblage recorded from the marginal marshy pasture indicated disturbed conditions, probably due to saline water flooding. However, further investigation of the reedbed marshes associated with this site may discover more freshwater wetland indicator species.

4.4.5 References

Booth, R.G. (1988) The identity of *Tachyporus chrysomelinus* (Linnaeus) and the separation of *T. dispar* (Paykull) (Coleoptera; Staphylinidae). *Entomologist* **107**: 127-133.

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Freude, H. (1976) Fam. Carabidae. In: Freude, H., Harde, K.W. and Lohse, G.A. (eds). *Die Käfer Mitteleuropas.* **2**. Goecke & Evers, Krefeld.

Koch, K. (1989) *Die Käfer Mitteleuropas. Ökologie.* **1**. Goecke & Evers, Krefeld.

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4.5 SUMMARY AND EVALUATION

Lissagriffin Lake is a relatively small (12 ha) shallow, **artificial saline lake** at least partly created by construction of a causeway at the head of a tidal inlet.

Ornithologically the area is great interest for its wintering waders and wildfowl, and for attracting rare American vagrants.

The lake lies within a proposed NHA (Site Code No. 1040).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	Low
Aquatic Fauna	Low
Vegetation	Low
Ecotonal Coleoptera	Low

Geomorphology

Lissagriffin Lake is not a coastal lagoon, but a relatively small (12 ha), shallow, saline lake lying at the head of a long sinuous tidal inlet. A natural lake may have existed in the past, but the presence of permanent water is at least partly due to the construction of a causeway which restricts water flows in both directions.

Although the lake and tidal inlet running through coastal dunes are geomorphologically very interesting, as a lagoon or saline lake it is relatively small and largely artificial.

Based on geomorphology, the lake is therefore rated as of low conservation value

Aquatic Fauna

A total of 24 taxa were identified which included only two lagoonal specialists. (*Sigara stagnalis* and *Palaemonetes varians*).

The recorded fauna typifies a brackishwater of medium to high salinity with open access to the sea. The poor representation of oligohaline species, even at the stations furthest from the sea, may be due to poor growth of submerged macrophytes caused by overheating in shallow water and possibly tidal scouring. However, the frequency of ragworms throughout the lake suggests that the lake bed is not exposed or overheated for long periods. When the presence of a sea inlet is taken into account, the lake may be described as poor in species

None of the recorded species can be described as rare in Ireland and the aquatic fauna is relatively poor and of little interest.

In conclusion, based on the aquatic fauna, Lissagriffin is of low conservation value.

Vegetation

Ruppia was the only aquatic higher plant recorded. It is confined to the southern half of the eastern section and occurs at a sparse to patchy cover. It is low-growing here. It was not possible to identify this *Ruppia* to species. *Ulva lactuca* and a *Fucus* species are occasional in the western section of the site, where no higher plant species occur.

Marginal communities are fairly diverse. *Phragmites* is extensive around the freshwater inflows at the eastern end and fringes the north eastern shore. *Scirpus maritimus* and *Schoenoplectus lacustris* ssp. *tabernaemontani* occur in single species swamps along south eastern shores and with saltmarsh species along southern shores. *Puccinellia maritima* dominated saltmarsh occurs at the western end on either side of the mouth of the outlet channel.

Lissagriffin Lake is a very species-poor site with no species or communities of notable interest and is regarded as of <u>low conservation value</u>

Further survey is not recommended.

Ecotonal Coleoptera

Five species of carabid and seventeen species of staphylinid were recorded, one of which is regarded as an indicator species

Carabus clathratus is a stenotopic species occurring in dense vegetation on peat soils, from bogs, lake shores and also salt-meadows. It occurs across the Palaeartic but is very local in Great Britain and appears the be local in Ireland. The single individual was recorded from the marshy meadow, but probably orginated in the nearby reedbeds.

The staphylinid assemblage recorded from the marginal marshy pasture indicated disturbed conditions, probably due to saline water flooding. However, further investigation of the reedbed marshes associated with this site may discover more freshwater wetland indicator species.

As only one wetland indicator species was recorded Lissagriffin Lake is regarded as of <u>low</u> conservation interest for terrestrial ecotonal community

Summary

The lake and tidal inlet are of great scenic and ornithological interest. However, based on all four criteria used in the survey Lissagriffin is rated as of <u>low conservation value.</u> as a coastal lagoon or saline lake and proposal as an SAC is not recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

5. FARRANAMANAGH LAKE

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

5. FARRANAMANAGH LAKE

CONTENTS

5. FARRANAMANAGH LAKE, Co. Cork.

OS Grid Reference: V 830 378, 1:50,000 Sheet No. 88
Alternative names:

5.1 STUDY AREA

General features

Farranamanagh Lake is situated in Dunmanus Bay on the south side of the Sheep's Head peninsula, 3 km east of Kilcrohane (Fig. 5.1.1). The lake is a small, completely natural lagoon lying behind a cobble barrier through which runs a permanent outlet. Small freshwater streams enter the lagoon in the north. On spring tides, seawater enters through the inlet and overtops the barrier during storms. Very little is known about the lake except that Whooper swans (*Cygnus cygnus*) are recorded in the winter.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6.5-7°C in January and 15.5 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 11 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1300 mm, and the number of rain days (1 mm or more) is about 200. Winds are mainly from the south and southwest. Mean annual hourly wind speeds are between 5 and 6 m/s and a maximum wind speed of 49-50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 25-30 (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) in the Kenmare River is 4.0 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology Bedrock is Old Red Sandstone and soils are generally acidic and mostly peaty podzols and acid brown earths (Royal Irish Academy, 1979). Land surrounding the lake is a mixture of rocky hillside, small peat bogs, wet heath and small irregular fields of pastureland.

Lake Topography The lake is roughly 300 m from north to south, 300 m across at its widest point and covers approximately 5 ha. The lake is about 2 m at its deepest

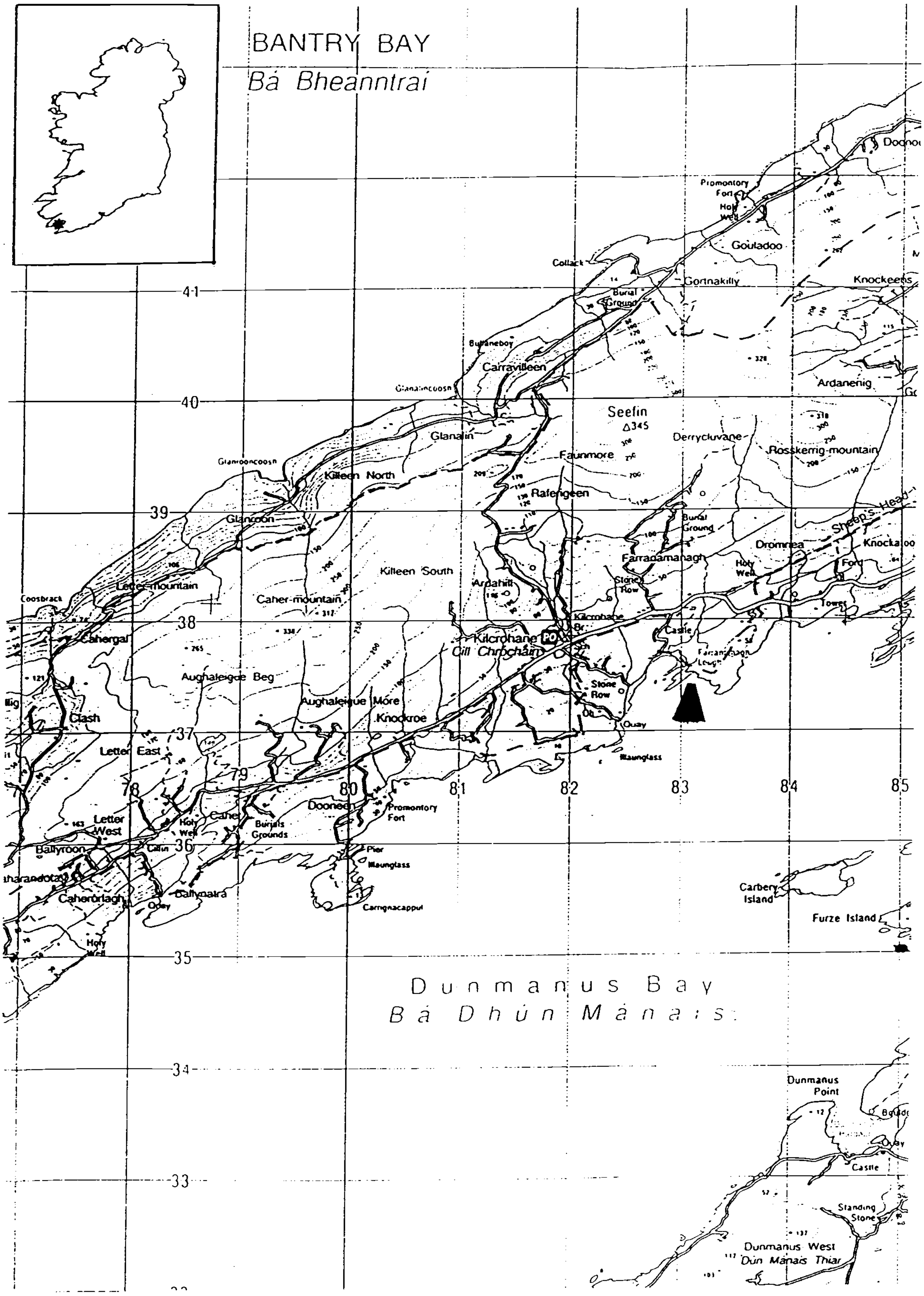

Fig. 5.1.1 Section of 1:50 000 map showing locality of Farranamanagh Lake

point and most of the bed of the lake is composed of cobbles and gravel, with sand, peat and organic silt in sheltered areas.

Hydrology Small streams enter the lake from the north and seawater enters on spring tides. During storms, at high tide, waves break over the shingle bar but entry of seawater by overtopping has increased due to gravel abstraction during the 1980's (P. Whelan *pers. comm.*). No tidal variation in water level of the lake was apparent during the study period, but winter water levels can be 1 m higher than summer.

Salinity and water quality Seawater at approximately 34‰ enters the lake on spring tides and by overtopping the barrier during storms but the lake is small and the volume of freshwater entering the lake is probably sufficient to ensure low salinities throughout the year. The only major source of nutrients to the lake is agricultural. The amount is likely to be low in this area and regular flushing by seawater is likely to prevent any serious eutrophication problems.

5.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver, Dept. of Zoology, University College Dublin

5.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰. precision). A photographic record was made of the site and local information sought concerning background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations B and C in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by

inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Standard keys were used to identify specimens, but larval or juvenile stages were difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level.

5.2.2 Results

Farranamanagh Lake was sampled on 5.vii.96 during the first part of the survey, and from 17-18.vii.96 during the more intensive survey.

Four sampling stations were selected in the lake to reflect the influences of substrate, freshwater and tidal inflows. Positions of the sampling stations are shown in Fig.5.2.1.

Environmental Variables

Station A (OS 8297 3774) was located at the western end of the lake, close to the barrier (Plate.5.2.1). Substrate consisted of cobbles and gravel close to the barrier with peat and organic silts in deeper water. Water depth varied from 0-1 m and salinity measured 2-3 ‰.

Station B (OS 8312 3784) was located at the northern end of the lake where the main freshwater stream enters the lake(Plate 5.2.2). Substrate consisted of sand and silt with large boulders, water depth varied from 25 - 60 cm and salinity measured 1 ‰.

Station C (8307 3765)was located at the southern end of the lake near the outlet (Plate 5.2.1). Substrate consisted of cobbles, gravel and sand, water depth was 1 - 1.5 m and salinity measured 6‰.

Station D: (OS 8301 3770) was located along the western shore between stations A and B (Plate 5.2.1). Substrate consisted of cobbles and gravel, water depth varied from 0-25 cm and salinity measured 5‰..

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 5.2.1. Among 17 taxa listed, 16 are identified to species. One species is poly-mesohaline, 10 are euryhaline, and one is oligo-mesohaline and 2 are limnic; no marine species were recorded (Fig. 5.2.2). One of the species is listed as a lagoonal specialist in Britain (Davidson *et al.* 1991).

The fauna was poor at all stations and only *Neomysis integer*, *Palaemonetes varians* and *Gasterosteus aculeatus* were common. *Jaera nordmanni* and gammarid amphipods were confined to D where there were cobbles in shallow water, and *Carcinus maenas* was only taken at C which was near to the sea inlet. Most other species were widely distributed in the lake.

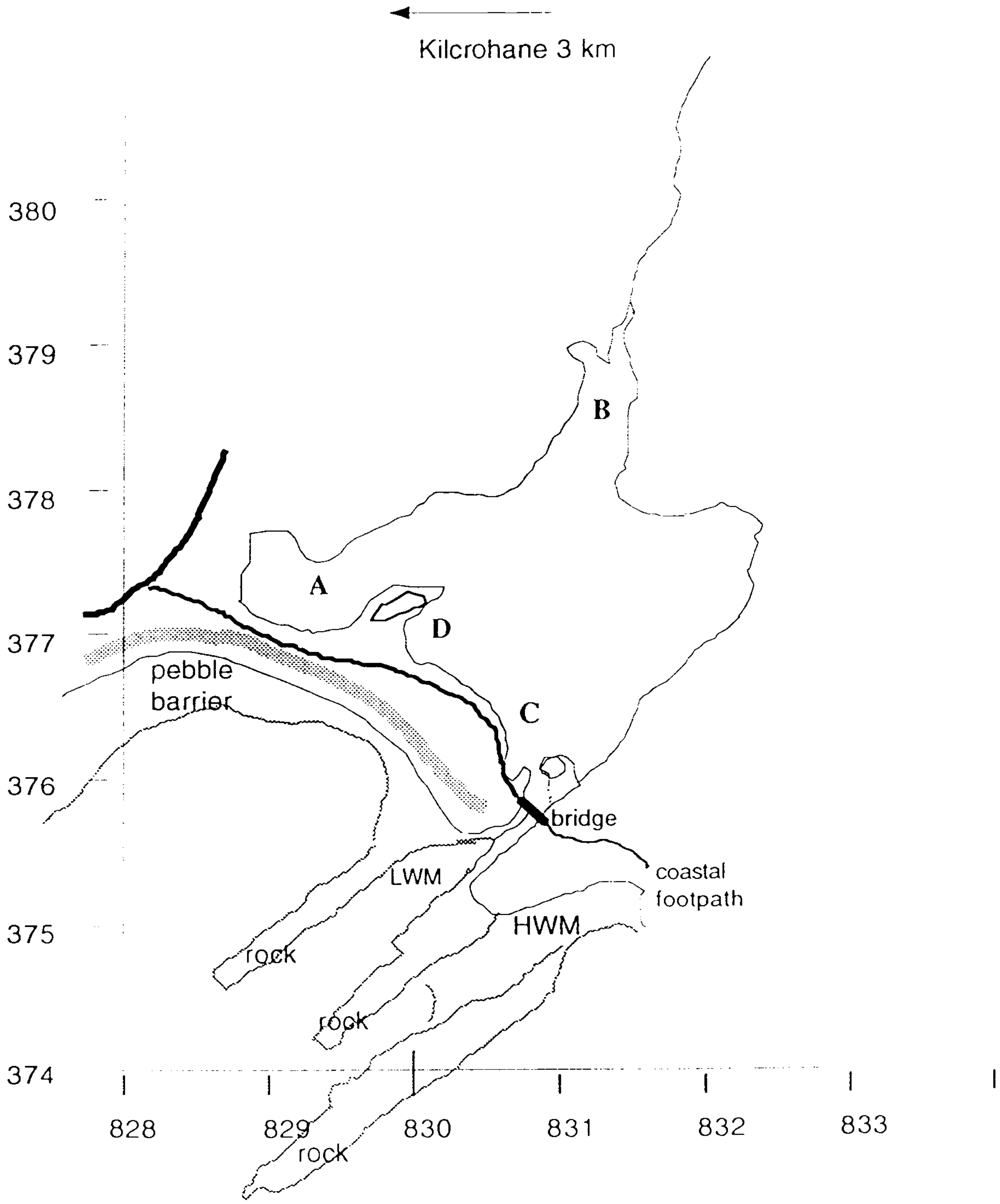

Fig. 5.2.1. Location Map of Sampling Stations in Farranamanagh Lake, Co. Cork

Table 5.2.1. Fauna Recorded at Farranamanagh Lake, Co. Cork. July and August, 1996.
( ) = recorded in July

Fauna		Sampling Stations (L.T. = light-trap)						
		A	L.T.A	B	L.T.B	C	L.T.C	D
Porifera								
Cnidaria	*Aurelia aurita*					(+)		
Turbellaria								
Nemertea								
Annelida								
Crustacea								
Ostracoda								
Cirripedia								
Mysidacea	*Neomysis integer*	o	10	o		15		
Isopoda	*Jaera nordmanni*							+
	Ligia oceanica							+
Amphipoda		+	+	a	25		+	+
	Allomelita pellucida		+					
	Gammarus duebeni							+
	G. zaddachi		+	a	+		+	
Tanaidacea								
Decapoda	*Carcinus maenas*			F		F, c		
	Crangon crangon				2			
	Palaemonetes varians	a	60	c	16	a	31	
Arachnida								
Insecta								
Thysanura								
Ephemeroptera								
Odonata								
Plecoptera								
Trichoptera								
Hemiptera								
Coleoptera	*Anacaena globulus*			+				
	Haliplus lineatocollis					+		
Diptera	Chironomidae			+			+	
Mollusca								
Prosobranchia	*Potamopyrgus antipodarum*	+		+		+	+	+
Opisthobranchia								
Pulmonata								
Bivalvia								
Bryozoa								
Echinodermata								
Tunicata								
Teleostei	*Anguilla anguilla*	+		F				
	Gasterosteus aculeatus	+	2	a	45	+		+
	Pomatoschistus microps	+	3	+	5	+		+

+ = present; o = occasional; c = common; a = abundant; F = fyke net;

Table 5.2.2 Ecological categories of the recorded taxa in Farranamanagh Lake (excluding marginal species). L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	None	
Poly-mesohaline	*Crangon crangon*	
Euryhaline	*Neomysis integer*	
	Jaera nordmanni	
	Gammarus duebeni	
	Gammarus zaddachi	
	*Allomelita pellucida**	
	Palaemonetes varians	L
	Carcinus maenas	
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
Oligo-mesohaline	*Potamopyrgus antipodarum*	
Limnic	*Anacaena globulus*	
	Haliplus lineatocollis	

*The salinity range of this species is not known

5.2.3 Discussion

Faunal diversity was poor and no species was present at high density. The faunal assemblage typifies a brackish lagoon with a sea inlet, but where the freshwater inflow is sufficient to counteract the marine influence and the salinity remains generally low. The salinities recorded at the time of sampling (2-6‰) may be typical but there are probably wide and rapid fluctuations according to tides and weather. The poor representation of oligohaline species may be due to temporary high salt levels which prevent populations becoming established. This seems to be the only possible explanation for the absence of corixids and the scarcity of beetles in areas where there was good growth of *Ruppia.*

None of the species recorded can be described as rare in Ireland

5.2.4 Threats

There are no apparent threats to the lake. A bridge has been constructed as part of the coastal path but this does not appear to affect the lake although it may attract more visitors.

Removal of shingle from the landward side of the barrier during the 1980s increased the frequency of overtopping (P.Whelan pers. comm.) but this practice appears to have been discontinued.

5.2.6 References and Additional Sources of Information

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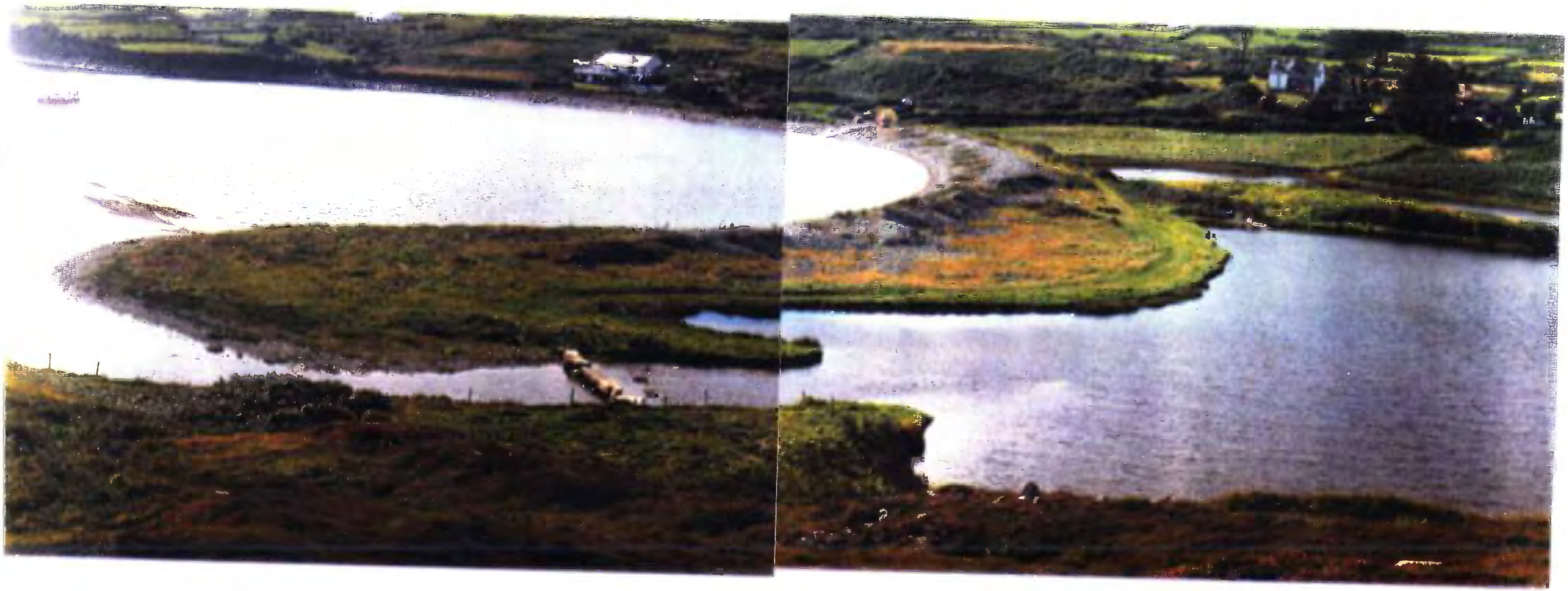

Plate 5.2.1 View of the southwestern area of Farranamanagh Lake looking west, Stations A (distance), D (middle distance) and C (foreground).

Plate 5.2.2 View of the northern area of Farranamanagh Lake looking west, Station B (left).

5. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

5.3.1 Site Description (Fig. 5.3.1)

This small lagoon is bordered by fairly low-lying pasture to the west and north west and heath and bog vegetation on higher ground to the east and north east. The shingle barrier lies to the south, through which the outlet to the sea runs from the southern tip of the lake.

The only freshwater stream flows in at the head of the northern bay. Fen vegetation occurs here with open willow carr. Marginal swamp is found here and as a fringing strip along the west and north western shores. It also occurs in small isolated patches along the rockier eastern shore where the low peat cliffs of the north eastern quarter give way to outcropping bedrock to the south.

A coastal footpath runs along the barrier, crossing the outlet channel via a stone bridge.

5.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

1. <u>Transects:</u>

The locality of these is shown in Fig. 5.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

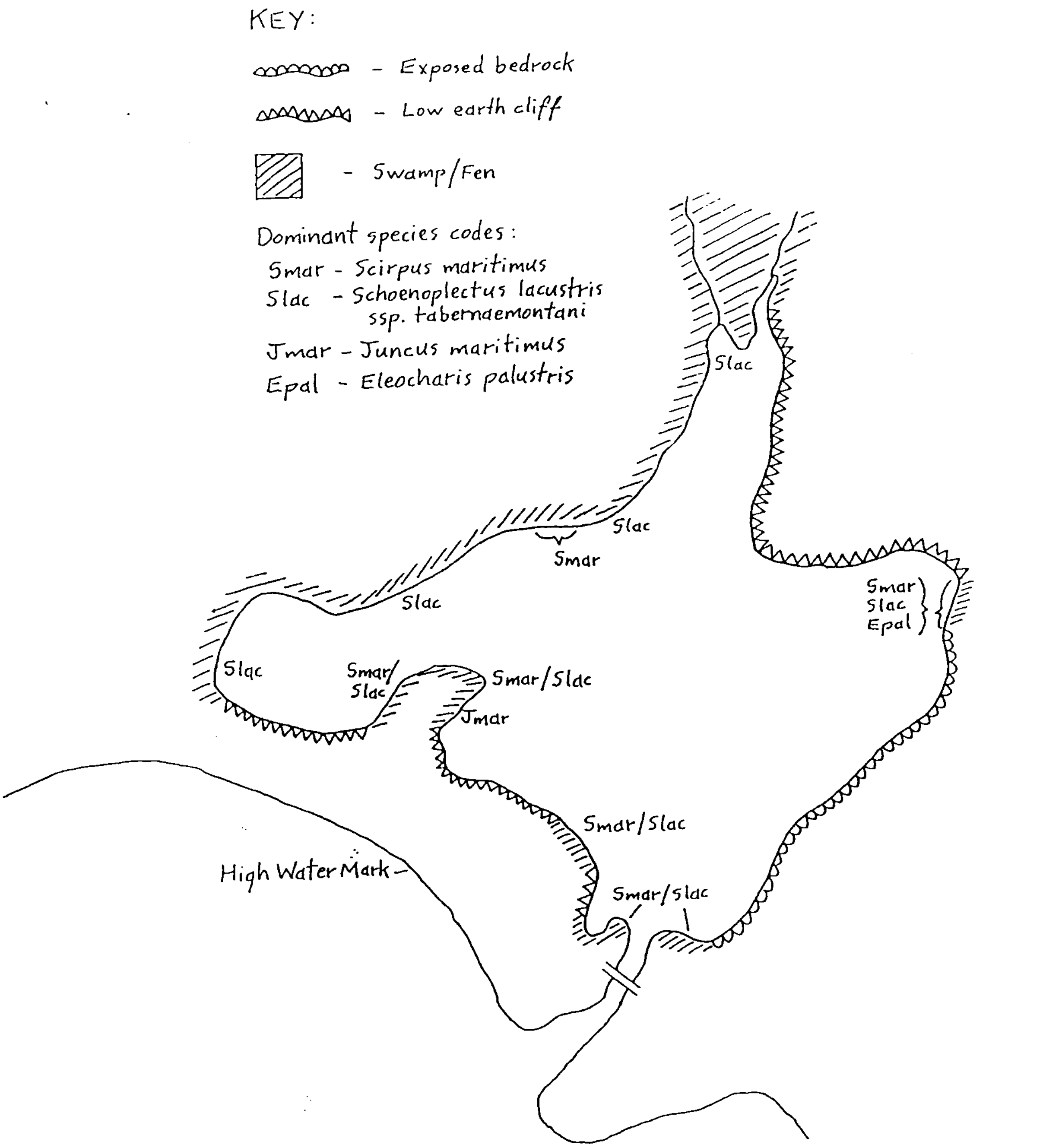

Fig. 5.3.1 Farranamanagh Lake, Co. Cork - Marginal Vegetation

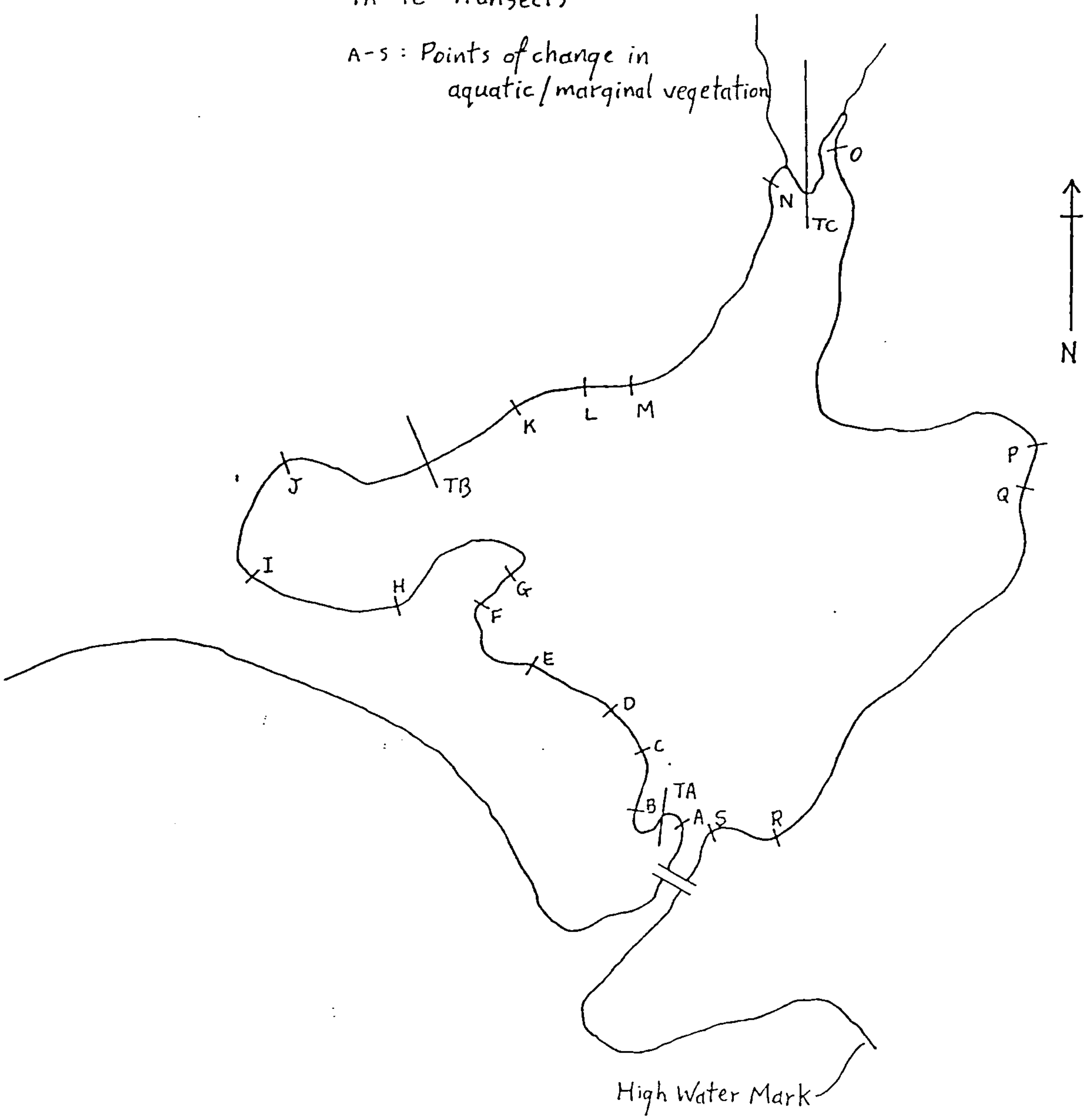

Fig. 5.3 2 Farranamanagh Lake, Co.Cork: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A '*Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A '*Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

5.3.3 Results

1. Shore-based survey

Section A-B (Transect A)

Aquatic: Ruppia sp. - sparse
Filamentous algae - patchy

Coarse sand and gravel substrate with frequent cobbles

Marginal: Single species Scirpus maritimus and Schoenoplectus lacustris ssp tabernaemontani swamps. 2-3m

Adjacent: Festuca rubra - Potentilla anserina dominated grassland

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Section B-C

Aquatic: Unchanged

Marginal: 30-40cm earth cliff

Adjacent: Unchanged

Section C-D

Aquatic: Unchanged

Marginal: Swamp vegetation as A-B

Adjacent: Unchanged

Section D-E

Aquatic: Filamentous algae - extensive
Enteromorpha - sparse

Marginal: As B-C

Adjacent: Unchanged

Section E-F

Aquatic: Ruppia sp. - fairly extensive to at least 4m out
Filamentous algae - extensive
Enteromorpha - sparse

Marginal: Unchanged

Adjacent: Unchanged

Section F-G

Aquatic: Unchanged

Marginal: Emergent Juncus maritimus forming 1m strip along shore

Adjacent: Heath vegetation dominated by Ulex europaeus and Pteridium aquilinum

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Section G-H

Aquatic: Ruppia sp. - sparse to at least 1m out
Filamentous algae - sparse

Gravel substrate with frequent cobbles

Marginal: Scirpus maritimus and Schoenoplectus lacustris ssp tabernaemontani swamp with each species locally dominant. 2-3m
Grading to 1m strip of dense Juncus gerardii and Agrostis stolonifera

Adjacent: Unchanged

Section H-I

Aquatic: Filamentous alge - sparse

Marginal: 30-50cm earth cliff

Adjacent: Festuca rubra - Potentilla anserina dominated grassland

---

Section I-J

Aquatic: Ruppia sp. - fairly extensive open cover to at least 2m out
Filamentous algae - patchy cover

Marginal: Schoenoplectus swamp with occasional Scirpus shoots and sparse Ruppia. 2-10m

Adjacent: 1.5m dry stone wall
Backing to Lolium perenne grassland

<u>Section J-K</u> (Transect B)

Aquatic: Ruppia sp. - fairly extensive open cover to at least 2m out
Filamentous algae - extensive

Silt and gravel substrate with frequent cobbles

Marginal: Open single species Schoenoplectus swamp with sparse Ruppia and patchy filamentous algae. 5-8m
Backing to 50cm earth cliff

Adjacent: Heath vegetation dominated by Pteridium aquilinum

<u>Section K-L</u>

Aquatic: Unchanged

Marginal: Unchanged

Adjacent: 1.5m dry stone wall
Lolium perenne - Holcus lanatus - Cynosaurus cristatus pasture

---

<u>Section L-M</u>

Aquatic: Ruppia sp.- sparse to at least 2m out
Filamentous algae - patchy cover

Cobble and boulder substrate

Marginal: Single species Scirpus maritimus swamp with sparse Ruppia. 3m

Adjacent: Unchanged

<u>Section M-N</u>

Aquatic: Ruppia sp. - sparse to at least 2m out
Filamentous algae - patchy

Silt and gravel substrate with frequent cobbles

Marginal: Schoenoplectus swamp as J-L

Adjacent: Unchanged

Section N-O (Transect C)

Aquatic: Unchanged

Silt substrate

Marginal: Single species Schoenoplectus swamp with sparse Ruppia. 25-40m
Backing to 30-50cm earth cliff

Adjacent: Molinia caerulea dominant amongst fen vegetation bordering freshwater inflow.
Frequent Lythrum salicaria, Mentha aquatica, Menyanthes trifoliata, Filipendula ulmaria. Occasional Salix cinerea

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Section O-P

Aquatic: Ruppia sp. - very sparse to at least 2m out
Filamentous algae - extensive

Gravel substrate with frequent cobbles and boulders

Marginal: 50cm earth cliff

Adjacent: Heath vegetation dominated by Ulex gallii and Pteridium aquilinum

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Section P-Q

Aquatic: Unchanged

Marginal: Small single species swamps of Scirpus maritimus (2x1m), Eleocharis palustris (12x1m) and Schoenoplectus lacustris ssp tabernaemontani (5x3m)

Adjacent: Heath as O-P and bog vegetation dominated by Molinia caerulea, Trichophorum cespitosum and Sphagnum spp.

Section Q-R

Aquatic: Unchanged

Marginal: Bedrock shore with occasional small Schoenoplectus swamps - average area c.15m2 - backing to short stretches 50cm earth cliff

Adjacent: Unchanged

Section R-S

Aquatic: Unchanged

Marginal: Scirpus maritimus - Schoenoplectus swamp with each species locally dominant. 1-6m
Grading to Juncus gerardii - Festuca rubra - Agrostis stolonifera community with sparse Cochlearia anglica and occasional Juncus maritimus tussocks. 15m

Adjacent: Festuca rubra - Potentilla anserina grassland

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2. Transects

Site: Farranamanagh Lake	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Sand, gravel, cobbles	
Depth: 20 - 50 cm	Salinity: 25 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		25
Higher Plant		15
Ruppia sp.	15	15
Algae		10
Filamentous algae		10
Description: Open cover of Ruppia with occasional patches of filamentous algae.		

Site: Farranamanagh Lake	Transect code: A	
Location: Outlet to sea	Sample point: 2 Marginal	
Sample area: 10m2 (10x1)	Substrate: Sand, gravel	
Depth: 20 cm	Salinity: 20 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Scirpus maritimus	70	80
Description: Fairly dense single species Scirpus maritimus swamp. 1m.		

Site: Farranamanagh Lake	Transect code: A	
Location: Outlet to sea	Sample point: 3 Marginal	
Sample area: 10m2 (10x1)	Substrate: Silt	
Depth: 0 - 20 cm	Salinity: 20 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Scirpus maritimus	70	75
Agrostis stolonifera	25	20
Description: Fairly open Scirpus swamp with patchy Agrostis cover. 2m.		
Grading to Festuca rubra - Potentilla grassland (barrier).		

Site: Farranamanagh Lake	Transect code: B	
Location: Marginal swamp	Sample point: 1 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Coarse sand, gravel, cobbles	
Depth: 50 cm	Salinity: 16 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		20
Ruppia sp.	25	20
Algae		90
Filamentous algae		90
Description: Filamentous algae dominant with open Ruppia cover.		

Site: Farranamanagh Lake	Transect code: B	
Location: Marginal swamp	Sample point: 2 Marginal	
Sample area: 40m2 (10x4)	Substrate: Silt, cobbles	
Depth: 30 - 50 cm	Salinity: 15 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		60
Schoenoplectus lacustris ssp tabernaemontani	100	60
Ruppia sp.	15	< 1
Algae		25
Filamentous algae		25
Description: Open Schoenoplectus swamp with sparse low growing Ruppia and patchy cover of free-floating filamentous algae. 4m.		

Site: Farranamanagh Lake	Transect code: B	
Location: Marginal swamp	Sample point: 3 Marginal - pool	
Sample area: 20m2 (10x2 - whole stand)	Substrate: Silt	
Depth: 30 cm	Salinity: 16 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		30
Higher Plant		30
Ruppia sp.	20	30
Algae		< 1
Filamentous algae		< 1
Description: Open cover of low growing Ruppia with sparse free-floating algae.		

Site: Farranamanagh Lake	Transect code: B	
Location: Marginal swamp	Sample point: 4 Marginal	
Sample area: 20m2 (10x2)	Substrate: Silt	
Depth: 20 - 30 cm	Salinity: 16 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		75
Higher Plant		70
Schoenoplectus lacustris ssp tabernaemontani	100	70
Ruppia sp.	15	< 1
Algae		5
Filamentous algae		5
Description: Fairly open Schoenoplectus swamp with sparse low growing Ruppia and free-		
floating filamentous algae. 2m		
Backing 50cm earth cliff.		
Backing Pteridium aquilinum dominated heath.		

Site: Farranamanagh Lake	Transect code: C	
Location: Freshwater inflow	Sample point: 1 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 50 cm	Salinity: 16 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		10
Higher Plant		5
Ruppia sp.	20	5
Algae		5
Filamentous algae		5
Description: Sparse Ruppia and filamentous algae. Ruppia low growing.		

Site: Farranamanagh Lough	Transect code: C	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 40 cm	Salinity: 9 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Schoenoplectus lacustris ssp tabernaemontani	120	80
Ruppia sp.	15	< 1
Description: Fairly dense Schoenoplectus swamp with sparse low growing Ruppia. 25m.		

Site: Farranamanagh Lough	Transect code: C	
Location: Freshwater inflow	Sample point: 3 Marginal - pool	
Sample area: 60m2 (15x4 - whole stand)	Substrate: Silt	
Depth: 30cm	Salinity: 9 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		20
Ruppia sp.	15	20
Description: Extensive but open cover of low growing Ruppia in single species stand.		
Backing 40cm earth cliff.		
Backing fen vegetation bordering freshwater inflow. Molinia caerulea dominant		
with Lythrum salicaria, Mentha aquatica, Menyanthes trifoliata, Filipendula ulmaria, Angelica		
sylvestris, Ranunculus acris, Myrica gale frequent. Occasional Salix cinerea, increasing		
cover to landward.		

5.3.4 Evaluation

<u>'Potentially Valuable'</u>

This is a rocky site of fairly high salinity (16-25 parts per thousand) at time of survey.

Ruppia was the only aquatic higher plant found during this survey. It is well distributed around the site, occuring within two metres of the shore at sparse to patchy cover in most areas. It was not possible to identify samples to species.

A *Fucus* species is locally abundant in the mouth of the outlet channel.

Marginal vegetation shows no notable diversity. *Schoenoplectus lacustris* ssp *tabernaemontani* single species swamps fringe the eastern and north eastern shores and also occur at the freshwater inflow and in places along the southern shore. *Scirpus maritimus* swamp occurs along parts of the southern shore. The eastern shore consists of exposed bedrock alternating with stretches of low earth cliff. Small *Scirpus*, *Schoenoplectus* and *Eleocharis palustris* swamps occur at one point here approximately half way along the shore.

This seems to be a very species-poor site, although it is possible that additional aquatic species are present in deeper parts of the lagoon more than ten metres out from the shore.

Further survey is recommended.

5.4 ECOTONAL COLEOPTERA

J.A. Good Ph.D MIEEM FRES,
Terrascope Environmental Consultancy, Riverstick, Co. Cork.

5.4.1 Site Description

Coastal brackish lake with shingle barrier and inlet channel (Plate 1), with seawater incursion at high spring tide. Lake shore with shingle cobbles and coarse sand behind barrier, covered at high spring tide, with grass topped c. 0.5 m high cliff. Small inlet flood area mainly *Juncus maritimus* and grass dominated vegetation.

Subsites (Fig. 5.4.1)

1. *Juncus maritimus/* grass (V 831376)
c. 100 m^2 area of *Juncus maritimus*, grass, *Potentilla anserina*, etc. on sandy shingle soil with upper organic layer, near inlet, flooded in winter, water-table close to surface during high spring tides. Near-shore water salinity 4‰ on 28 viii 1996.

2. Lake/barrier margin (V 830376)
Cobble shingle on coarse sand to silt shore, covered at spring tides, with organic-rich silty-pebble cliffs to shingle/sand grassland.

3. Grass bank (V 829377)
Grass bank with cliff to water with emergent *Schoenoplectus lacustris* and *Pteridium aquilinum* etc., landward on interior not barrier shore, flooded during high water

5.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

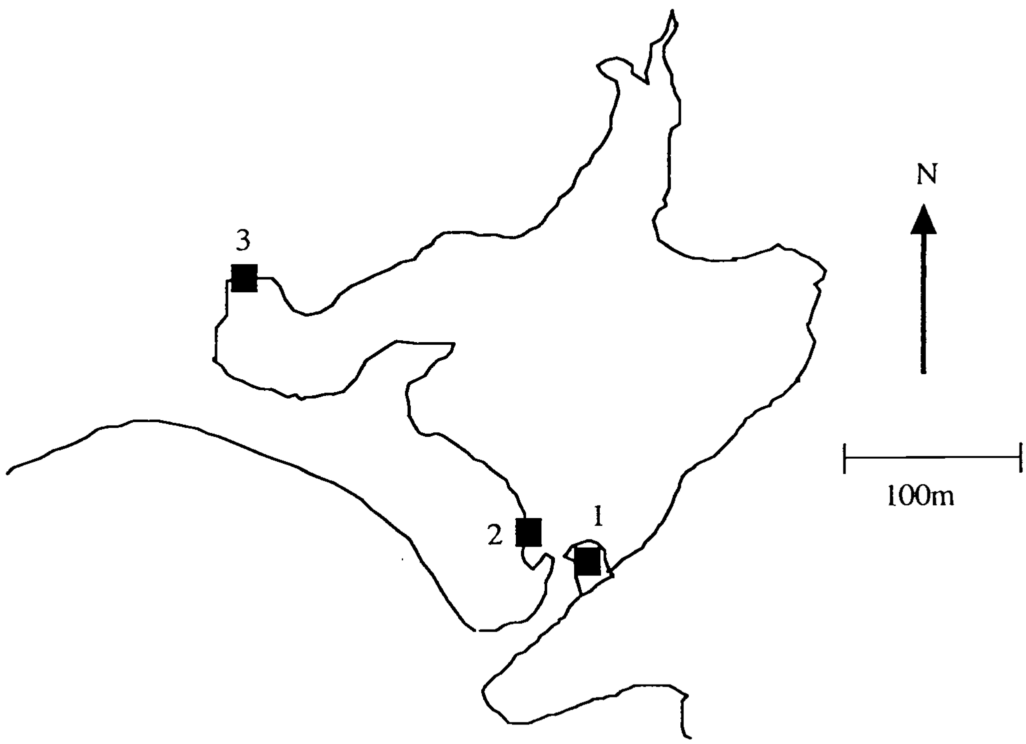

Fig. 5.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Farranamanagh Lake, Co. Cork

1 - Pitfall traps, S-vac
2 - Cobble search
3 - Pitfall traps

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 5.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were

fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 5.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References

Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Juncus maritimus/* grass area - S-vac suction sampler (19 ix 1996), c. 2 m^2;
(2) *Juncus maritimus/* grass area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (28 viii - 19 ix 1996);
(3) Grass bank - 6 pitfall traps (28 viii - 19 ix 1996);
(4) Lake/barrier margin - cobbles search (2 x n=30, 12 vii 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

5.4.3 Results

Thirteen species of carabid and thirty-five species of staphylinid were recorded, one species of which is regarded as an indicator species (Table 5.4.2).

There are three pevious Irish records of *Stenus lustrator* (Anderson 1984), which appears to be local in Europe (Horion 1963). The species is tyrphophilous (associated with peat), but also occurs on marshy shores and flood meadows, according to Koch (1989). The Irish records are from bogs (Anderson 1984), and the species was also recorded at Lough Aconeera and Drowngawn Lough in this survey, both of which possess peat and bog margins.

TABLE 5.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Faranamanagh Lake. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), and Booth (1988) for *Tachyporus dispar.*

Species	No. individuals
Carabidae	
Abax parallelipedus (Pill. Mitt)	4
Agonum gracile (Gyll.)	1
Agonum marginatum (L.)	1
Agonum pelidnum (Payk.)	1
Anisodactylus binotatus (F.)	1
Bembidion mannerheimi Sahlb.	15
Dromius linearis (Ol.)	1
Dromius melanocephalus Dej.	2
Platynus albipes (F.)	1
Pterostichus niger (Schall.)	6
Pterostichus strenuus (Panz.)	1
Pterostichus vernalis (Panz.)	1
Trechus obtusus Er.	6
Staphylinidae	
Amischa analis (Grav.)	1
Anotylus rugosus (F.)	14
Atheta amplicollis (Muls. Rey)	12
Atheta fungi (Grav.)	8
Calodera aethiops Grav.	1
Cordalia obscura (Grav.)	1
Dinaraea angustula (Gyll.)	4
Drusilla canaliculata (F.)	56
Encephalus complicans Steph.	1
Gabrius pennatus Sharp	2
Geostiba circellaris (Grav.)	1
Lathrobium brunnipes (F.)	2
Lesteva sicula Er.	1

	Metopsia retusa (Steph.)	1	
	Ocypus olens (Müll.)	1	
	Omalium excavatum Steph.	1	
	Oxypoda elongatula Aubé	2	
	Philonthus varians (Payk.)	1	
	Quedius nigriceps Kr.	1	
	Quedius schatzmayri Grid.	1	
	Quedius tristis (Grav.)	3	
	Rugilus erichsoni (Fauv.)	5	
	Sepedophilus nigripennis (Steph.)	9	
	Stenus bimaculatus Gyll.	8	
	Stenus brunnipes Steph.	7	
	Stenus cicindeloides (Schall.)	1	
	Stenus clavicornis (Scop.)	2	
	Stenus fulvicornis Steph.	17	
	Stenus impressus Germ.	1	
	Stenus juno (Payk.)	19	
*	*Stenus lustrator* Er.	5	**Indicator species**
	Stenus ossium Steph.	2	
	Tachinus signatus Grav.	4	
	Tachyporus dispar (Payk.)	2	
	Xantholinus longiventris Heer	2	

5.4.4 Evaluation

Of no conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of one indicator species would indicate conservation interest, but a population of this species (*Stenus lustrator*) is probably not viable in the small area of flooded *Juncus maritimus*, and the main population is likely to occur in the nearby peaty soils with *Sphagnum* flushes.

5.4.5 References

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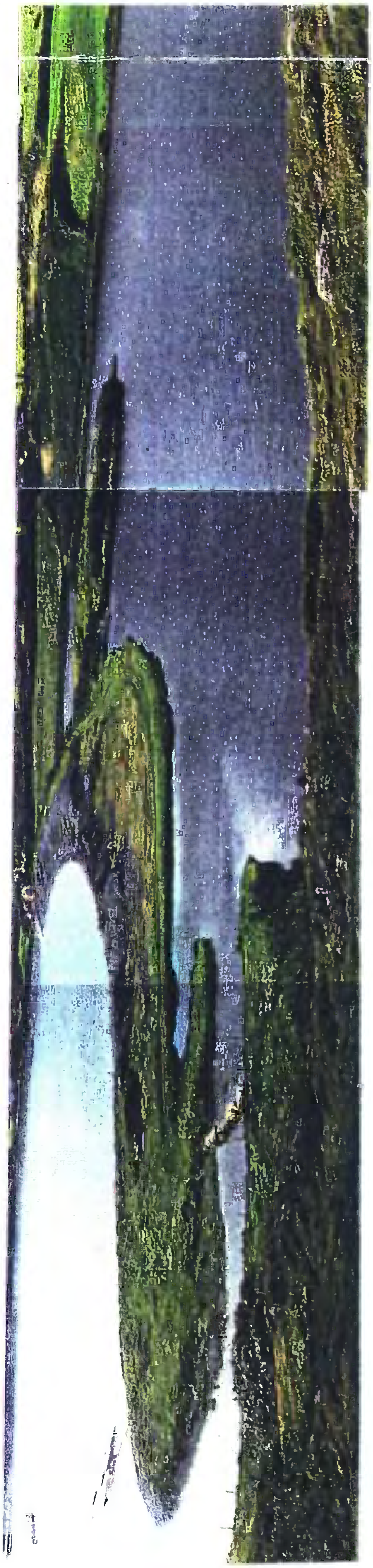

Plate 1 Faranamanagh Lake and barrier, Co. Cork

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

6. DRONGAWN LOUGH

Brenda Healy
Geoff Oliver
Pat Hatch
Jervis Good

February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

6. DRONGAWN LOUGH

CONTENTS

6. DRONGAWN LOUGH, Co. Kerry.

OS Grid Reference: V 731640, 1:50,000 Sheet No. 84
Alternative names: ?

6.1 STUDY AREA

General features
Drongawn Lough is a natural saline lake with a restricted tidal range due to a narrow connection with the sea through a small tidal bay which itself has a narrow connection to the open sea. The lake lies on the south coast of the Ring of Kerry peninsula, 6 km to the east of Sneem (Fig. 6.1.1). Kenmare Bay lies 300 m to the south of the lake but is separated by a ridge of rock and the inlet to the lake lies in the northeast corner via Coongar Harbour.

Very little appears to be known about this lake, other than the fact that a small flock of Whooper swans (*Cygnus cygnus*) is often present in the winter. It is, however, a good example of a completely natural, moderately large, saline lake on the mountainous Kerry coastline in an almost perfect state of preservation.

Climate and oceanographic influences
(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 7°C in January and 15.5°C in July. The growing season (the period of mean daily air temperatures above 6 °C is 11 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1400 mm, and the number of rain days (1 mm or more) is 175-200. Prevailing winds are from the south and southwest. Mean annual hourly wind speeds are around 5.6 m/s and a maximum wind speed of 49-50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 25-30 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) in the Kenmare River is 4.0 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology The surrounding area consists largely of rock, moorland, small peat bogs and scattered small fields of semi-improved pasture. Bedrock is Old Red Sandstone. Soils are generally acidic and consist mostly of peaty podzols and acid brown earths (Royal Irish Academy (1979). Land rises steeply from the coastline to mountains which run the length of the peninsula. The Macgillycuddy's Reeks and the highest peak in Ireland, Carrauntohil (1041 m) lie only 20 km to the northeast.

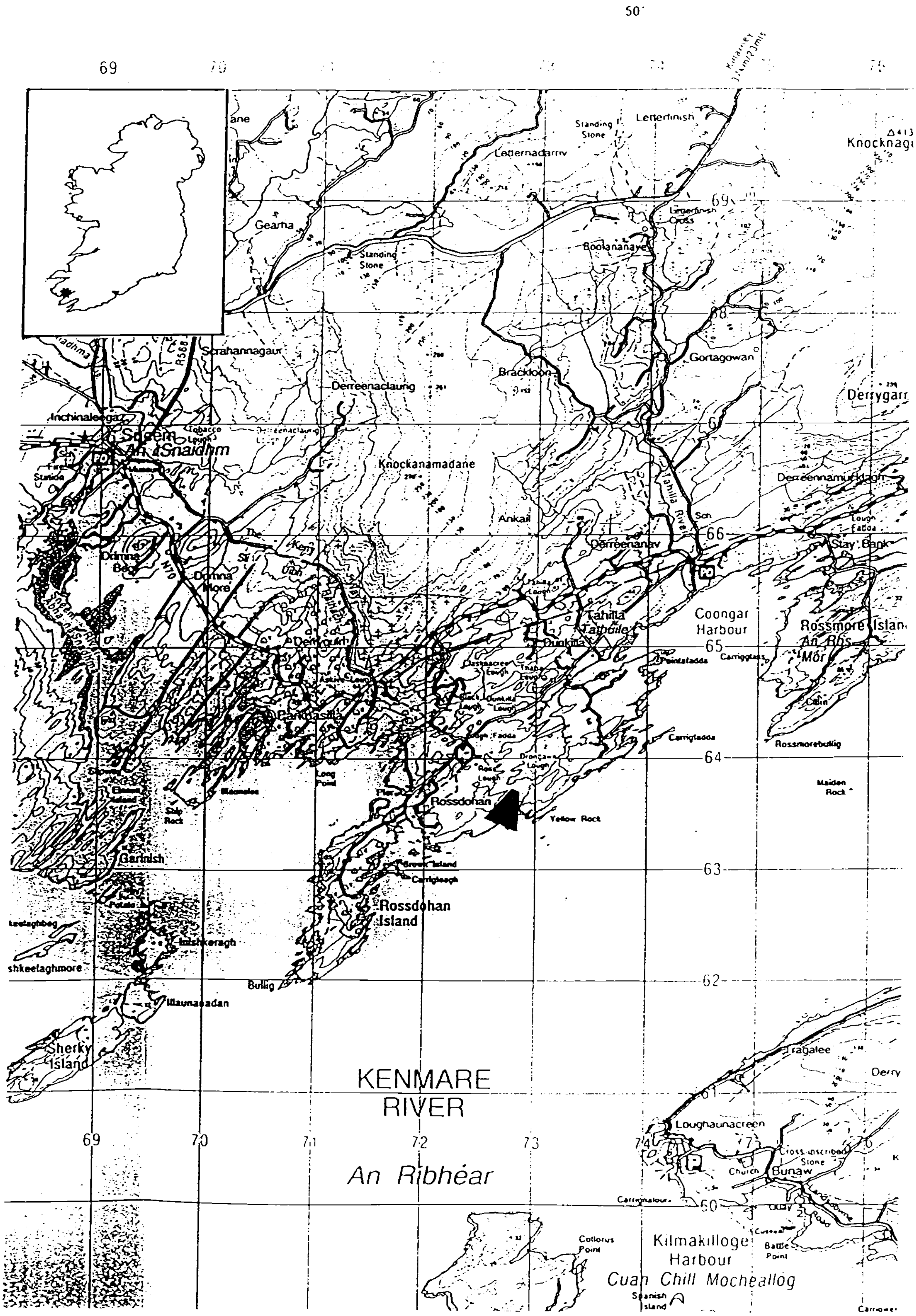

Fig. 6.1.1 Section of 1:50 000 map showing locality of Drongawn Lough

Lake Topography The lake may be glacial in origin. It is 700 m from southwest to northeast, width varies from 50 to 300 m, area is approximately 20 ha. The lake is very deep (up to 18 m) and most of the bed of the lake appears to be solid rock, or stone of various sizes. In sheltered bays, especially in the southwest, the substrate consists largely of unconsolidated peaty silt.

Hydrology Precise details of hydrology are not known. Spring tides enter through the very narrow (approx. 3 m) inlet, but due to the time lag and large volume of the lake, tidal fluctuations in water level are minimal. Only small streams enter the lake but a relatively small seasonal fluctuation in water level presumably occurs as a result of increased rainfall during the winter and evaporation during summer.

Salinity and water quality Seawater at approximately 34 ‰ enters through the narrows. Stratification undoubtedly occurs due to the depth of the lake, but was not investigated. Salinity of the lake is likely to remain close to that of seawater, with a possible rise in summer due to evaporation and decrease in winter due to dilution from direct rainfall and a limited amount of runoff from the small catchment area.

There are no major sources of pollutants to the lake and water quality is presumably very high.

6.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver, Dept. of Zoology, University College Dublin

6.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰. precision). A photographic record was made of the site and local information sought concerning background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations D and F in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The

Lake Topography The lake may be glacial in origin. It is 700 m from southwest to northeast, width varies from 50 to 300 m, area is approximately 20 ha. The lake is very deep (up to 18 m) and most of the bed of the lake appears to be solid rock, or stone of various sizes. In sheltered bays, especially in the southwest, the substrate consists largely of unconsolidated peaty silt.

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There are no major sources of pollutants to the lake and water quality is presumably very high.

results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (eg *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

6.2.2 Results

Drongawn Lough was sampled on 5.vii.96 during the first part of the survey, and from 8-10.ix.96 during the more intensive survey.

Eight sampling stations were selected in the lake to reflect the influences of substrate, freshwater and tidal inflows. Fig. 6.2.1 shows the position of these sampling stations in the lake.

Environmental Variables

Station A (OS 7326 6428) was located at the northeast corner of the lake in the area approaching the narrows (Plate 6.2.3). In this area water depth varied from 0 to 60 cm, substrate was small to medium sized cobbles with outcrops of bedrock and salinity measured 32‰.

Station B: (OS 7310 6414) was located on the shore of a small wooded island (Plate.6.2.3). Sampling was limited to the 0 - 1 m depth of the shoreline, substrate consisted mostly of large rocks with some coarse sand/gravel, salinity measured 30‰.

Station C: was located in the central area of the lake where water depth was recorded as 18m., salinity was 30‰. No faunal sampling was carried out at this station.

Station D: (OS 7276 6378) Located at the extreme southwest end of the lake. Substrate consisted of consolidated peat with occasional stones, depth varied from 50 cm to 2 m and salinity measured 30‰.

Station E: (OS 7302 6419) Located on the northern shoreline of the lake, where a small stream enters and a small bed of *Phragmites* has become established. Substrate in this area consisted of soft unconsolidated peat and small stones, depth ranged from 0 to 1 m, and salinity measured 30‰.

Station F: (OS 7329 6421) Located in the northeast of the lake where a small stream draining from a marshy pool, Little Drongawn Lough, enters the Lake. Substrate at this station consisted of large stones and rock with soft peat sediment filling the spaces between them. Depth varied from 15-60 cm, and salinity measured 30‰.

Station G: (OS 7313 6393) Located on the southern shoreline. Substrate consisted of stones, rock and soft peat, depth varied from 0 - 1 m and salinity ranged from 10 - 28‰. No obvious stream enters at this point but a freshwater spring discharges just above the water level of the lake. A salinity gradient exists with distance from this

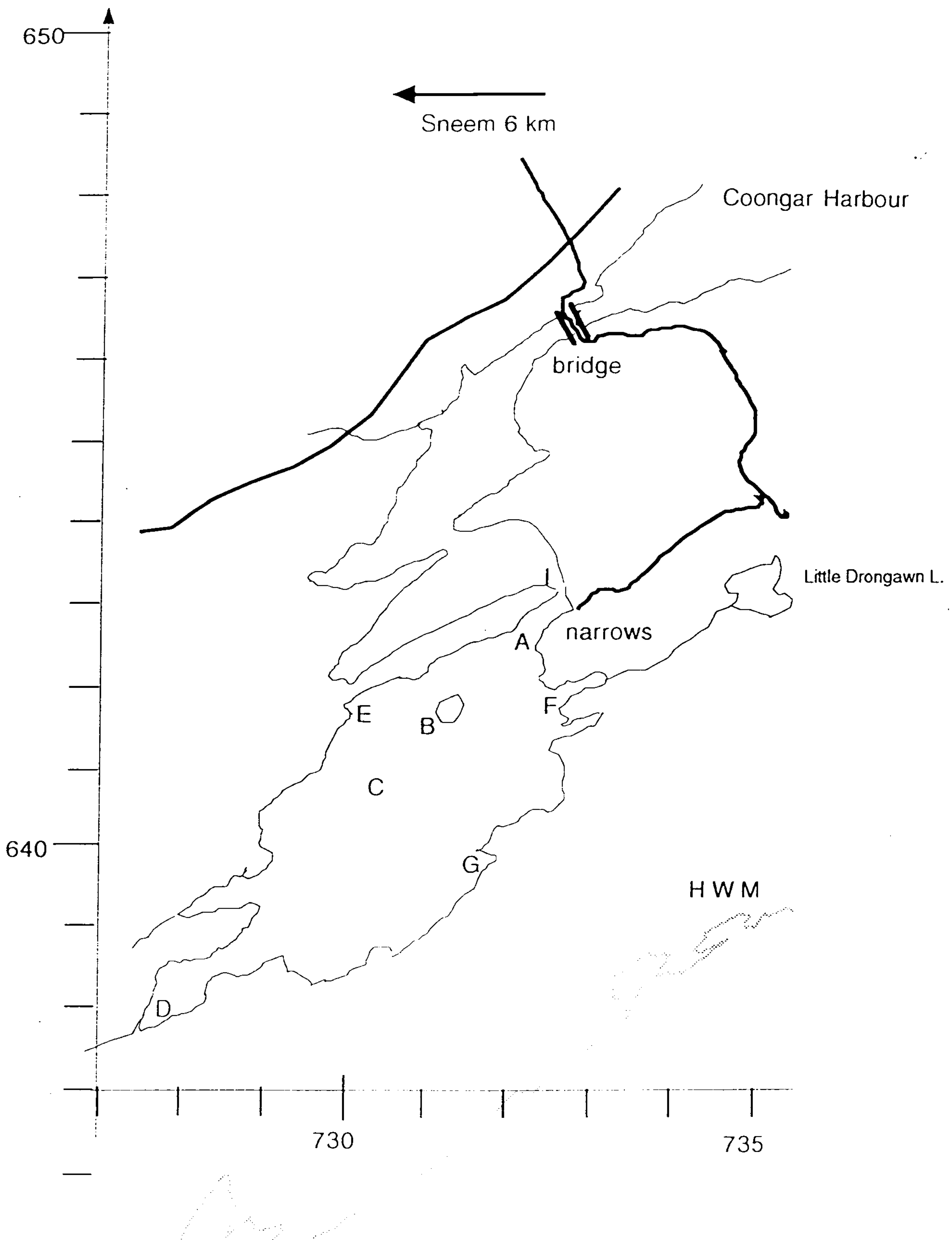

Fig. 6.2.1 Location Map of Sampling stations In Drongawn Lough, Co. Kerry

Table 6.2.1. Fauna Recorded in Drongawn Lough, Co. Kerry. July and September 1996.
( ) = records for July

		Sampling Stations (L.T. = light-trap)											
		A	L.T.A	B	L.T.B	D	L.T. D	E	L.T.E	F	G	L.T.G	Inlet
Porifera	*Halichondria panicea*	+		+		+				+			
Cnidaria													
	Chrysaora hysoscella									+			
	Acanthopleura balli	+		+		+		+		+			+
Turbellaria													
Nemertea				+									
Annelida	*Amphitrite edwardsi*												+
	Arenicola marina	+											
	Janua pagenstecheri												+
	Nereidae	+											+
	Platynereis dumerili				+			+					
	Pomatoceros triqueter	+		+		+				+			
	Spirorbis rupestris	+		+		+		+		+	+		+
Crustacea													
Ostracoda													
Cirripedia	*Semibalanus balanoides*	+		+									+
	Verruca stroemia			+									
Mysidacea	*Hemimysis lamornae*						2						
	Neomysis integer								1?				
	Praunus flexuosus	+	250	+	2	o	2	c	65	o	o		
Isopoda	*Jaera sp.*			+		+		+			+		
	Jaera forsmanni							+			+		
	Ligia oceanica							+					
Amphipoda	*Ampithoe ramondi*			+				+		+		+	
	Caprella acanthifera					+							
	Corophium volutator						+						
	Erichthonius difformis	+		+		+		+				+	
	Gammarus duebeni					+	+				+		
	Lembos longipes			+		+							
	Melita palmata	+		+						+			
	Orchestia gammarella										+		
Tanaidacea													
Decapoda	*Carcinus maenas*	+		+		+				+	+		+
	Palaemonidae	a		a		a		a		a	a		a
	Palaemon elegans	+	1	+				o					
	P. longirostris	+											
	P. serratus	+				o							
	Palaemonetes varians	+				a		a		a	a		
Arachnida	Pycnogonida						+						
Insecta													
Thysanura													
Ephemeroptera													
Odonata													
Plecoptera													
Trichoptera													
Hemiptera	*Sigara dorsalis*											+	

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Table 6.2.1. cont., Fauna Recorded in Drongawn Lough, Co. Kerry. July and September 1996.
( ) = records for July

Fauna		Sampling Stations	(L.T. = light-trap)										
		A	L.T.A	B	L.T.B	D	L.T. D	E	L.T.E	F	G	L.T.G	Inlet
Coleoptera	*Haliplus wehnckei*					+							
Diptera	Chironomidae					+				+	+		
Mollusca													
Prosobranchia	*Bittium reticulatum*	+		c		c	5	a	4		+	+	
	Gibbula umbilicalis	+											
	Hydrobia ventrosa					+				+			
	Lepidochitona cinerea	+											
	Littorina littorea	+		+				+			+		+
	L. obtusata	+		+				+		+			
	L. saxatilis							+					
	Onoba sp.							+					
	Patella vulgata	+											
	Rissoa membranacea							+					
	Rissoa sp.			+									
Opisthobranchia	*Elysia viridis*										+		
	Scaphander lignarius			+	24	+		+			+		
Pulmonata													
Bivalvia	*Anomia sp.*			+									
	Cerastoderma glaucum			a		a		+		+	+		
	Chlamys varia	+		+		+							
	Mytilus edulis	a		a									a
	Ostrea edulis	+		+		+		+					
	Venerupis sp.										+		
Bryozoa	*Bowerbankia sp.*							+					
	Cryptosula pallasiana	+		+		+		+		+	+		
Echinodermata	*Asterias rubens*			+									
	Amphipholis squamata			+		+				+			
Tunicata	*Ascidiella aspersa*					+		+		+			
	Clavelina lepadiformis	+		+		+		+		+	+		
	Dendrodoa grossularia									+			
Teleostei	*Anguilla anguilla*	+				F, 1				F,4			
	Atherina presbyter							+	2	a			
	Crenilabrus melops					F,5				F.2			
	Gasterosteus aculeatus							+					
	Gobius niger					F,1							
	Platichthys flesus									F,2			
	Pomatoschistus microps	+		+		+		+	9	+	+		

+ = present; o = occasional; c = common; a = abundant; F = fyke net

point and the water during the sampling period was obviously stratified even in very shallow water.

Station I was an additional sampling station from within the narrows of the lake (Plate 6.2.3). No salinity measurements were made. Water depth varied from 0 to 25 cm and substrate consisted largely of a mussel bed on top of stones and bedrock.

The tide was seen to reach the water level of the lake on the final day of sampling but no tidal flow into the lake was observed.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 6.2.1. Among 68 macrofaunal taxa listed, 60 are identified to species. A few need confirmation and specimens of 5 taxa were too small, only represented by females, or in poor condition. One "worm" remains to be identified. The majority of recorded species are marine, 6 are poly-mesohaline (*Arenicola marina, Praunus flexuosus, Melita palmata, Hydrobia ventrosa, Rissoa membranacea, Cerastoderma glaucum)* and 6 are euryhaline (*Neomysis integer, Gammarus duebeni, Carcinus maenas, Palaemonetes varians, Anguilla anguilla, Pomatoschistus microps*), and two are limnic (*Sigara dorsalis* and *Haliplus wehnckei*). Only three insects were taken, including single specimens of a corixid and a beetle. Three species (*Cerastoderma glaucum, Palaemonetes varians* and *Hydrobia ventrosa*) are listed as lagoonal specialists in Britain (Davidson *et al.* 1991).

The greatest number of species (27-31) was recorded among the rocks and mussels of the sea inlet (station A) and at stations B and D where the salinity was 30-32‰. Somewhat fewer species (24-29) were found at stations where a salinity <30‰ was recorded i.e. at E and F, and only 21 species were present at G where the salinity fell to 10‰ in the region of a freshwater spring.

6.2.3 Discussion

The fauna was rich and predominantly marine but with 18% of brackish (poly-euryhaline) species, three of which are recognised as lagoonal specialists, and two limnic species. The conditions which favour the brackishwater species are the small tidal range coupled with a small, but probably continuous, freshwater inflow from the surrounding peatlands. The corixid and beetle species are normally associated with freshwater and may have been immigrants from a nearby pond. The lake contains a natural population of large oysters

Jaera forsmani may not have been officially recorded for Ireland, (possibly in L. Hyne) but there are unpublished reports of its occurrence. The only record of *Erichthonius difformis* in Ireland is for L. Hyne (Costello *et al.* 1989). *Palaemon longirostris*, which is regarded as an estuarine and brackish species, was not taken at any other site during this survey.

6.2.4 Threats

The lake lies in a sparsely inhabited area and there are no apparent threats to the aquatic community.

Mussels are farmed commercially in the adjacent inlet, and Drongawn may be considered as a good site for mariculture e.g. oysters which occur naturally.

6.2.5 Evaluation

Drongawn Lough is a **natural saline lake** with a shallow, constricted outlet.

Geomorphologically, the lake is not a true lagoon but is a good example of a deep, "silled" lake in pristine condition. It is presumably of glacial origin and is similar to Salt Lake and Lough Hyne and probably resembles the Scottish "obs".

Very little is known about this lake.

The lake has a rich and interesting aquatic fauna which includes two rare crustacean species. An interesting feature is the presence of lagoonal and freshwater species in a community dominated by marine species. Further study of the fauna, to include a diving survey of the deeper regions, is recommended.

The lake is a good example of a completely natural, moderately large, saline lake on the mountainous Kerry coastline in an almost perfect state of preservation.

It lies between two small proposed NHAs (Site Code Nos. 1375 and 2098).

In conclusion, Drongawn Lough is considered to be of high conservation value and worthy of further study. The presence of two rare species qualify it to be considered as of national importance. Its designation as a proposed SAC is recommended.

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Plate 6.2.1 View of Drongawn Lough from the inlet.

Plate 6.2.2 View of the narrow inlet of Drongawn Lough taken from the lake.

Plate 6.2.3 View of Drongawn Lough from the inlet, Stations A (foreground) and B (island).

Plate 6.2.4 View of the narrow inlet of Drongawn Lough taken from the hill, Station A.

6.3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

6.3.1 Site Description (Fig. 6.3.1)

This is a fairly rocky site set in a landscape dominated by bog vegetation and frequent heathy outcrops. The whole area is criss-crossed by dry stone walls and subject to grazing.

The bedrock barrier lies across the northern end of the lagoon with the outlet to the sea at its eastern end. There is no inflowing freshwater stream of any size, only occasional small drainage ditches and flushes.

The shores of the lough are mainly peat of irregular slope with occasional areas of low peat cliff. Bedrock outcrops occur occasionally along the south eastern shore, forming small steep sided promontories in places. There is no swamp vegetation.

6.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

1. <u>Transects:</u>

The locality of these is shown in Fig. 6.3.2.

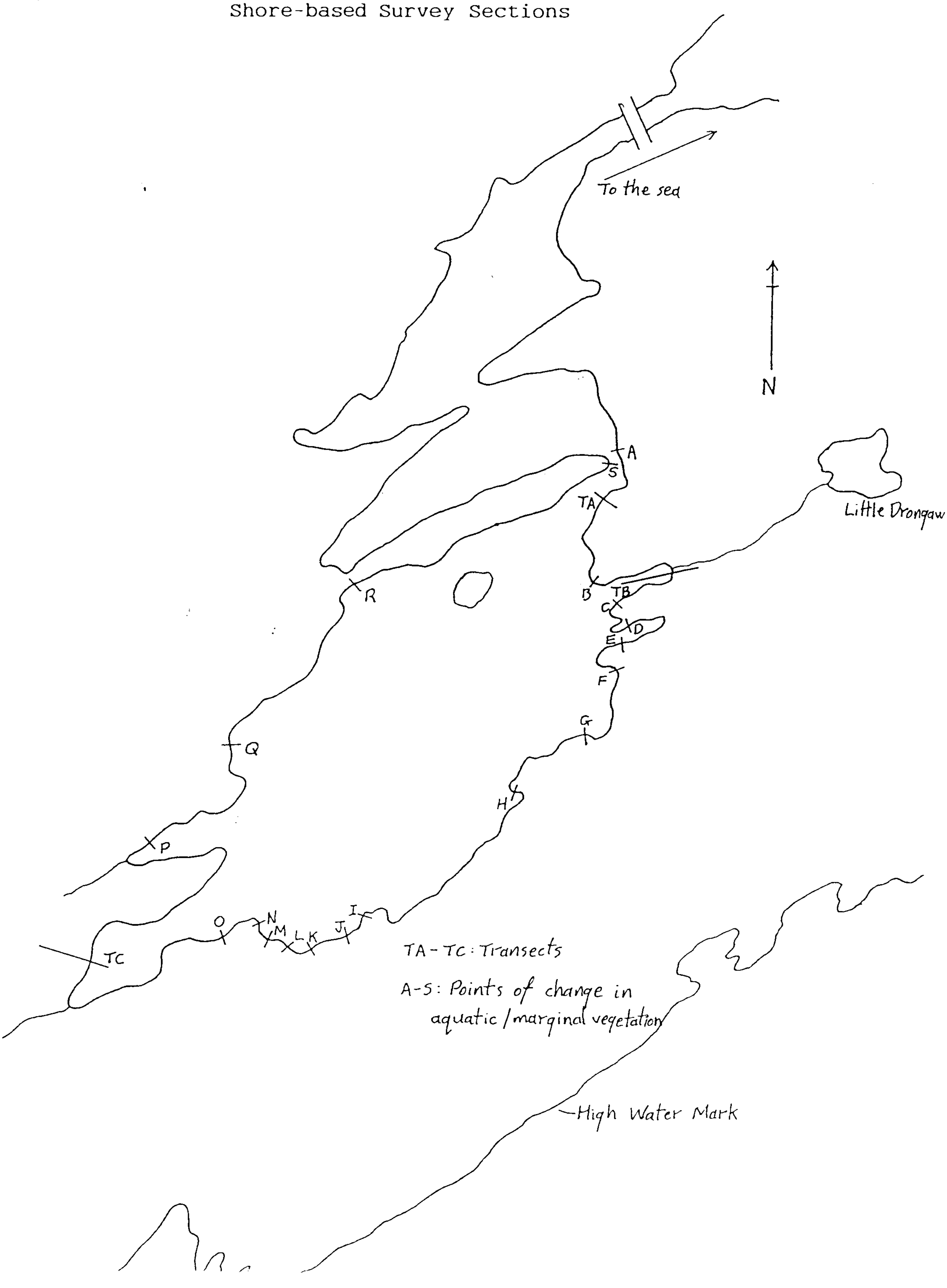
Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

Fig. 6.3.1 Drongawn Lough, Co. Kerry - Marginal Vegetation

Fig. 6.3.2 Drongawn Lough, Co.Kerry: Location of Transects and Shore-based Survey Sections



At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values
Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values
Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A '*Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A '*Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

6.3.3 Results

1. Shore-based survey

<u>Section A-B</u> (Transect A)

Aquatic: Filamentous algae - patchy
Enteromorpha - patchy
Fucus serratus - patchy
Fucus sp. - patchy
Codium tomentosum - sparse

Bedrock and silt substrate

Marginal: Juncus maritimus tussocks with species-poor salt tolerant understorey dominated by Agrostis stolonifera. 1m strip

Adjacent: Heath vegetation with Ulex europaeus, Calluna vulgaris, Erica cinerea, Potentilla erecta dominant

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<u>Section B-C</u> (Transect B)

Aquatic: Ruppia c.f. cirrhosa - dense patches
Filamentous algae - patchy
Enteromorpha - patchy

Marginal: Juncus maritimus community as A-B. Extending back to c.50m at bayhead, forming 1-2m strip along shore elsewhere

Adjacent: Unchanged

Section C-D

Aquatic: Ruppia c.f. cirrhosa - sparse
Filamentous algae - extensive
Enteromorpha - patchy
Fucus serratus - patchy

Marginal: Exposed bedrock shore with lichens. Occasional small patches of Juncus maritimus dominated community as before

Adjacent: Unchanged

Section D-E

Aquatic: Ruppia c.f. cirrhosa - dense beds
Filamentous algae - extensive
Enteromorpha - sparse

Marginal: Juncus maritimus community as before forming 1-2m strip along shore

Adjacent: Unchanged

Section E-F

Aquatic: Filamentous algae - patchy
Enteromorpha - sparse
Fucus serratus - patchy
Fucus sp. - patchy
Codium tomentosum - sparse

Marginal: Lichenous bedrock shore

Adjacent: Unchanged

Section F-G

Aquatic: Ruppia c.f. cirrhosa - dense beds c.10m out, sparse to landward
Filamentous algae - patchy
Enteromorpha - sparse

Marginal: Juncus maritimus community as D-E

Adjacent: Unchanged

Section G-H

Aquatic: Ruppia c.f. cirrhosa - dense beds c. 10m out, sparse to landward
Enteromorpha - sparse
Fucus serratus - patchy
Fucus sp. - patchy
Codium tomentosum - sparse

Marginal: Bedrock shore as E-F

Adjacent: Unchanged

Section H-I

As F-G

Section I-J

Aquatic: Unchanged

Marginal: Juncus maritimus community now to c.70m

Adjacent: Unchanged

Section J-K

As F-G

Section K-L

As I-J

Section L-M

As F-G

Section M-N

As I

Section N-O

As G-H

Section O-P (Transect C)

Aquatic: Ruppia c.f. cirrhosa - cover and zonation unchanged
Filamentous algae - patchy cover

Marginal: Juncus maritimus tussocks with Agrostis stolonifera, Festuca rubra and Juncus gerardii locally dominant below with more or less sparse salt tolerant associates. 1-20m

Adjacent: Bog vegetation dominated by Molinia caerulea, Schoenus nigricans, Eriophorum angustifolium and Sphagnum spp. with frequent Myrica gale, Erica tetralix, Trichophorum cespitosum and Drosera rotundifolia

Section P-Q

Aquatic: Unchanged

Marginal: Juncus maritimus community as Transect C forming 1-3m strip along shore

Adjacent: Heath as A-B

Section Q-R

Aquatic: Unchanged

Marginal: Unchanged

Adjacent: Bog vegetation as O-P with occasional heath as A-B

Section R-S

Aquatic: Unchanged

Marginal: Unchanged

Adjacent: Heath as A-B

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2. Transects

Site: Drongawn Lough	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Bedrock, silt	
Depth: 0 - 50 cm	Salinity: 34 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Fucus serratus	25	25
Fucus sp.	30	20
Enteromorpha	15	20
Filamentous algae		20
Codium tomentosum	6	< 1
Description: Fairly dense cover of algal community dominated by fucoids and filamentous		
species.		

Site: Drongawn Lough	Transect code: A	
Location: Outlet to sea	Sample point: 2 Marginal	
Sample area: 10m2 (10x1)	Substrate: Peat, exposed bedrock	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Juncus maritimus	80	80
Agrostis stolonifera	15	25
Glaux maritima	6	5
Triglochin maritima	10	5
Plantago maritima	8	< 1
Samolus valerandi	10	< 1
Carex extensa	15	< 1
Description: Fairly dense cover of Juncus maritimus tussocks with Agrostis dominant below		
amongst species-poor salt tolerant community forming 1m strip along the shore.		
Backing to heath vegetation on rising rocky ground. Dominant species - Ulex		
europaeus, Calluna vulgaris, Erica cinerea, Potentilla erecta.		

Site: Drongawn Lough	Transect code: B	
Location: Sheltered bay	Sample point: 1 Aquatic - 30m out	
Sample area: 16m2 (4x4)	Substrate: Bedrock, silt	
Depth: 60 cm	Salinity: 26 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Filamentous algae		100
Description: Dense cover of filamentous algae only.		

Site: Drongawn Lough	Transect code: B	
Location: Sheltered bay	Sample point: 2 Aquatic - 15m out	
Sample area: 16m2 (4x4)	Substrate: Bedrock, silt	
Depth: 50 cm	Salinity: 23 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		50
Ruppia c.f. cirrhosa	50	50
Algae		
Filamentous algae		25
Enteromorpha	20	25
Description: Patchy cover of Ruppia growing through patchy cover of Enteromorpha and filamentous algae.		

Drongawn Lough

Site: Drongawn Lough	Transect code: B	
Location: Sheltered bay	Sample point: 3 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Bedrock, peat	
Depth: 50 cm	Salinity: 19 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		90
Higher Plant		10
Ruppia c.f. cirrhosa	40	10
Algae		
Filamentous algae		80
Description: Filamentous algae dominant with open cover of Ruppia.		
Backing stone and earth barrier (height 70cm, width 50cm).		

Site: Drongawn Lough	Transect code: B	
Location: Sheltered bay	Sample point: 4 Aquatic - pool	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 50cm	Salinity: 16 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		70
Ruppia c.f. cirrhosa	40	70
Description: Ruppia dominant in semi-isolated pool (area c.6x4m).		

Site: Drongawn Lough	Transect code: B	
Location: Sheltered bay	Sample point: 5 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	80	75
Agrostis stolonifera	15	30
Plantago maritima	10	< 5
Glaux maritima	6	< 5
Triglochin maritima	15	< 5
Samolus valerandi	10	< 1
Carex extensa	20	< 1
Description: Fairly dense cover of Juncus maritimus tussocks over species-poor salt tolerant vegetation. Agrostis stolonifera dominant amongst an otherwise sparse understorey. 50m. Backing Ulex europaeus - Calluna vulgaris - Erica cinerea heath.		

Site: Drongawn Lough	Transect code: C	
Location: Peat cliff shore	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 60 cm	Salinity: 34 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		75
Ruppia c.f. cirrhosa	50	75
Algae		30
Filamentous algae		30
Description: Ruppia dominant in extensive bed with filamentous algae restricted to areas of lower cover.		

Site: Drongawn Lough	Transect code: C	
Location: Peat cliff shore	Sample point: 2 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 50 cm	Salinity: 34 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		5
Ruppia c.f. cirrhosa	40	5
Algae		75
Filamentous algae		75
Description: Filamentous algae dominant with sparse Ruppia cover.		
Backing 70cm peat cliff.		

Site: Drongawn Lough	Transect code: C	
Location: Sheltered bay	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	70	60
Agrostis stolonifera	20	20
Juncus gerardii	25	15
Festuca rubra	20	15
Glaux maritima	8	5
Aster tripolium	20	5
Triglochin maritima	10	< 1
Plantago maritima	8	< 1
Cochlearia anglica	5	< 1
Samolus valerandi	8	< 1
Carex extensa	20	< 1
Description: Open cover of Juncus maritimus tussocks. Agrostis, Festuca and Juncus gerardii		
co-dominant below with more or less sparse salt tolerant associates. 20m.		
Grading to bog vegetation dominated by Sphagnum spp., Molinia caerulea,		
Schoenus nigricans and Eriophilum angustifolium with Myrica gale, Erica tetralix,		
Trichophorum cespitosum, Drosera rotundifolia.		

6.3.4 Evaluation

'Potentially Valuable'

This is a tidal, rocky lagoon. Salinity was high at time of survey (34 parts per thousand in the main body of the lough). There is no major freshwater inflow stream.

Two fucoid species (*Fucus serratus* and an unidentified species) are abundant along the rocky stretches of the eastern and south eastern shores. *Codium tomentosum* is occasional in the vicinity of the outlet to the sea.

Ruppia c.f. *cirrhosa* is abundant and well distributed. It occurs in dense beds, usually more than ten metres out from the shore, around the whole site with the exception of the outlet area. Dense patches are found in the narrow sheltered bays of the north east.

Zostera fragments were found washed up on the shore but their origin is unknown.

Marginal vegetation is limited to a *Juncus maritimus* salt tolerant community, typically forming a narrow strip associated with low peat cliffs, with occasional areas of bedrock shore.

Drongawn Lough seems to be a good representative of a tidal, high salinity lagoon. Its *Ruppia* beds are extensive and other interesting aquatic species may be present.

Aquatic areas were surveyed almost entirely from the shore due to water depth.

Full aquatic survey is recommended.

6.4 ECOTONAL COLEOPTERA

J.A. Good PhD MIEEM FRES,
Terrascope Environmental Consultancy, Riverstick, Co. Cork.

6.4.1 Site Description

Saline lake with channel to sea, and small tidal response. Lake shore with eroded cliffed peat margins, boulders and outcropping rock. Extensive margins of *Juncus maritimus*/pasture on peat.

Subsites (Fig. 6.4.1)

1. *Juncus maritimus* (South-west) (V 730638)
c. 0.2 ha area of *Juncus maritimus* with grass, *Plantago maritima*, *Armeria maritima*, etc., on peat, flooded during winter. Near-shore salinity 22‰ (1 ix 1996).

2. *Juncus maritimus* (North-west) (V 727638)
Vegetation as above, but part of more extensive *Juncus* margin along north-west margin of lake.

3. Rocky shore (V 731639)
Cobbles between unvegetated zone and grass, etc., on organic/coarse sand soil on rocky shore.

6.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if: (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

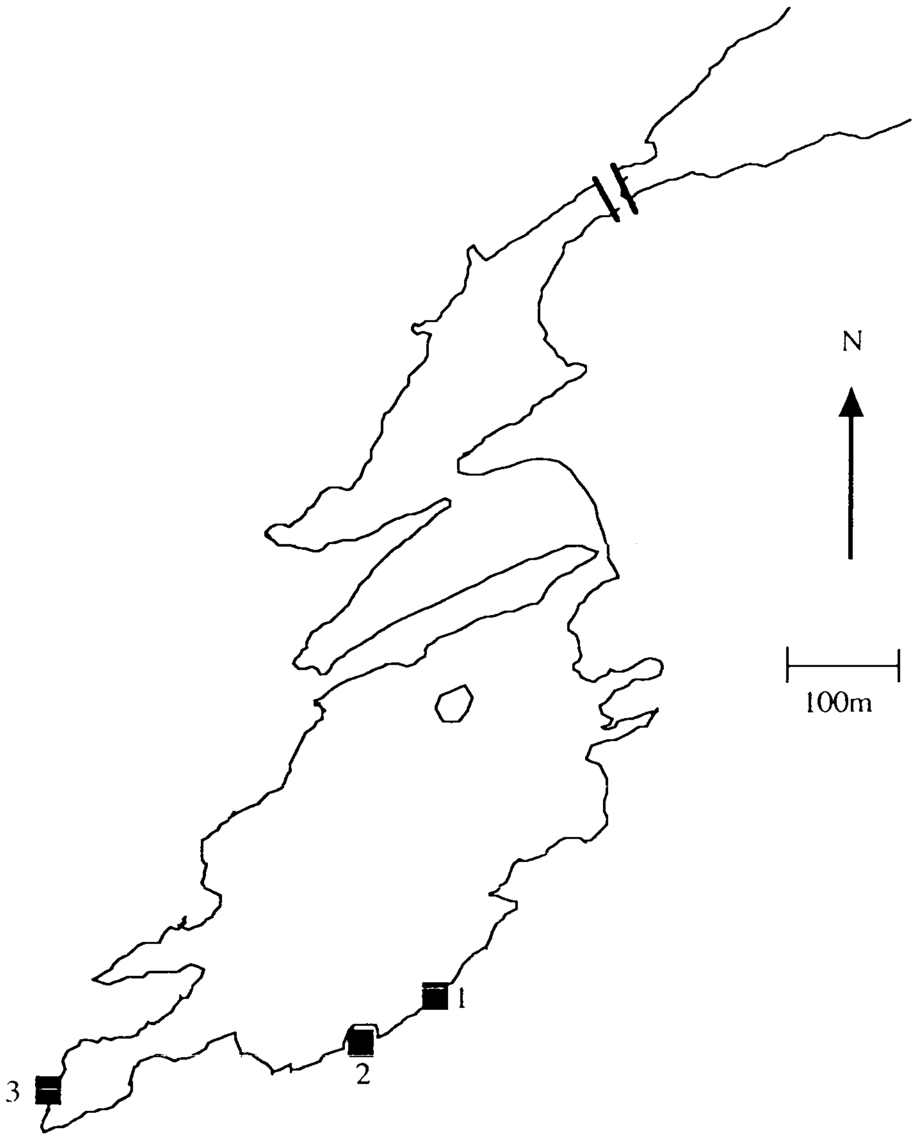

Fig. 6.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Drongawn Lough, Co. Kerry.

1 - Cobble search
2 - Pitfall traps, S-vac
3 - Pitfall traps

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 6.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 6.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References

Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Juncus maritimus* (South-west) area - S-vac suction sampler (19 ix 1996), c. 2 m^2;
(2) *Juncus maritimus* (South-west) area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (1 - 19 ix 1996);
(3) Rocky shore - cobble search (30 cobbles, 1 ix 1996);
(4) *Juncus maritimus* (North-west) area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (19 ix - 19 x 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; <u>and</u>, (2) they

are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

6.4.3 Results

Six species of carabid and ten species of staphylinid were recorded, one species of which is regarded as an indicator species (Table 6.4.2).

There are three pevious Irish records of *Stenus lustrator* (Anderson 1984), which appears to be local in Europe (Horion 1963). The species is tyrphophilous (associated with peat), but also occurs on marshy shores and flood meadows, according to Koch (1989). The Irish records are from bogs (Anderson 1984), and the species was also recorded at Lough Aconeera and Faranamanagh Lake in this survey, both of which posess peat and bog margins

TABLE 6.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Drongawn Lough. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

	Species	No. individuals	
Carabidae			
	Agonum fuliginosum (Panz.)	1	
	Agonum muelleri (Hbst.)	2	
	Bembidion mannerheimi Sahlb.	6	
	Dyschirius globosus (Hbst.)	5	
	Notiophilus biguttatus (F.)	1	
	Pterostichus niger (Schall.)	6	
Staphylinidae			
	Atheta vestita (Grav.)	1	
	Cryptobium fracticorne (Payk.)	2	
	Drusilla canaliculata (F.)	8	
	Gabrius pennatus Sharp	1	
	Paederus fuscipes Curt.	34	
	Stenus brunnipes Steph.	1	
	Stenus juno (Payk.)	1	
*	*Stenus lustrator* Er.	7	**Indicator species**
	Stenus nitens Steph.	1	
	Zyras limbatus (Payk.)	1	

6.4.4 Evaluation

Of low conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of one peat-soil indicator species and a relatively low species diversity indicates that these margins may be more disturbed than at other sites (e.g. L. Tanaí, Co. Galway). The site can therefore only be rated as of low value. However, unlike at Lough Aconeera, the indicator species was present in numbers.

References

Anderson, R. (1984) Staphylinidae (Coleoptera) in Ireland - 3: Steninae. *Ir. Nat. J.* **21**: 242-251.

Horion, A. (1963) *Faunistik der Mitteleuropäischen Käfer*. IX. *Staphylinidae: Micropeplinae bis Euaesthetinae.* Feyel, Überlingen-Bodensee.

Koch, K. (1989) *Die Käfer Mitteleuropas. Ökologie*. **1**. Goecke & Evers, Krefeld.

Lohse, G.A. and Lucht, W.H. (1989) *Die Käfer Mitteleuropas*. **12**. *1. Supplementband mit Katalogteil.* Goecke & Evers, Krefeld.

Lucht, W.H. (1987) *Die Käfer Mitteleuropas. Katalog.* Goecke & Evers, Krefeld.

6.5 SUMMARY AND EVALUATION

Drongawn Lough is a medium-sized (20 ha) **natural saline lake** with a shallow, constricted outlet.

Very little is known about this lake. It lies between two small proposed NHAs (Site Code Nos. 1375 and 2098).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	High
Aquatic Fauna	High
Vegetation	Potentially High
Ecotonal Coleoptera	Low

Geomorphology.

The lake is a good example of a completely natural, moderately large (20 ha), saline lake on the mountainous Kerry coastline in an almost perfect state of preservation.

Geomorphologically, the lake is not a true lagoon but is a good example of a deep, "silled" lake in pristine condition. It is presumably of glacial origin and is similar to Salt Lake and ough Hyne and probably resembles the Scottish "obs".

Although not a coastal lagoon in the strict sense, as a saline lake it is rated as of <u>high</u> conservation value based on its relatively large size and almost complete state of natural preservation.

Aquatic Fauna

Among 68 macrofaunal taxa recorded, 60 were identified to species including three lagoonal specialists (*Cerastoderma glaucum, Palaemonetes varians* and *Hydrobia ventrosa*).

The fauna was rich and predominantly marine but with 18% of brackish (poly-euryhaline) species, three of which are recognised as lagoonal specialists, and two limnic species. The conditions which favour the brackishwater species are the small tidal range coupled with a small, but probably continuous, freshwater inflow from the surrounding peatlands. The corixid and beetle species are normally associated with freshwater and may have been immigrants from a nearby pond. The lake contains a natural population of large oysters

Jaera forsmani may not have been officially recorded for Ireland, (possibly in L. Hyne) but there are unpublished reports of its occurrence. The only record of *Erichthonius difformis* in Ireland is for L. Hyne (Costello *et al.* 1989). *Palaemon longirostris,* which is regarded as an estuarine and brackish species, was not taken at any other site during this survey.

The lake has a rich and interesting aquatic fauna which includes two rare crustacean species. An interesting feature is the presence of lagoonal and freshwater species in a community dominated by marine species. Further study of the fauna, to include a diving survey of the deeper regions, is recommended.

In conclusion, the presence of two rare species qualify it to be considered as of national importance. The richness of the site and near pristine conditions qualify Drongawn Lough to considered as of high conservation value and worthy of further study.

Vegetation

Ruppia c.f. *cirrhosa* is abundant and well distributed. It occurs in dense beds, usually more than ten metres out from the shore, around the whole site with the exception of the outlet area. Dense patches are found in the narrow sheltered bays of the north east. *Zostera* fragments were found washed up on the shore but their origin is unknown.

Marginal vegetation is limited to a *Juncus maritimus* salt tolerant community, typically forming a narrow strip associated with low peat cliffs, with occasional areas of bedrock shore.

Drongawn Lough seems to be a good representative of a tidal, high salinity lagoon. Its *Ruppia* beds are extensive and other interesting aquatic species may be present.

As aquatic areas were surveyed almost entirely from the shore due to water depth the site is given a rating of "potentially valuable" and a full aquatic survey is recommended.

Ecotonal Coleoptera

Six species of carabid and ten species of staphylinid were recorded, one species of which is regarded as an indicator species

There are three previous Irish records of *Stenus lustrator*, which appears to be local in Europe. The species is tyrphophilous (associated with peat), but also occurs on marshy shores and flood meadows, according to Koch (1989). The Irish records are from bogs and the species was also recorded at Lough Aconeera and Faranamanagh Lake in this survey, both of which posess peat and bog margins

The presence of one peat-soil indicator species and a relatively low species diversity indicates that these margins may be more disturbed than at other sites (e.g. L. Tanaí, Co. Galway).
The site can therefore only be rated as of low value. However, unlike at Lough Aconeera, the indicator species was present in numbers.

Summary

Very little is known about this lake. There appear to have been no previous studies, or exploitation of the lake, although mariculture might be considered. There is very little disturbance to the site apart from occasional duck shooting and fishing.

Geomorphologically, the lake is not a true lagoon but is a good example of a deep, "silled" lake in pristine condition. It is presumably of glacial origin and is similar to Salt Lake and Lough Hyne and probably resembles the Scottish "obs".

A mixed community of marine and lagoonal fauna and flora is of interest

On the basis of geomorphology as a saline lake and its aquatic faunal and floral communities, Drongawn Lough is regarded as of high conservation value.

Proposal as an SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

7. LOUGH GILL

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Geoff Oliver
Pat Hatch
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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

7. LOUGH GILL

CONTENTS

7. LOUGH GILL, Co. Kerry

OS Grid Reference: Q 606 142, 1:50,000 Sheet Nos. 70/71
Alternative names: Loch Gile

7.1 STUDY AREA

General features

Lough Gill is situated on the north coast of the Dingle peninsula, 1 km from the town of Castlegregory. The lake is a shallow natural lagoon "in a classical position" (Guilcher & King 1961) lying between two barriers which unite to form a tombolo connecting the mainland to a group of the Magharee islands. This tombolo is known as the Castlegregory spit with Brandon Bay to the east and Tralee Bay to the west (Fig. 7.1.1). A freshwater stream enters in the southwest and a channel (The Trench) runs from the northeast of the lake to Tralee Bay, but tidal exchange is limited by a one-way sluice at the outlet and a small weir which prevents all but the highest tides from entering the lagoon.

The lagoon is a state-owned Wildfowl Sanctuary, and an SPA for birds, although Sheppard (1993) points out that peak waterfowl counts have declined drastically from those quoted by Hutchinson (1979). The Tralee Bay and Magherees Peninsula is a proposed NHA (Site Code No. 2070). An Foras Forbartha listed the site as of special scientific importance with a national rating of botanical, geomorphological, zoological and ornithological importance. The L. Gill area is also of major importance as the main breeding site of the Natterjack toad (*Bufo calamita*) (see Gresson and O'Dubhda 1971) and is scheduled for designation as a National Nature Reserve. The Castlegregory Golf Club has a 20 year lease on the warren at the western end of the lake.

A golf course has recently been extended in the area of dunes which borders the southwest shoreline of the lake. This extension into a natural dune area and breeding site of Natterjack toads was highly controversial, but permission was granted and the golf course itself does not appear to affect the lake. Land between the lake and the sea has escaped tourist development. The golf courses extension, although damaging the original dunes is sown with *Festuca rubra* and no fertilisers are used. Grazing is continued in winter and spring, thus preventing invasion by scrub and allowing the diverse herbaceous flora to grow.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6.5°C in January and 15.5°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 11 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual

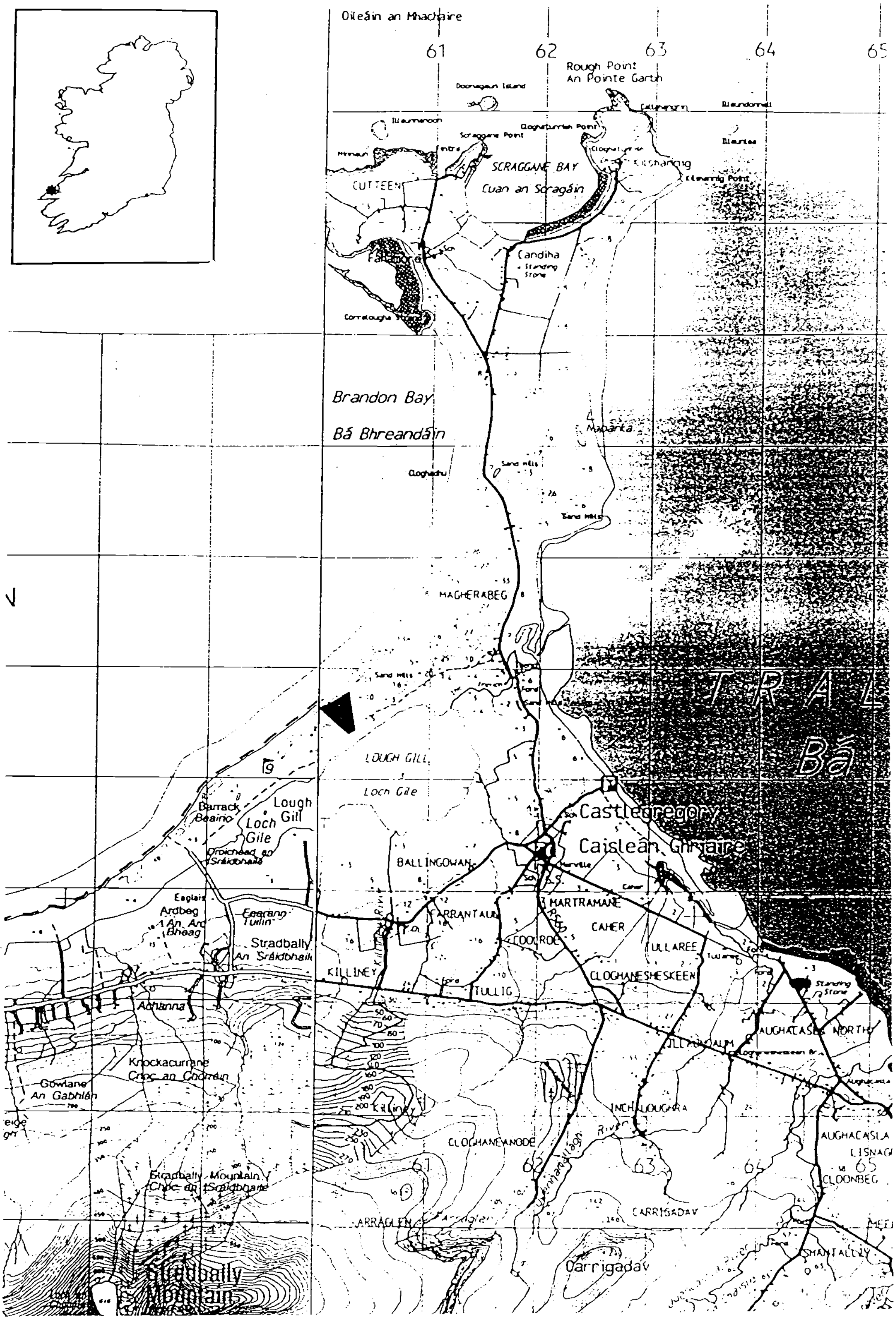

Fig. 7.1.1 Section of 1:50 000 map showing locality of Lough Gill

rainfall is approximately 1400 mm, and the number of rain days (1 mm or more) is 175-200. Prevailing winds are from the south and west. Mean annual hourly wind speeds are between 5.6 m/s and a maximum wind speed of 49-50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) in Tralee Bay is 4.2 m (Admiralty Tide Tables).

Landscape and Geology The bedrock of the coastline is composed of limestone, giving rise to alkaline groundwater, often covered by glacial drift or dunes. Inland, the limestone is overlain with sandstones and slates of the Dingle Beds. Most of the lagoon is bordered by dunes and dune grassland to the north and by peaty podzolic soils to the south. The surrounding agricultural land consists mostly of improved pastureland, and it appears that milk production has become more intensive recently. Land rises steeply from the coastline to mountains of Old Red Sandstone (R.I.A. 1979) which run the length of the peninsula.

Lake Topography The lake is approximately 2.5 km from southwest to northeast, width varies from 3-400 m in the narrow southwestern end to almost 1 km from central to northeast end and total area is approximately 160 ha. The lake is very shallow (30-40 cms) except in the dredged channels at both ends of the lagoon. The substrate is mostly firm sand and it is possible to cross most of the lake on foot. It appears that until recently most of the bed of the lagoon was covered with extensive areas of *Chara*, but these seem to have been out-competed by blooms of filamentous algae.

Hydrology A freshwater stream enters in the southwest and a channel runs from the northeast of the lake to Tralee Bay, but tidal exchange is limited by a one-way sluice at the outlet and a small weir which prevents all but the highest tides from entering the lagoon. The bridge, with sluices to prevent seawater from entering, was built in 1929. Kerry Co. Council dredged the outlet channel, known as "The Trench" and removed the sandbar which was then blocking the outlet in 1971. The first weir was constructed to maintain higher water levels in the lake some time after 1971. The weir was removed in 1981 and then replaced again in 1983. (Sean Bowler *pers. comm.*).

There is no tidal fluctuation in water level of the lake, but a seasonal one whereby water levels rise in the winter with the increased rainfall, and gradually decline to sometimes very low levels in the summer.

Salinity and water quality Seawater enters the lagoon less frequently since construction of the sluice and the weir. However, neither appear to function perfectly and recent water analyses carried out at U.C.D. show the undeniable presence of seawater within the lagoon, despite the fact that it is widely regarded as being completely fresh.

Although the surrounding hills are acidic and streams entering the lake have a low pH, it appears that alkaline ground waters also enter the lake, and the water is generally base-rich, which is unusual for a wetland in this part of Ireland.

There have been considerable problems with eutrophication in this lake, presumably due to agricultural runoff and waste discharge from the town of Castlegregory. Blooms of filamentous algae have been common recently. The lake is an important trout fishery and the first serious fish-kill occurred in July 1984.

7.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver, Dept. of Zoology, University College Dublin

7.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰. precision). As salinity levels were very low, water samples were collected for subsequent analysis. A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A, B, and F in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of

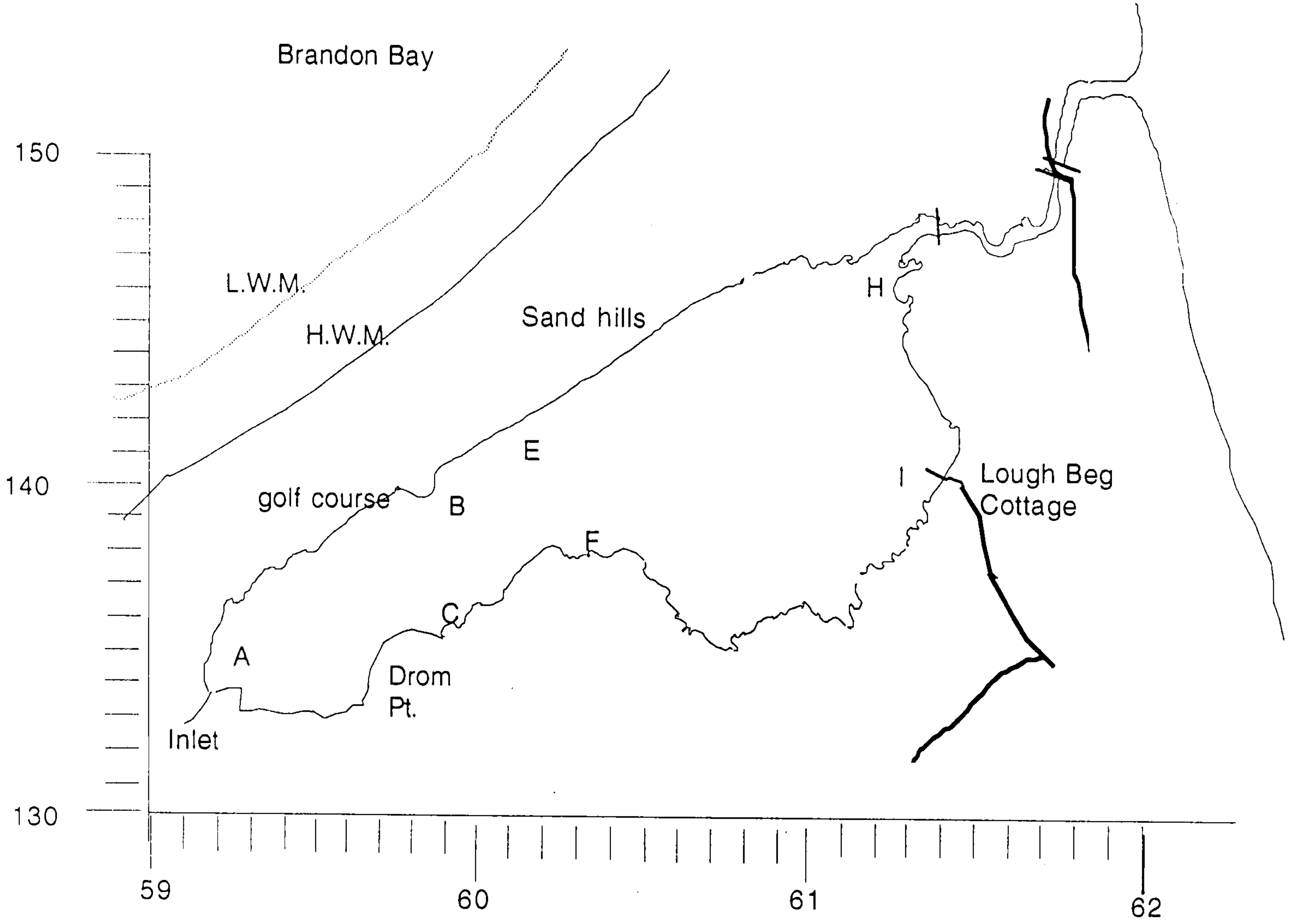

Fig. 7.2.1 Location Map of sampling stations in lough gill, Co Kerry

Table 7.2.1. Fauna Recorded at Lough Gill, Co. Kerry. July and September, 1996.
( ) = records from July.

		Sampling Stations (L.T. = light-trap)															
		Inlet	L.T.	A	L.T.A	B	L.T.B	C	E	L.T.E	F	L.T.F	G	H	L.T.H.	I	L.T.I
Porifera																	
Cnidaria																	
Turbellaria																	
Nemertea																	
Annelida	Hirudinea			+		+		+	+							+	
	Clitellio arenarius															+	+
	Naididae																+
Crustacea																	
Ostracoda			+	+	+	+	+	+	+	+	+	+					+
Copepoda			+	+	+	+	+				+	+					+
Cirripedia																	
Mysidacea	*Neomysis integer*					+		+	+	+	c	150	o	+	1	(+)	(+)
Isopoda	*Lekanesphaera hookeri*													a	25	(+)	(+)
Amphipoda	*Gammarus zaddachi*					+					+			+	+		
	Melita palmata								+	+							
Tanaidacea																	
Decapoda																	
Arachnida	Hydracarina		12	+			+	+								+	+
Insecta																	
Thysanura																	
Ephemeroptera	*Cloeon simile*		+		+		+										
	Procloeon bifidum		+														
Odonata	*Ischnura elegans*	+						+	+		+			+	1	+	+
Plecoptera															1		
Trichoptera						+		+									
Hemiptera	*Nepa cinerea*															+	

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Table 7.2.1 cont.. Fauna Recorded at Lough Gill, Co. Kerry. July and September, 1996.
( ) = records from July.

		Sampling Stations (L.T. = light-trap)															
		Inlet	L.T.	A	L.T.A	B	L.T.B	C	E	L.T.E	F	L.T.F	G	H	L.T.H.	I	L.T.I
	Corixidae	+	+	+	100	+	150	+	+	+	+	300	o	+	65	+	+
	Callicorixa praeusta			+	+	+	+		+	+			a			(+)	
	Corixa punctata															+	+
	C. panzeri	a	+	+	+			a	+	a	+	+	+	+	c	c	c
	Arctocorisa germari			+	+												
	Sigara dorsalis	a	a	a	a	a	a	a	+	a	+	a	a	+	+	c	c
Coleoptera	***Cercyon sternalis*																
	Enochrus testacus													+			
	Haliplus confinis						+			+		+					
	H. fulvus				+		+										
	H. lineatocollis				+												
	Hygrotus inaequalis													+		(+)	
	Laccobius biguttatus															(+)	
	L. minutus						+										
	Laccophilus minutus				+		+										
	Llybius fuliginosus																
	Nebrioporus depressus						+			+							
Diptera	Chironomidae	+				+		+					+	+			
	Tipulidae														+	+	+
Mollusca																	
Polyplacophora	*Lepidochitona cinerea*													1			
Prosobranchia	Hydrobiidae	+				+		+	+	+			+	+	+	+	+
	Potamopyrgus antipodarum	+				+		+	+	+			+	+	+	+	+
Opisthobranchia																	
Pulmonata	*Lymnaea peregra*			+		+		+	+				+		+	+	

+ = present; o = occasional; c = common; a = abundant; F = fyke net
** = First Irish record

Table 7.2.1 cont.. Fauna Recorded at Lough Gill, Co. Kerry. July and September, 1996.
( ) = records from July.

		Sampling Stations (L.T. = light-trap)															
		Inlet	L.T.	A	L.T.A	B	L.T.B	C	E	L.T.E	F	L.T.F	G	H	L.T.H.	I	L.T.I
	Sementina complanata	+													+	+	
Bivalvia	*Cerastoderma sp.*			shells		shells									shells	shells	shells
	Pisidium sp.					+		+	+				+		+	+	+
	Sphaerium sp.	+				+							+				
Bryozoa	*Plumatella repens*							a								(+)	
Echinodermata																	
Tunicata																	
Teleostei	*Anguilla anguilla*		1	F,1		F,46		+			F, 94				+	+	+
	Gasterosteus aculeatus	a	49	a	130	a	14	c	c	4	+		+	+	4	+	+
	Mugilidae										F, 3						
	Platichthys flesus			F, 23		+					F, 6		+	+	+	+	+
	Pomatoschistus microps													c			
	Salmo trutta			F, 3							F, 2						

+ = present; o = occasional; c = common; a = abundant; F = fyke net

the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it s assumed that early instars of this group were of the same species.

7.2.2 Results

Lough Gill was sampled on 6.vii.96 during the first part of the survey, and from 11-13.ix.96 during the more intensive survey.

Stations were selected within the lake to reflect the influences of fresh and saline water and differences in vegetation and substrate. Positions of the sampling stations are shown in Fig.7.2.1

Environmental Variables

Station "inlet" was an additional sample site in the area where boats are launched near the golf club, approximately 50 m up the stream which leads into the lake. This inlet had been dredged and depth was approximately 2 m, substrate was sand and salinity measured 0 ‰ (Plate 7.2.1).

Station A (OS 5933 1346) was located at the southwest corner where the freshwater stream first enters the lagoon. to In this area water depth varied from 25 cm to 1 m, substrate was sand and salinity measured 0‰ (Plate 7.2.1).

Station B (OS 5956 1381) was located along the northern shoreline at the end of the golf course. Water depth varied from 25-80 cm , substrate consisted of sand with occasional stones, salinity measured 0‰

Station C (5967 1341) was located on the southern shoreline of the narrow arm of the lake, just east of Drom Point. Water depth varied from 0- 50 cm., substrate consisted of stones and fine organic silt, salinity was 2‰.

Station D (OS 5983 1373) was located in the open water area of the lake. salinity measured 2‰ and substrate was sand. No faunal sampling was carried out at this station.

Station E (OS 6030 1396) was located on the northern shoreline in a bay formed by *Phragmites* . Substrate in this area consisted of firm sand, depth ranged from 40-50 cm and salinity measured 2‰ (Plate 7.2.2).

Station F (OS 5955 ?? 1382) was located on the southern shoreline of the lagoon at the corner where the lagoon widens. This is the deepest area of the lagoon (2 m), substrate is fine organic silt and salinity measured 2‰.

Station G (OS 6077 1349) was located on the southern shore where a small stream enters and cattle drink. Substrate was rich organic mud, depth was 0-25 cm and salinity measured 0-1 ‰.

Station H (OS 6122 1464) was located at the northeast corner where The Trench connects the lake to the sea. Substrate was clean sand, depth varied from 25-50 cm, and salinity measured 2‰ (Plate 7.2.5).

Station I (OS 6134 1403) was located beside the jetty at Lough Beg Cottage. Substrate was sand with occasional rocks and stones, some of which had fallen from the jetty, depth varied from 25-50 cm and salinity measured 1-2‰.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 7.2.1. Among 43 taxa listed, 35 are identified to species; Trichoptera remain to be identified and the bryozoan needs confirmation. No attempt will be made to identify Hirudinea, Hydracarina, larvae of Chironomidae and Tipulidae, *Pisidium* and *Sphaerium* spp. or the polychaete which is in poor condition. One marine species was recorded (a chiton, which was presumably an accidental introduction), 3 are poly-mesohaline taxa, 7 are euryhaline, 2 are oligo-mesohaline and 25 are limnic (Table 7.2.2). One species (*Lekanesphaera hookeri*) is listed as a lagoonal specialist in Britain (Davidson *et al.* (1991).

Some limnic taxa (Hirudinea, Ephemeroptera, Trichoptera) were found only in the inland sector of the lake i.e. stations A, B and C, while others (Hydracarina, Corixidae, Coleoptera and molluscs) were more widespread, extending into an area where the salinity was 2‰ in September and 5‰ in July. Most of the beetles were taken in light traps and could have been attracted by the lights while flying. Some brackishwater species e.g. *Lekanesphaera hookeri* and *Pomatoschistus microps* were confined to the area near the mouth of the sea inlet while others e.g. *Clitellio arenarius* and *Neomysis integer* were more widely distributed. Juvenile flounder and mullet, all of which were under 15 cm, had probably entered in the current year.

Table 7.2.2 Ecological categories of the recorded taxa in Lough Gill (Trichoptera not included). L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Lepidochitona cinerea*	
Poly-mesohaline	*Clitellio arenarius*	
	Melita palmata	
	Mugilidae	
Euryhaline	*Neomysis integer*	
	Lekanesphaera hookeri	L
	Gammarus zaddachi	
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
	Platichthys flesus	

Lough Gill

Oligo-mesohaline	*Ischnura elegans* *Potamopyrgus antipodarum*
Limnic	Hiudinea Hydracarina *Cloeon simile* *Prcloeon bifidum* *Nepa cinerea* *Callicorixa praeusta* *Corixa punctata* *C. panzeri* *Arctocorisa germari* *Sigara dorsalis* **Cercyon sternalis* *Enochrus testaceus* *Haliplus confinis* *H. fulvus* *H. lineatocollis* *Hygrotus inaequalis* *Laccobius biguttatus* *Llybius fuliginosus* *Nebrioporus depressus* *Lymnaea peregra* *Sementina complanata* *Pisidium* sp. *Sphaerium* sp. *Plumatella repens* *Salmo trutta*

*** New Irish record**

7.2.3 Discussion

The fauna is rich and diverse, comprising both freshwater and brackishwater elements. Hemiptera (6 spp.) and Coleoptera (11 spp.) were especially abundant and diverse. The faunal assemblage typifies a system which is essentially freshwater but which receives small incursions of seawater. All of the hemipterans and beetles are freshwater species. The long, sluiced inlet and weir apparently prevent crabs and prawns entering the lake but juvenile flounder and mullet were able to find their way in during 1996.

Cercyon sternalis is a new record for Ireland. This and four other beetles were not recorded at any other site during the survey.

7.2.4 Threats

There have been considerable problems with eutrophication in this lake, presumably due to agricultural runoff and waste discharge from the town of Castlegregory. Blooms of filamentous algae have been common recently. The lake is an important trout fishery and the first serious fish-kill occurred in July 1984. Allowing seawater to enter may help to control the algal blooms but expert advice is needed before this is attempted.

The golf course has recently been extended in the area of dunes which borders the southwest shoreline of the lake. This extension into a natural dune area and breeding site of Natterjack toads was highly controversial, but permission was granted and the golf course itself does not appear to affect the lake. The golf courses extension, although damaging the original dunes is sown with *Festuca rubra* and no fertilisers are used.

Land between the lake and the sea has escaped tourist development. Grazing is continued in winter and spring, thus preventing invasion by scrub and allowing the diverse herbaceous flora to grow.

Unauthorised drainage and development of water sports may still be a threat.

7.2.5 Evaluation

Lough Gill is a **natural sedimentary lagoon** with a sand barrier and therefore of international importance based purely on geomorphology.

Geomorphologically it is a classic example of a lagoon lying between two sedimentary barriers. However, salinity levels, determining the biological community, are controlled by management. If seawater was allowed to enter on a regular basis the lake would merit more protection as a classic brackish lagoon.

The lake lies within a proposed NHA. It is a Wildfowl Sanctuary and an SPA for birds, although peak waterfowl counts have declined drastically since 1979. The dune area is of major importance as the main breeding site for the Natterjack Toad.

The lake is an important trout fishery and of great concern to the local inhabitants.

The aquatic fauna appears to be diverse and consists mainly of freshwater species but a significant brackish element is also present which includes a lagoonal specialist. An aquatic beetle is recorded for the first time in Ireland.

In conclusion Lough Gill is of high conservation value. Its conservation value as a coastal lagoon, however, depends entirely on management. Designation as a proposed SAC is recommended. However, the predominance of freshwater species among the aquatic fauna and the localised occurrence of the single lagoonal specialist near to the sea inlet, casts some doubt upon the acceptance of the lake as a true lagoon based on the fauna alone.

7.2.6 References and Additional Sources of Information

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Plate 7.2.1 View of freshwater inlet entering southern end of Gill, Station A.

Plate 7.2.2 View of the northwest shore of Lough Gill looking west, Station E.

Plate 7.2.3 View looking north across Lough Gill towards the sandhills.

Plate 7.2.4 Photograph of as yet unidentified freshwater Bryozoan found in Lough Gill.

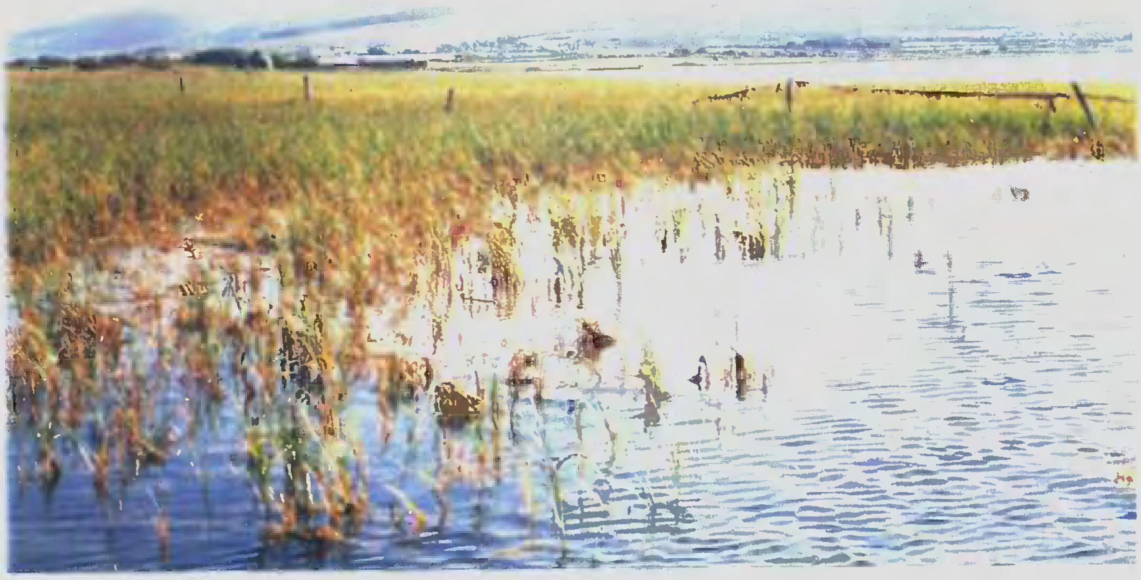

Plate 7.2.5 View of the area near the outlet of Lough Gill, Station H

Plate 7.2.6 View of the weir on the outlet channel of Lough Gill

7. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

7.3.1 Site Description (Fig. 7.3.1)

Low-lying pastoral farmland lies to the south of this lough with mountainous country beyond. The sea lies beyond sand dunes to the north, north east and west.

The major freshwater inflow discharges into the lough at its western end and the outlet to the sea runs from the opposite, eastern end. Fairly extensive Phragmites dominated swamps occur at the freshwater inflow and bordering the southern shore. A narrow strip of swamp vegetation fringes most of the northern shore and Scirpus and Schoenoplectus swamps are found at the eastern end.

The only open shores are in the south west where, according to local knowledge, an area of pasture has been extended into the lough by a local landowner. A golf course adjoins the lough to the north west.

Shores are shallowly sloping around the whole site.

7.3.2 Methods

This site was surveyd by means of transects only. The locality of these is shown in Fig. 7.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic

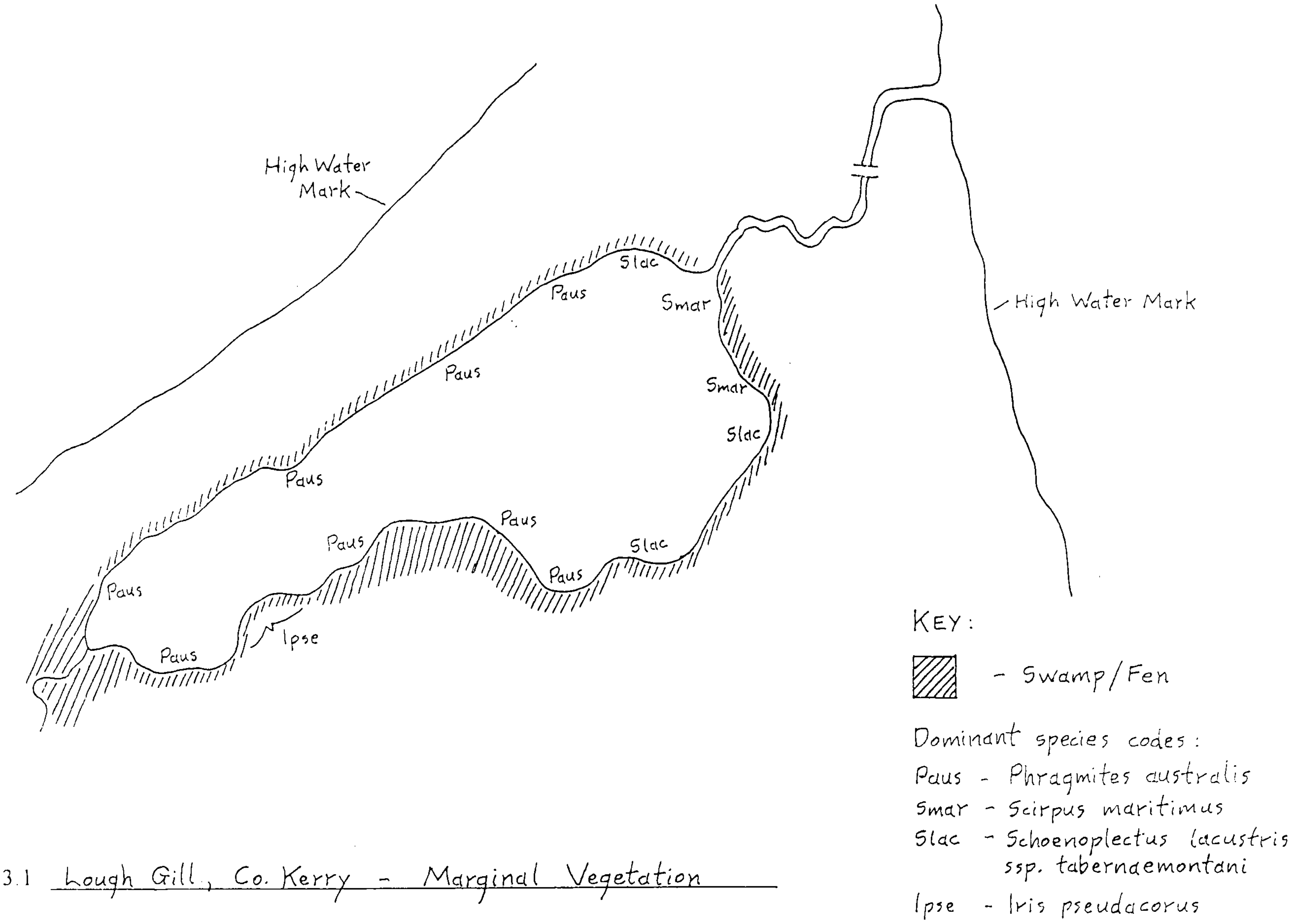

Fig. 7.3.1 Lough Gill, Co. Kerry - Marginal Vegetation

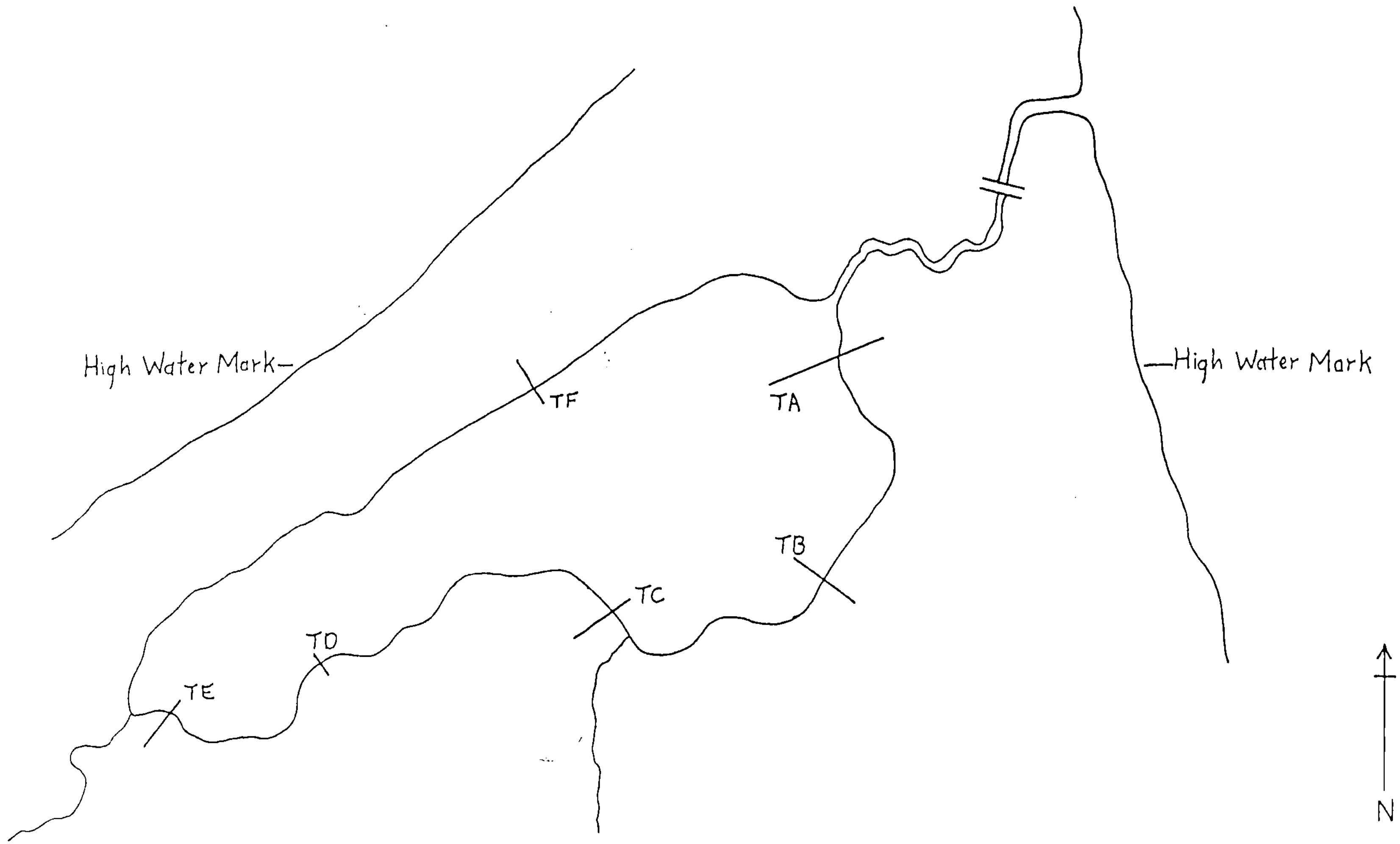

Fig. 7.3.2 Lough Gill, Co.Kerry: Location of Transects

survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

A brief site description was written for each lagoon.

<u>Constraints</u>

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

<u>Identifications</u>

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

7.3.3 Results

Transects

Site: Lough Gill	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - 100m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 50 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		70
Ruppia maritima	5	70
Algae		50
Filamentous algae		50
Description: Fairly dense low growing Ruppia (some in flower) beneath patchy cover of free-floating filamentous algae. Same species at more or less the same cover at 75m, 50m, 25m and 10m out from the shore. Water depth gradually decreasing to 30cm at 50m out, remaining constant to 3m out.		

Site: Lough Gill	Transect code: A	
Location: Outlet to sea	Sample point: 2 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 20 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		60
Ruppia maritima	5	60
Algae		70
Filamentous algae		70
Enteromorpha	40	< 1
Description: Patchy cover of low growing Ruppia beneath extensive free-floating algal mat.		

Site: Lough Gill	Transect code: A	
Location: Outlet to sea	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 15 cm	Salinity: 0 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		70
Scirpus maritimus	80	70
Schoenoplectus lacustris ssp tabernaemontani	90	< 1
Phragmites australis	90	< 1
Algae		95
Enteromorpha	20	95
Description: Fairly dense Scirpus maritimus swamp with occasional Schoenoplectus and		
Phragmites shoots over a dense algal mat. Extending 25m to stock fence.		

Site: Lough Gill	Transect code: A	
Location: Outlet to sea	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 15 cm	Salinity: 0 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		60
Scirpus maritimus	70	50
Schoenoplectus lacustris ssp tabernaemontani	80	10
Phragmites australis	70	< 1
Potamogeton pectinatus	6	5
Algae		80
Filamentous algae		80
Description: Increasingly open cover of dominant Scirpus maritimus with Schoenoplectus		
increasingly frequent. Potamogeton pectinatus low growing and fairly sparse beneath		
floating algal mat. Extending 15m landward of stock fence. Grazed.		
Backing to Iris psuedacorus - Juncus effusus - Agrostis stolonifera community,		
100m.		
Grading to Ammophila arenaria - Festuca rubra dune grassland.		

Site: Lough Gill	Transect code: B	
Location: Swamp bordering shallow shelf	Sample point: 1 Aquatic - 40m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 50 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		30
Filamentous algae		20
Chara aspera var. aspera	6	20
Description: Open charophyte cover beneath patchy free-floating filamentous algae.		

Site: Lough Gill	Transect code: B	
Location: Swamp bordering shallow shelf	Sample point: 2 Aquatic - 20m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 30 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		50
Higher Plant		10
Zannichellia palustris	5	10
Ruppia maritima	6	< 5
Algae		40
Filamentous algae		20
Chara aspera var. aspera	6	20
Description: Chara aspera dominant with higher plant associates beneath patchy mat of		
filamentous algae.		

Site: Lough Gill	Transect code: B	
Location: Swamp bordering shallow shelf	Sample point: 3 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 30 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		5
Zannichellia palustris	5	< 5
Ruppia maritima	8	< 5
Potamogeton pectinatus	8	< 5
Algae		60
Filamentous algae		60
Chara aspera var. aspera	5	10
Description: Chara aspera dominant with higher plant associates beneath increasing cover of surface algal mat.		

Site: Lough Gill	Transect code: B	
Location: Swamp bordering shallow shelf	Sample point: 4 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 30 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		90
Higher Plant		5
Zannichellia palustris	5	5
Algae		90
Filamentous algae		90
Description: Sparse Zannichellia beneath extensive algal mat.		

Site: Lough Gill	Transect code: B	
Location: Swamp bordering shallow shelf	Sample point: 5 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 30 cm	Salinity: 1 part per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Higher Plant		75
Schoenoplectus lacustris ssp tabernaemontani	120	70
Phragmites australis	100	5
Potamogeton pectinatus	40	< 1
Algae		25
Filamentous algae		25
Description: Tall, fairly dense Schoenoplectus lacustris swamp with sparse Phragmites.		
Patchy algal mat with sparse Potamogeton pectinatus. 40m.		

Site: Lough Gill	Transect code: B	
Location: Swamp bordering shallow shelf	Sample point: 6 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 20 cm	Salinity: 0 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Higher Plant		80
Schoenoplectus lacustris ssp tabernaemontani	120	70
Phragmites australis	100	< 1
Potamogeton natans	30	< 1
Lemna minor		< 1
Algae		25
Filamentous algae		25
Description: Tall, fairly dense Schoenoplectus lacustris swamp with sparse Phragmites.		
Patchy algal mat with sparse Potamogeton natans and Lemna minor. 20m. Grazed.		
Grading to Iris psuedacorus - Juncus effusus - Agrostis stolonifera community.		

Site: Lough Gill	Transect code: C	
Location: Swamp bordering deeper water	Sample point: 1 Aquatic - 10m out - grapnel	
Sample area: Grapnel only	Substrate: Silt (depth - 60cm +)	
Depth: 1 m	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Myriophyllum spicatum		
Enteromorpha		
Filamentous algae		
Description:		

Site: Lough Gill	Transect code: C	
Location: Swamp bordering deeper water	Sample point: 2 Aquatic - 2m out - grapnel	
Sample area: Grapnel only	Substrate: Silt (depth - 60cm +)	
Depth: 70 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Enteromorpha		
Filamentous algae		
Description:		

Lough Gill

Site: Lough Gill	Transect code: C	
Location: Swamp bordering deeper water	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 5 - 70 cm	Salinity: 1 part per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	240	100
Rumex hydrolapathum	70	< 1
Description: Tall dense Phragmites swamp with sparse R. hydrolapathum the only associated		
species for 20m. Water depth decreasing rapidly from 70 - 5cm within 3m of swamp edge.		

Site: Lough Gill	Transect code: C	
Location: Swamp bordering deeper water	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 5 cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - sub-community undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	240	100
Angelica sylvestris	50	< 1
Apium nodiflorum	40	< 1
Potentilla palustris	40	< 1
Menyanthes trifoliata	30	< 1
Lemna minor		< 1
Description: Tall dense Phragmites bed with sparse understorey of freshwater associates.		
Extending for c.200m.		
Backing to Lolium perenne - Cynosaurus cristatus pasture.		

Site: Lough Gill	Transect code: D	
Location: Open shore	Sample point: 1 Aquatic - 20m out - grapnel	
Sample area: Grapnel only	Substrate: Sand	
Depth: 80 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Myriophyllum spicatum		
Filamentous algae		
Chara aspera var. aspera		
Description:		

Site: Lough Gill	Transect code: D	
Location: Open shore	Sample point: 2 Aquatic - 10m out - grapnel	
Sample area: Grapnel only	Substrate: Sand	
Depth: 70 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Myriophyllum spicatum		
Filamentous algae		
Description:		

Site: Lough Gill	Transect code: D	
Location: Open shore	Sample point: 3 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Sand, gravel, cobbles	
Depth: 0 - 40 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Filamentous algae		100
Description: Water surface covered by free-floating algal mat from shore to 5m out.		

Site: Lough Gill	Transect code: D	
Location: Open shore	Sample point: 4 Marginal	
Sample area: !6m2 (4x4)	Substrate: Sandy soil	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		80
Iris psuedacorus	100	40
Agrostis stolonifera	15	25
Juncus articulatus	30	5
Potentilla anserina	8	5
Eleocharis palustris	25	5
Mentha aquatica	20	< 1
Nasturtium officinale	6	< 1
Filipendula ulmaria	50	< 1
Hydrocotyle vulgaris	2	< 1
Ranunculus acris	3	< 1
Polygonum hydropiper	30	< 1
Rumex acetosa	8	< 1
Galium palustre	10	< 1
Juncus bufonius	10	< 1
Samolus valerandi	10	< 1
Apium nodiflorum	8	< 1
Stellaria alsine	15	< 1
Rumex conglomeratus	12	< 1
Caltha palustris	10	< 1
Leontodon autumnalis	20	< 1
Senecio palustris	15	< 1
Potentilla palustris	5	< 1
Juncus effusus	45	< 1
Description: Patchy cover of Iris dominated community forming 4m wide strip along poached wet earth and sand bank, average slope c.30 degrees. Grazed. Many species fairly low growing.		
Grading to Lolium perenne - Cynosaurus cristatus pasture.		

Lough Gill

Site: Lough Gill	Transect code: E	
Location: Freshwater inflow	Sample point: 1 Aquatic - 20m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 50 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		25
Higher Plant		20
Zannichellia palustris	6	15
Myriophyllum spicatum	30	5
Algae		20
Filamentous algae		20
Enteromorpha	10	< 1
Description: Zannichellia dominant among sparse submergent species. Patchy surface layer of filamentous algae.		

Site: Lough Gill	Transect code: E	
Location: Freshwater inflow	Sample point: 2 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Sand and silt	
Depth: 50 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		40
Zannichellia palustris	6	20
Ruppia maritima	40	20
Algae		40
Filamentous algae		40
Enteromorpha	10	< 1
Description: Ruppia and Zannichellia in mixed and single species patches, some Ruppia plants in flower. Surface algal mat becoming more extensive but still patchy.		

Site: Lough Gill	Transect code: E	
Location: Freshwater inflow	Sample point: 3 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Sand and silt	
Depth: 50 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		30
Ruppia maritima	40	25
Potamogeton pectinatus	40	5
Myriophyllum spicatum	40	< 5
Description: Ruppia dominant with sparse associates. Some Ruppia in fruit. No algal mat to c.5m out.		

Site: Lough Gill	Transect code: E	
Location: Freshwater inflow	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 50 cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	200	100
Callitriche hermaphroditica		< 1
Description: Dense Phragmites swamp. 15m. Water depth decreasing gradually.		

Site: Lough Gill	Transect code: E	
Location: Freshwater inflow	Sample point: 5 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Galium palustre sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	200	100
Equisetum fluviatile	100	5
Mentha aquatica	70	5
Apium nodiflorum	20	5
Galium palustre	15	< 1
Description: Dense species-poor Phragmites fen with sparse freshwater associates. c.100m.		
Grading to Lolium perenne - Cynosaurus cristatus pasture.		

Site: Lough Gill	Transect code: F	
Location: Barrier	Sample point: 1 Aquatic - 10m out - grapnel	
Sample area: Grapnel only	Substrate: Sand	
Depth: 50 cm	Salinity: 3 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Filamentous algae		30
Chara aspera var. aspera		
Description: Patchy surface cover of free-floating algal mat. Same species and algal mat cover		
from 10m out to marginal zone.		

Site: Lough Gill	Transect code: F	
Location: Barrier	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand and silt	
Depth: 50 cm	Salinity: 3 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		50
Higher Plant		40
Scirpus maritimus	100	25
Schoenoplectus lacustris ssp tabernaemontani	120	10
Phragmites australis	130	5
Algae		10
Filamentous algae		10
Description: Open Scirpus maritimus dominated swamp for 20m. Sparse cover of associated emergents and surface algal layer.		

Site: Lough Gill	Transect code: F	
Location: Barrier	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand and silt	
Depth: 40 cm	Salinity: 3 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		95
Higher Plant		90
Phragmites australis	170	75
Schoenoplectus lacustris ssp tabernaemontani	120	5
Typha latifolia	170	5
Scirpus maritimus	100	< 1
Nymphaea alba		5
Baldellia ranunculoides	80	< 1
Algae		10
Filamentous algae		10
Description: Fairly dense Phragmites dominated swamp with sparse cover of associated species and sparse surface mat of filamentous algae. 17m.		

Site: Lough Gill	Transect code: F	
Location: Barrier	Sample point: 4 Marginal	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	150	20
Agrostis stolonifera	30	75
Potentilla anserina	30	5
Juncus articulatus	70	5
Mentha aquatica	30	< 5
Filipendula ulmaria	130	< 5
Ranunculus acris	20	< 1
Caltha palustris	30	< 1
Angelica sylvestris	90	< 1
Heracleum sphondylium	100	< 1
Vicia cracca	80	< 1
Equisetum fluviatile	40	< 1
Description: Open Phragmites cover with dense Agrostis dominant amongst fen vegetation, 5m		
Grading to improved meadow with Trifolium repens, T. pratense, Bromus		
hordeaceus, c.100m.		
Grading to Ammophila arenaria - Festuca rubra dune grassland.		

7.3.4 Evaluation

'Potentially Valuable'

This large sandy site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared to most other sites. Six transects were carried out.

Ruppia maritima was found growing in fairly dense patches near the freshwater inflow, the outlet channel and the south east shore. It is extensive around the outlet, growing in dense beds to 50 metres out from the shore.

Potamogeton pectinatus was found at the same three transects at more or less sparse cover. Both species are seen to have a wide distribution across the site.

Locally abundant *Zannichellia palustris* grows with the last two species at the freshwater inflow and south eastern transect sites. *Myriophyllum spicatum* was found at three places in the western half of the lagoon.
Chara aspera var. *aspera* showed a wide distribution, occurring at the south western, south eastern and north central transect sites.

There is a notable diversity of marginal species and communities here. *Phragmites, Schoenoplectus* and *Scirpus maritimus* all occur in fairly extensive mixed and single species swamps. *Typha latifolia* occurs with *Phragmites* along the north shore and Iris psuedacorus is locally dominant on the south eastern shore. Freshwater *Phragmites* fen can be found in the south east and associated with the main freshwater inflow. *Rumex hydrolapathum* occurs in this community.

Lough Gill is representative of mildly brackish conditions. Aquatic species composition is interesting and distribution and abundance worthy of further study. Diversity of marginal communities is fairly high.

Full aquatic survey is recommended.

7.4 ECOTONAL COLEOPTERA

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7.4.1 Site Description

Large coastal brackish lake with road-bridge sluice (Trench Bridge) and inlet channel, and extensive sand dune barrier. Most of lake shore with sandy and organic-rich margins. Vegetation dominated by *Phragmites communis*, with algal mats developing in areas.

Subsites (Fig 7.4.1)

1. *Phragmites communis* (Q 614141)
Phragmites communis with grasses, *Mentha aquatica* etc., on organic soil between zone of *Phragmites* in standing water and *Iris pseudocorus* wet pasture zone. Near shore water salinity low (2‰ on 15 ix 96).

2. Sandy shore with algal mat (Q 605144)
c. 2m wide sandy beach uncovered by water with dried algal mat covering most of sand, and *Phragmites communis, Schoenoplectus lacustris, Typha* sp. and *Nymphaea alba* in water. Dune herb-rich grassland above c. 0.3 m cliff from beach. Hirundinea (leeches) common under mat.

7.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

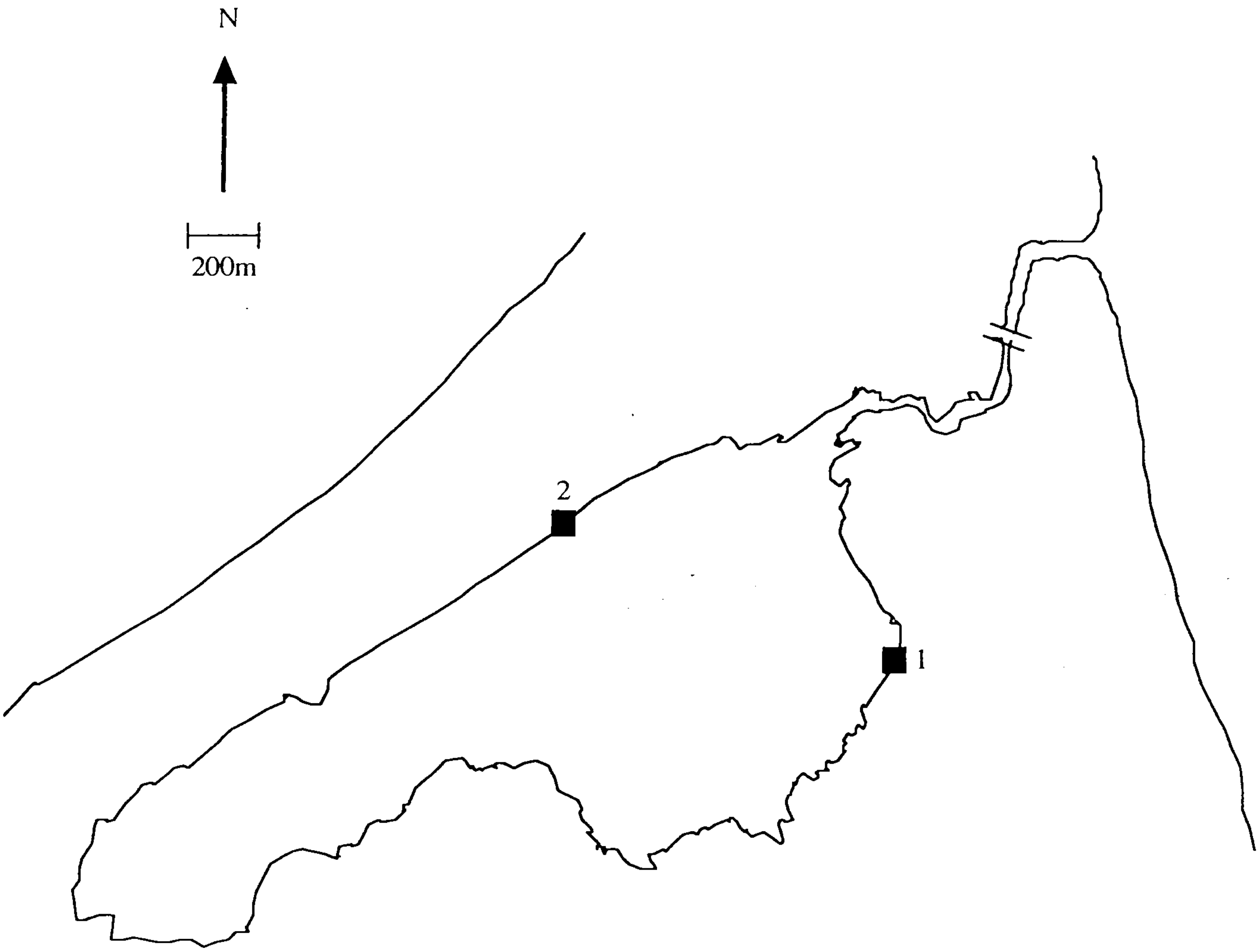

Fig. 7. 4. 1 Map of sampling sites (Carabidae and Staphylinidae) at Lough Gill, Co Kerry

1 - Pitfall traps, S-vac
2 - Pitfall traps, Ground search

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 7.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held

pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 7.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity.

That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References

Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Phragmites communis* area - S-vac suction sampler (15 ix 1996), c. 2 m^2;
(2) *Phragmites communis* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (15 ix - 12 x 1996);
(3) Sandy shore with algal mat - 6 pitfall traps (28 vii - 15 ix 1996);
(4) Sandy shore with algal mat - 1h ground search under algal mat (28 vii 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

7.4.3 Survey Results

Twenty one species of carabid and fifty-five species of staphylinid were recorded, two species of which are regarded as indicator species (Table 7.4.2).

Gabrius keysianus is a halobiont coastal shore species (Koch 1989), widespread but local in England and Wales (Hyman and Parsons 1994), and generally local and mostly rare in western Europe (Horion 1965). It has been previously recorded in Ireland (O'Mahony 1929).

Myllaena infuscata is generally local in Europe and occurs in marshy meadows, ditches, alder carr, etc. (Horion 1967), rather than on lake shores. While it can be regarded as stenotopic (e.g. Koch 1989), it could occur inland of Lough Gill, and is not likely to be dependant on shore habitats created by coastal processes. It has not therefore been selected as an indicator species.

Philonthus fumarius appears to be widespread but local in Ireland (Johnson and Halbert 1902, Lott and Bilton 1991) and Great Britain (Hyman and Parsons 1994). It is not rare in Central Europe, but rather rare eslewhere (Horion 1965). The species occurs in marshes including muddy and marshy freshwater shores, but is not recorded as halotolerant (Horion 1965, Koch 1989) and especially on coastal marshes (Hyman and Parsons 1994). It was also recorded during this survey from Kilkern Lake and Lough Tanaí.

TABLE 7.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Lough Gill. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), with the exception of Booth (1988) for *Tachyporus dispar*.

Species	No. individuals
Carabidae	
Agonum marginatum (L.)	2
Agonum muelleri (Hbst.)	1
Agonum pelidnum (Payk.)	5
Amara ovata (F.)	1
Bembidion lampros (Hbst)	2
Bembidion mannerheimi Sahlb.	46
Bembidion normannum Dej.	1
Bembidion tetracolum Say	3
Carabus granulatus L.	13

TABLE 7.4.2 (cont.)

	Demetrias atricapillus (L.)	7	
	Dromius linearis (Ol.)	1	
	Dyschirius globosus (Hbst.)	11	
	Dyschirius thoracicus (Rossi)	1	
	Harpalus rufipes (Geer)	29	
	Leistus terminatus (Hellw.)	1	
	Nebria brevicollis (F.)	16	
	Pterostichus melanarius (Ill.)	4	
	Pterostichus minor (Gyll.)	6	
	Pterostichus niger (Schall.)	43	
	Pterostichus nigrita (Payk.)	65	
	Trichocellus placidus (Gyll.)	1	

Staphylinidae

	Acrotona aterrima (Grav.)	1	
	Aloconota gregaria (Er.)	1	
	Amischa analis (Grav.)	1	
	Anotylus rugosus (F.)	13	
	Atheta amplicollis (Muls. Rey)	28	
	Atheta clientula (Er.)	7	
	Atheta elongatula (Grav.)	7	
	Atheta fungi (Grav.)	16	
	Atheta graminicola (Grav.)	3	
	Atheta luteipes (Er.)	1	
	Atheta orbata (Er.)	3	
	Atheta volans (Scriba)	1	
	Bledius gallicus (Grav.)	2	
	Carpelimus corticinus (Grav.)	17	
	Carpelimus elongatulus (Er.)	6	
	Carpelimus rivularis (Motsch.)	5	
	Cordalia obscura (Grav.)	16	
*	*Gabrius keysianus* Sharp	2	**Indicator species**
	Gabrius pennatus Sharp	4	
	Ischnopoda atra (Grav.)	3	
	Lathrobium brunnipes (F.)	2	
	Lathrobium geminum Kr.	1	
	Lathrobium quadratum (Payk.)	1	
	Lesteva sicula Er.	8	
	Mycetoporus splendidus (Grav.)	1	
	Myllaena dubia (Grav.)	7	
	Myllaena infuscata Kr.	4	
	Olophrum fuscum (Grav.)	8	
	Philonthus cognatus (Steph.)	3	
*	*Philonthus fumarius* (Grav.)	10	**Indicator species**
	Philonthus laminatus (Creutz.)	5	
	Philonthus micans (Grav.)	1	
	Philonthus quisquiliarius (Gyll.)	12	
	Quedius fuliginosus (Grav.) /*curtipennis* Bernh.	1	
	Rugilus erichsoni (Fauv.)	1	
	Sepedophilus nigripennis (Steph.)	1	
	Staphylinus dimidiaticornis Gemm.	1	
	Stenus bimaculatus Gyll.	11	
	Stenus brunnipes Steph.	1	
	Stenus cicindeloides (Schall.)	10	

TABLE 7.4.2 (cont.)

Stenus clavicornis (Scop.)	1
Stenus formicetorum Mannh.	3
Stenus fulvicornis Steph.	1
Stenus juno (Payk.)	8
Stenus melanopus (Marsh.)	1
Stenus nitidiusculus Steph.	2
Stenus pallitarsus Steph.	1
Stenus similis (Hbst.)	2
Tachinus signatus Grav.	2
Tachyporus dispar (Payk.)	7
Tachyporus obtusus (L.)	3
Tachyporus pallidus Sharp	1
Tachyporus pusillus Grav.	2
Tachyporus solutus Er.	2
Xantholinus longiventris Heer	4

7.4.4 Evaluation

Of average conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of two indicator species associated with coastal shores indicates average conservation interest.

7.4.5 References

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7.5 SUMMARY AND EVALUATION

Lough Gill is a large (160 ha.) **natural sedimentary lagoon** with a sand barrier and therefore of international importance based on the Habitats Directive.

The lake lies within a proposed NHA (Site Code 2070). It is a Wildfowl Sanctuary and an SPA for birds, although peak waterfowl counts have declined drastically since 1979. The dune area is of major importance as the main breeding site for the Natterjack Toad, *Bufo calamita.*

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	High
Aquatic Fauna	Moderate
Vegetation	Potentially High
Ecotonal Coleoptera	Average

Geomorphology.

The lake is a shallow natural lagoon "in a classical position" (Guilcher & King 1961) lying between two sand barriers which unite to form a tombolo connecting the mainland to a group of the Magharee Islands

On this basis it is rated as of High conservation value.

Aquatic Fauna

A total of 43 taxa and 35 species were recorded, but this list included only one species (*Lekanesphaera hookeri*) regarded as a lagoonal specialist.

Most of the beetles were taken in light traps and could have been attracted by the lights while flying. Some brackishwater species e.g. *Lekanesphaera hookeri* and *Pomatoschistus microps* were confined to the area near the mouth of the sea inlet while others e.g. *Clitellio arenarius* and *Neomysis integer* were more widely distributed.

The fauna is rich and diverse, comprising both freshwater and brackishwater elements. Hemiptera (6 spp.) and Coleoptera (11 spp.) were especially abundant and diverse. The faunal assemblage typifies a system which is essentially freshwater but which receives small incursions of seawater. All of the hemipterans and beetles are freshwater species. The long, sluiced inlet and weir apparently prevent crabs and prawns entering the lake but juvenile flounder and mullet were able to find their way in during 1996.

Cercyon sternalis is a new record for Ireland. This and four other beetles were not recorded at any other site during the survey.

The aquatic fauna appears to be diverse and includes one rare species but is typically freshwater. A significant brackish element is present but only one lagoonal specialist was recorded. As a result of this, based on the invertebrate fauna Lough Gill is rated only as of moderate conservation value as a coastal lagoon.

Vegetation

This large sandy site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared to most other sites.

Ruppia maritima was found growing in fairly dense patches near the freshwater inflow, the outlet channel and the south east shore. It is extensive around the outlet, growing in dense beds to 50 metres out from the shore. *Potamogeton pectinatus* was found at the same three transects at more or less sparse cover. Both species are seen to have a wide distribution across the site. Locally abundant *Zannichellia palustris* grows with the last two species at the freshwater inflow and south eastern transect sites. *Myriophyllum spicatum* was found at three places in the western half of the lagoon. *Chara aspera* var. *aspera* showed a wide distribution, occurring at the south western, south eastern and north central transect sites.

There is a notable diversity of marginal species and communities here. *Phragmites*, *Schoenoplectus* and *Scirpus maritimus* all occur in fairly extensive mixed and single species swamps. *Typha latifolia* occurs with *Phragmites* along the north shore and *Iris psuedacorus* is locally dominant on the south eastern shore. Freshwater *Phragmites* fen can be found in the south east and associated with the main freshwater inflow. *Rumex hydrolapathum* occurs in this community.

Lough Gill is representative of mildly brackish conditions. Aquatic species composition is interesting and distribution and abundance worthy of further study. Diversity of marginal communities is fairly high.

As a full aquatic survey was not possible Lough Gill is only rated as "potentially valuable". A full aquatic survey is recommended.

Ecotonal Coleoptera

Twenty one species of carabid and fifty-five species of staphylinid were recorded, two species of which are regarded as indicator species

Gabrius keysianus is a halobiont coastal shore species, widespread but local in England and Wales and generally local and mostly rare in western Europe. It has been previously recorded in Ireland (O'Mahony 1929).

Myllaena infuscata is generally local in Europe and occurs in marshy meadows, ditches, alder carr, etc., rather than on lake shores. While it can be regarded as stenotopic it could occur inland of Lough Gill, and is not likely to be dependent on shore habitats created by coastal processes. It has not therefore been selected as an indicator species.

Philonthus fumarius appears to be widespread but local in Ireland and Great Britain. It is not rare in Central Europe, but rather rare eslewhere. The species occurs in marshes including muddy and marshy freshwater shores, but is not recorded as halotolerant and especially on coastal marshes. It was also recorded during this survey from Kilkeran Lake and Lough Tanaí.

The presence of two indicator species associated with coastal shores indicates average conservation interest. Lough Gill is therefore rated as of average conservation value for terrestrial ecotonal community.

Summary

The lake is an important trout fishery and of great concern to the local inhabitants as a local resource to encourage tourism.Recent algal blooms, presumably resulting from eutrophication have caused fish kills, and an apparent decline in waterfowl numbers.

Geomorphologically it is a classic example of a lagoon lying between two sedimentary barriers. However, the predominance of freshwater species among the aquatic fauna and the localised occurrence of the single lagoonal specialist near to the sea inlet, casts some doubt upon the acceptance of the lake as a true lagoon based on the fauna alone. Its conservation value as a coastal lagoon depends entirely on management. If seawater was allowed to enter on a regular basis the lake would merit more protection as a classic brackish lagoon
The lake is a good example of a low salinity lagoon where a few brackishwater species coexist with a predominantly freshwater fauna and flora.

In conclusion, despite the paucity of lagoonal fauna and inconclusive evidence based on vegetation, Lough Gill is rated of high conservation value mainly due to geomorphology.

Designation as a proposed SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

8. CLOONCONEEN POOL

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Geoff Oliver
Pat Hatch
Jervis Good

February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

8. CLOONCONEEN POOL

CONTENTS

8. CLOONCONEEN POOL, Co. Clare.

OS Grid Reference: Q 836 497, 1:50,000 Sheet No. 63

Alternative names: Rinevella Bay, Kilkredaun Pool (The pool is un-named on the 6" map.)

8.1 STUDY AREA

General features

Clooncconeen Pool is the name we have given to a partially cut peat bog which has become flooded by seawater. This pool lies on the north shore of the mouth of the Shannon estuary, just west of Kilcredaun Point, 2 km southwest of Carrigaholt (Fig. 8.1.1. A cobble barrier lies between the pool and the beach which is over-topped during spring tides. Seepage areas can be seen along the landward side of the barrier. Clooncconeen can be regarded as an unusual type of lagoon formed in peat. The barrier itself is transgressive and the peat exposed on the seaward side of the barrier has been eroded to reveal a drowned forest of pine, some 4,000 years old. Mitchell (1990) describes this as the finest example of "submerged forest' that he knows. Further offshore is another barrier of rock extending from both sides of the bay with an opening in the middle, which possibly represents the position of a former complete barrier, enclosing a larger lagoon. Plate 8.2.5 shows this outer rock barrier and the sea breaking over the inner cobble barrier (Plate 8.2.6) during a storm in September 1996.

The lagoon is small, and very little is known about it, except that the area to the east is an area for wildlife under the REP scheme. The lagoon and cobble barrier, together with the drowned forest, is of great geomorphological interest.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6.5°C in January and 15.5°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 10.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1100 mm, and the number of rain days (1 mm or more) is 175-200. Prevailing winds are from the west. Mean annual hourly wind speeds are about 5.6 m/s and a maximum wind speed of 49 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Carrigaholt is 4.9 m (Admiralty Tide Tables).

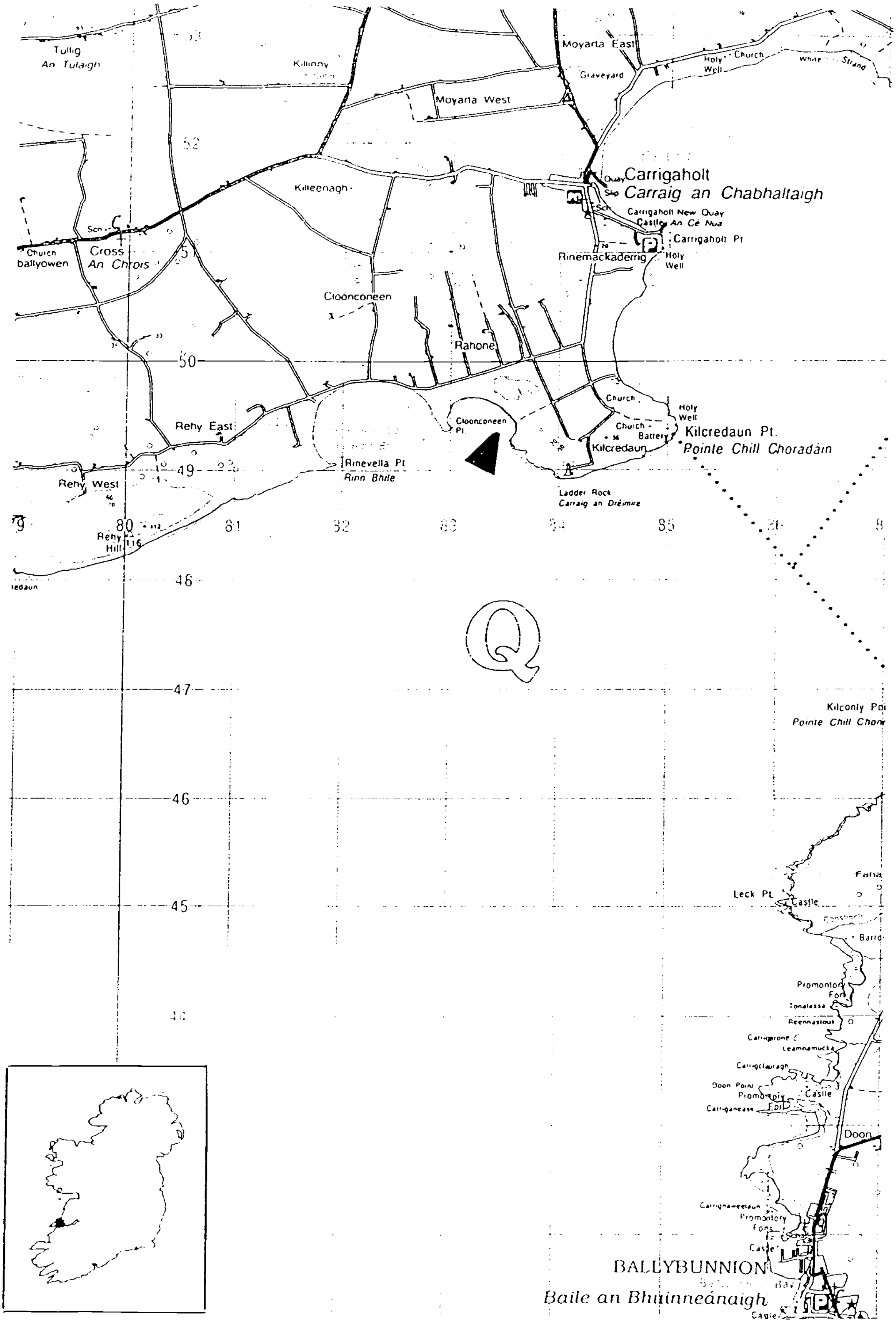

Fig. 8.1.1 Section of 1:50 000 map showing locality of Clooncoreen Pool

Cloonconeen Pool

Landscape and Geology The lagoon lies in a small flat valley between areas of higher land to the east and west. The valley is comprised mostly of peat which has been partially cut. The whole valley is subject to winter flooding from the sea, and is crossed by numerous drainage ditches, the largest of which runs from the lagoon, under the road, to empty into the bay to the east near Carrigaholt. According to local information, the peat in the area to the east of the road was cut during the last generation and this is partly the cause of serious flooding. Bedrock is described as Namurian Carboniferous (R.I.A. 1979)

Lake Topography The lagoon is approximately 200 m x 300 m and total area is 4-5 ha during the dry periods but considerably more when flooded. The lake is very shallow and appears to have a fairly uniform depth of about 80 cm over most of its area. The substrate is mostly unconsolidated peat with stones occurring along the edge of the barrier and in washover fans.

Hydrology No large streams enter the lake but there are several small drainage ditches, especially in the western part of the lake. Undoubtedly there are groundwater discharges to the lake through the peat, but very little is known about the water balance or ecology of coastal lagoons formed in peat. Seawater enters by percolation through the barrier, apparently on most high tides, and overtopping of the barrier appears to occur regularly on higher tides.

There is no daily tidal fluctuation in water level of the lake, but it is assumed that levels rise during each spring tide, and during storms. A seasonal pattern is likely, whereby water levels rise in the winter with the increased rainfall, and gradually decline to sometimes very low levels in the summer.

Salinity and water quality Seawater at approximately 34 ‰ enters the lagoon and mixes with fresh groundwater discharges and direct rainfall but we have no historical details of salinity levels.

The valley is heavily grazed by cattle and the lagoon appears to be nutrient-rich, with dense growths of filamentous algae and soft organic substrate, but no precise details are available.

8.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

8.2.1 Methods

Environmental variables

A transverse profile of the barrier was drawn using heights measured with a builders level and staff. Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰ precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and D in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons

between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level.

8.2.2 Results

Clooncaneen Pool was sampled on 6.vii.96 during the first part of the survey, and from 9 to 10.viii.96 during the more intensive survey.

Four sampling stations were selected in the lagoon to reflect the influences of substrate, vegetation and freshwater/seawater. Fig. 8.2.1 shows the location of the sample stations.

Environmental variables

Fig. 8.2.2 shows a profile of the barrier.

Station A (OS 8362 4966) was located at the southern corner of the lagoon where the barrier is lowest and over-topping is frequent. In this area water depth varied from 0 cm to 1 m, substrate was a mixture of cobbles, gravel and coarse sand, and salinity measured 34‰. (Plate 8.2.2)

Station B (OS 8351 4976) was located in the northwest corner of the lagoon, between the barrier and a small island. A drainage channel enters the lagoon at this point and substrate was mostly fine silts and sand mixed with unconsolidated peat, depth varied from 0 - 40 cm and salinity measured 30‰.

Station C (OS 8382 4974) was located in the eastern corner of the lagoon, closest to the road (Plate 8.2.1). Substrate consisted of soft unconsolidated peat and fine silt, depth varied from 0-50 cm, and salinity measured 32‰.

Station D (OS 8373 4981) was located in the northeastern corner of the lagoon, depth varied from 0-50 cm, substrate consisted of soft, unconsolidated peat, and salinity measured 32‰.

Salinity at all sampling stations during this study period was only slightly lower than that of seawater, but small isolated pools within 20 m of the lagoon registered salinities between 10 and 20‰.

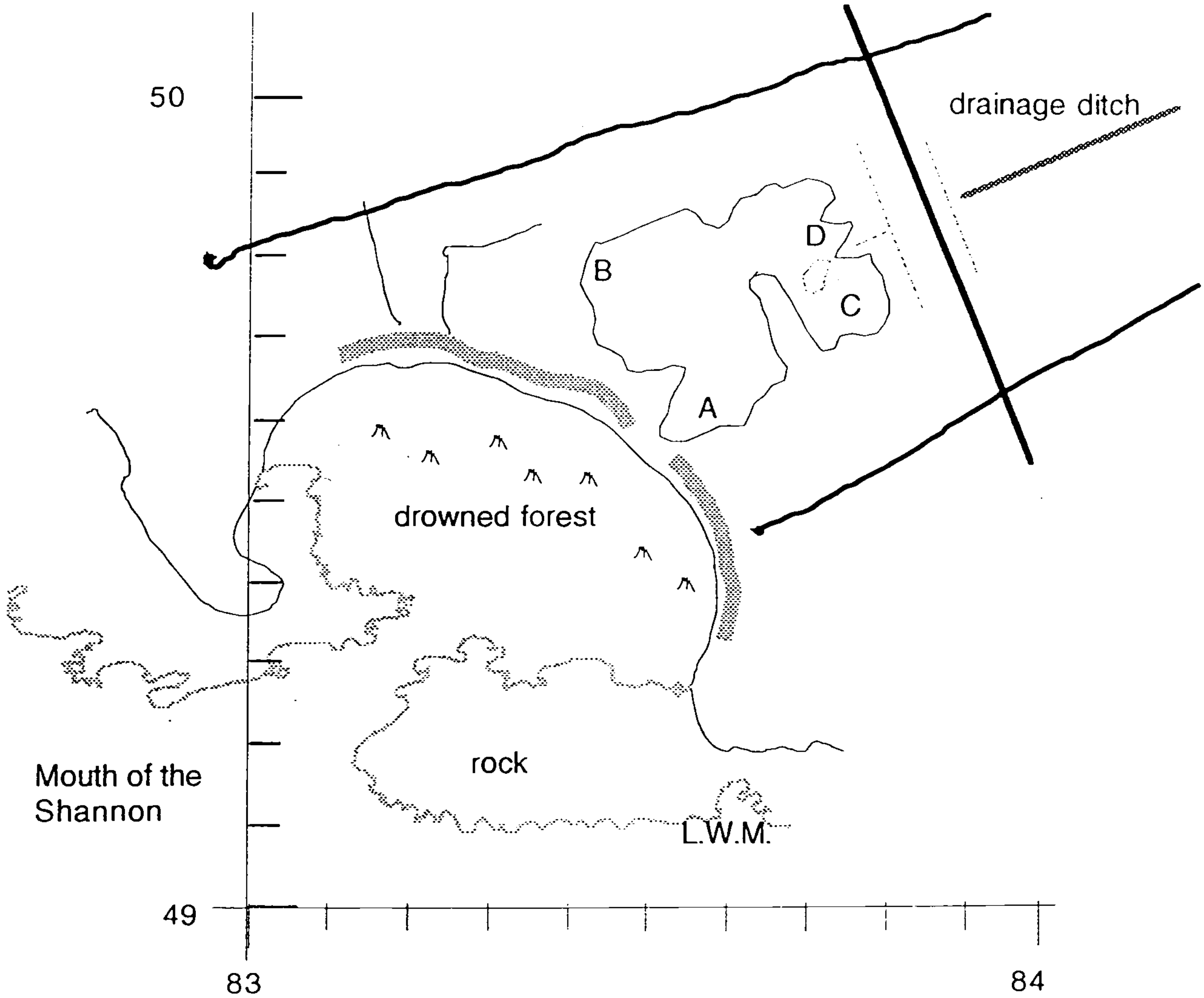

Fig. 8.2.1 Location Map of Sampling Stations in Clooncaneen Pool, Co. Clare.

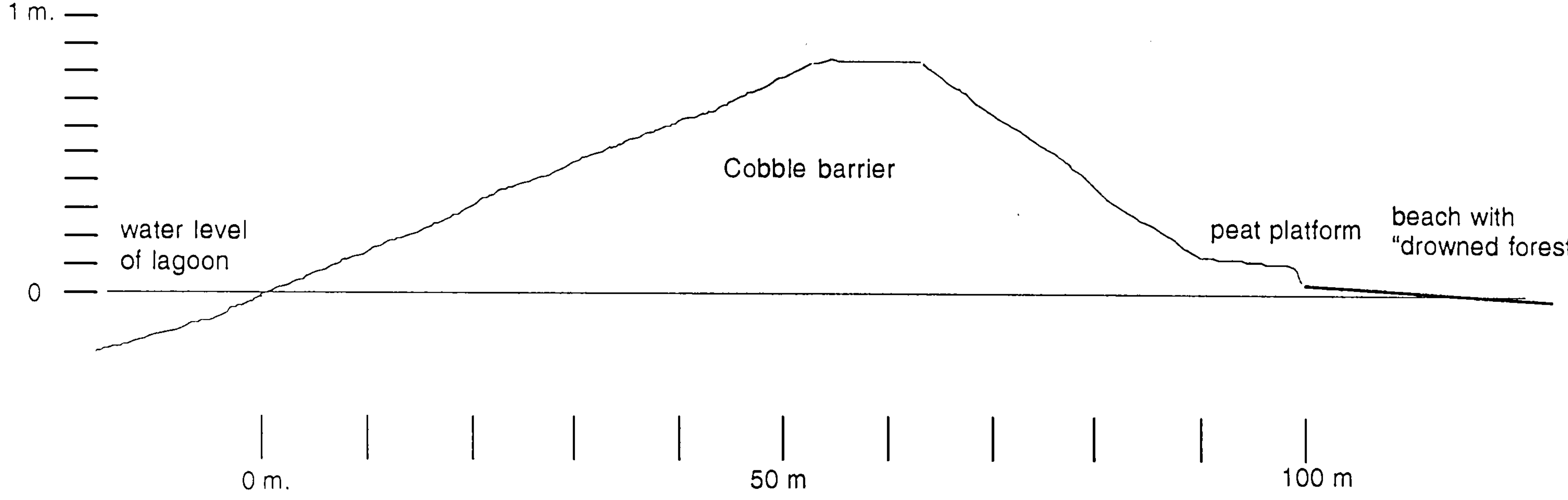

Fig. 8.2.2 Profile of Barrier at Cloonconeen Pool, Co. Clare.

Table 8.2.1. Fauna Recorded in Cloonconeen Pool. July and August 1996.

		Sampling Stations (L.T. = light-trap)							
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D
Porifera									
Cnidaria									
Turbellaria									
Nemertea									
Annelida									
Crustacea									
Ostracoda									
Copepoda									
Cirripedia									
Mysidacea									
Isopoda	*Lekanesphaera hookeri*	a	50	a	50	a	150	a	120
	Jaera nordmanni	+							
Amphipoda	*Gammarus locusta*	+						+	
	Orchestia gammarella			+					
Tanaidacea									
Decapoda	*Carcinus maenas*	+		+					
	Palaemonetes varians	a	55	a	200	a	110	a	56
Arachnida									
Insecta									
Hemiptera	Corixidae	a	150	o	2	a	50	a	40
	Sigara stagnalis	a	a	+	+	a	+	a	+
Coleoptera	*Enochrus bicolor*	+		+		+		+	
Odonata									
Plecoptera									
Trichoptera									
Ephemeroptera									
Diptera	Chironomidae	+				+		+	
Mollusca									
Prosobranchia	Hydrobiidae	a				c		+	
	Hydrobia ulvae	10							
	Hydrobia ventrosa	1				+			
Pulmonata									
Opisthobranchia									
Bivalvia	*Cerastoderma glaucum*	a		shells		c		a	
Bryozoa									
Echinodermata									
Tunicata									
Teleostei	*Anguilla anguilla*	F.						F.	
	Gasterosteus aculeatus	a	24	a	43	a	56	c	16

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Clooncaneen Pool

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 8.2.1. Among 14 taxa listed, 13 are identified to species. The list (excluding marginal species) comprises 2 marine species, 2 poly-mesohaline, 7 euryhaline, and one oligo-mesohaline; no limnic species was recorded (Table 8.2.2). Six of the species are listed as a lagoonal specialists in Britain (Davidson *et al.* (1991).

Salinity and substrate were similar throughout the pool and most species were recorded at all stations. However, *Jaera ?nordmanni* (females only and therefore not positively identified) and *Gammarus locusta*, which live mainly under stones, were only present at station A where cobbles from the barrier were present. Only eels and sticklebacks were taken in fyke nets.

A noteworthy feature of the pool was the abundance of juvenile *Cerastoderma glaucum* Adults were searched for but none was found and shells were rare.

Table 8.2.2 Ecological categories of the recorded taxa in Clooncaneen Pool. L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Gammarus locusta*	
	Hydrobia ulvae	
Poly-mesohaline	*Hydrobia ventrosa*	L
	Cerastoderma glaucum	L
Euryhaline	*Jaera nordmanni*	
	Lekanesphaera hookeri	L
	Palaemonetes varians	L
	Carcinus maenas	
	Sigara stagnalis	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
Oligo-mesohaline	*Enochrus bicolor*	L
Limnic	None	

8.2.3 Discussion

The fauna was poor, reflecting the small size of the pool, the absence of emergent vegetation and hard substrates, and a soft substrate which may be unsuitable for most burrowing forms. The faunal assemblage typifies a lagoon without a tidal inlet which receives frequent influxes of seawater which maintain a high salinity, but also receives enough freshwater throughout the year for brackish conditions to persist. However, there may be periods when the salinity remains high for too long for some species and this may explain the absence of adult cockles. Nearly half of the species recorded are lagoonal specialists.

The abundance of the corixid *Sigara stagnalis* at such high salinity (nowhere in the main body of the pool was the salinity <30‰ on either sampling occasion), is thought to be unusual.

None of the recorded species can be described as rare in Ireland.

8.2.4 Threats

The area around the lake is grazed and the lagoon itself appears enriched.

The storm in September caused serious problems to the owner by flooding the area so badly that cattle were washed onto the beach. There must be a serious threat of drainage unless the area could be in a REP scheme. Attempts to prevent the sea entering would, however, be costly and unlikely to be attempted.

8.2.5 Evaluation

Cloonconeen Pool is **natural sedimentary lagoon** with a cobble barrier on peat and is therefore of international importance based purely on geomorphology.

Although small, and probably not originating entirely by natural processes, the pool is a true lagoon with a low cobble barrier which has not been modified by installation of a drainage pipe as is usually the case. It represents a type which may be unique to Ireland (and possibly Scotland) in that the substrate is composed almost entirely of peat which also underlies the barrier and extends onto the shore. The presence of an intertidal drowned forest, said to be the best coastal example in Ireland, makes this site of special historical interest.

The aquatic fauna is not diverse but is typical of a brackish lagoon with a high salinity, and includes a high proportion of lagoonal specialists.

The pool does not lie in or near a proposed NHA.

The pool and shoreline are worthy of conservation for their unusual geomorphology, the presence of the drowned forest, and the pool with its typical lagoonal fauna. Designation as a proposed SAC is recommended.

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Plate 8.2.1   View across eastern area of Cloonconeen Pool, Station C

Plate 8.2.2   View of seepage area in the barrier of Cloonconeen Pool, Station A

Plate 8.2.3 View of northwest area of Clooncconeen Pool, Station B

Plate 8.2.4 View of "drowned forest" on the beach at Clooncconeen Pool

Plate 8.2.5 View of outer rock barrier at Clooncóneen Pool, looking toward Kilcredaun Pt.

Plate 8.2.6 View of seawater overtopping the cobble barrier at Clooncóneen Pool, during a storm in September 1996.

8. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

8.3.1 Site Description (Fig. 8.3.1)

A low-lying area with flat grazed wet grassland to the north, south and east. A wetland area extends away to the west with fairly extensive Phragmites and Spartina stands lying between the coast and drier pastoral farmland to the north. This wetland is associated with the lagoon's main freshwater inflow, which flows in at its western end. The sea lies beyond the shingle barrier to the south west with the remnants of a 'drowned forest' on the shore below high water mark.

There are drainage channels to the north and east and some evidence of small-scale peat cutting to south and east where Ruppia and Scirpus maritimus occur in the resulting pools.

There are no extensive emergent stands. Scirpus forms a narrow fringe around much of the south and east shores and Phragmites occurs in one small area in the east and with saltmarsh species on the edge of the barrier.

Away from the stony barrier shore and the silty shore associated with the freshwater inflow the remaining shores are of peat. Low cliffs occur in places with shores of more shallow slope elsewhere.

8.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

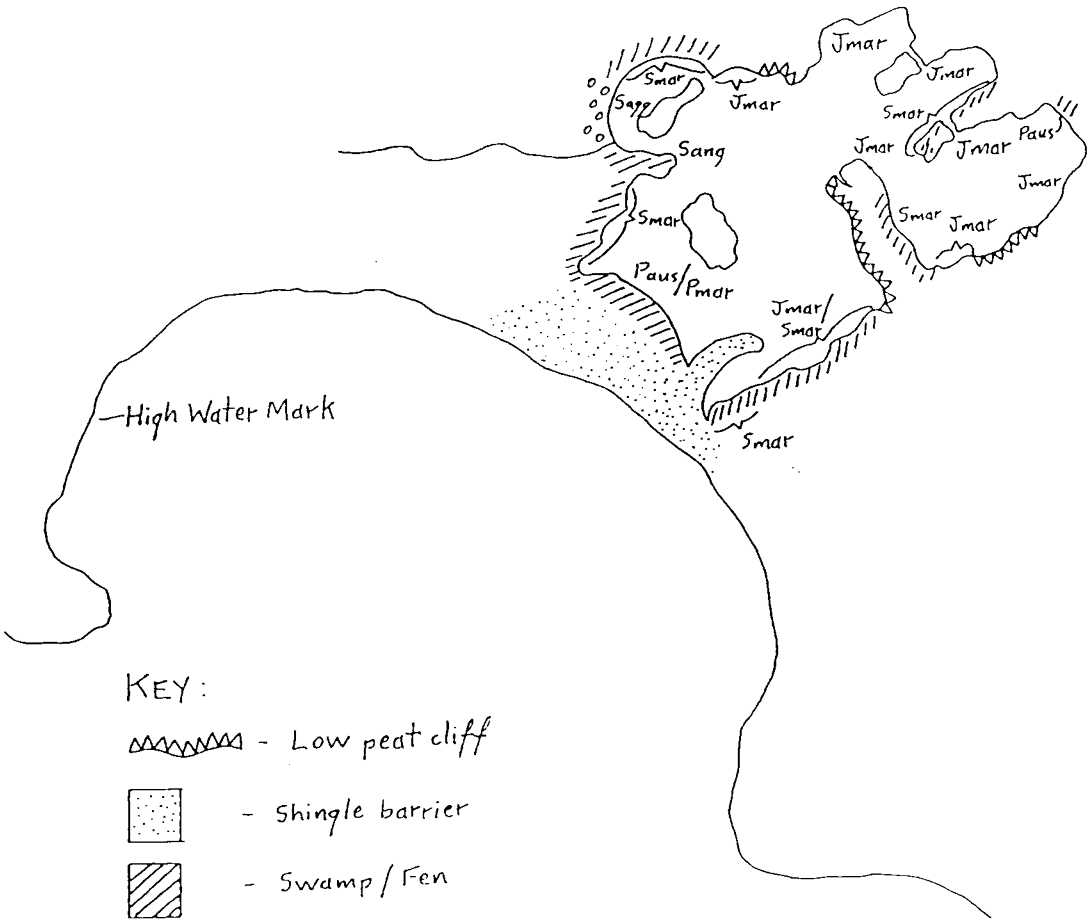
1. <u>Transects:</u>

The locality of these is shown in Fig. 8.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A

Fig. 8.3.1. Cloonconeen Pool, Co. Clare - Marginal Vegetation



KEY:

- Low peat cliff

- Shingle barrier

- Swamp / Fen

- Saltmarsh

Dominant species codes:

Paus - Phragmites australis
Smar - Scirpus maritimus
Jmar - Juncus maritimus
Sang - Spartina anglica
Sagg - Salicornia agg.
Pmar - Puccinellia maritima

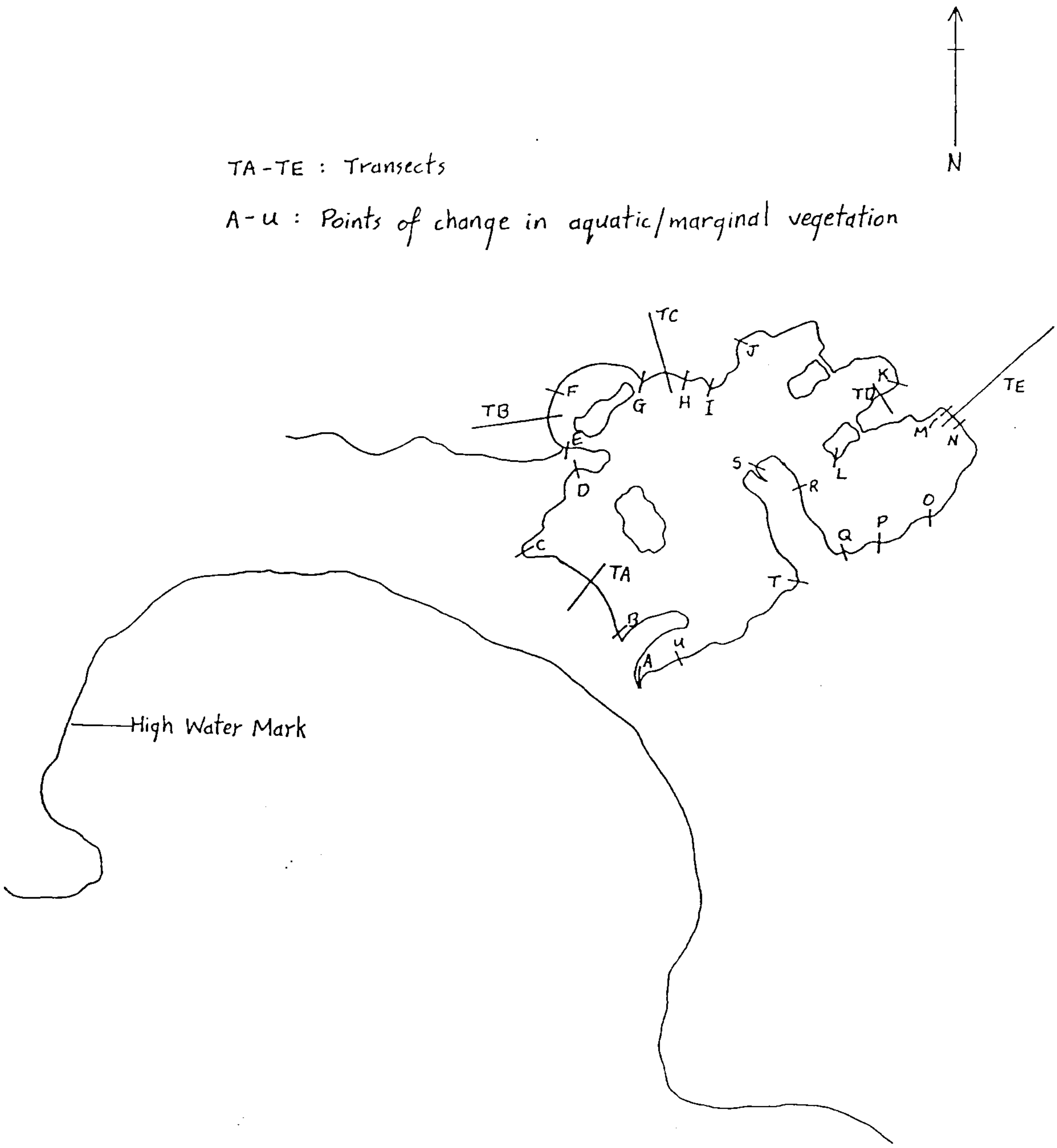


Fig. 8.3.2 Clooncóneen Pool, Co. Clare: Location of Transects and Shore-based Survey Sections

transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin .	10	91-100 %
	9	76-90 %
	8	51-75 %
	7	34-50 %

6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency V	81-100 %
IV	61-80 %
III	41-60 %
II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

8.3.3 Results

1. Shore-based survey

Section A-B

Aquatic: Ruppia maritima - sparse and low growing
Filamentous algae - sparse

Sand and gravel substrate

Marginal: Sparsely vegetated shingle barrier. Tripluerospermum maritimum and Atriplex hastata dominant

Adjacent: Shingle barrier

Section B-C (Transect A)

Aquatic: Ruppia maritima - cover unchanged
Filamentous algae - extensive surface layer to c.15m out

Peat substrate

Marginal: Open Phragmites cover with Puccinellia maritima dominant below over salt tolerant vegetation on peaty substrate. Juncus gerardii frequent. 5-12m

Adjacent: Unchanged

Clooncóneen Pool

Section C-D

Aquatic: Ruppia maritima - very sparse
Filamentous algae - sparse

Marginal: Scirpus maritimus strip. 1m
Backing to Puccinellia maritima dominated saltmarsh community. As B-C but
now with sparse Scirpus cover replacing Phragmites. 12-15m
Occasional small single species patches of Spartina along shore. Average area 4m2
Grading to Juncus gerardii - Festuca rubra saltmarsh community. c.150m

Adjacent: Spartina anglica dominated vegetation. c. 100m
Phragmites australis bed. c.100m

Section D-E

Aquatic: Unchanged

Marginal: Spartina anglica single species stand forming 2-4m strip along shore
Backing to Juncus gerardii - Festuca rubra saltmarsh community with frequent
Juncus maritimus tussocks as Transect B. c.150m

Adjacent: Unchanged

Section E-F (Transect B)

Aquatic: Filamentous algae - sparse

Silt substrate

Marginal: Salicornia on open mud shore with occasional Spartina stands of average area c.20m2. Salicornia sparse on lower shore, cover increasing to landward. 10-15m

Backing to Puccinellia maritima dominated saltmarsh with patchy Agrostis stolonifera and occasional Scirpus maritimus shoots. 10-15m
Grading to Juncus gerardii - Festuca rubra saltmarsh community with frequent
Juncus maritimus tussocks. c.100m

Adjacent: Embankment with Rubus fruticosus and Salix cinerea
Backing to public road
Backing to Lolium perenne pasture

Clooncooneen Pool

Section F-G

Aquatic: Unchanged

Marginal: Open muddy shore with sparse Scirpus maritimus and occasional Juncus maritimus tussocks and Spartina patches of c.6m2 maximum.
Scirpus and Spartina heavily grazed. 15-20m
Grading to Puccinellia saltmarsh as E-F. Heavily poached and grazed. 5-8m
Grading to Juncus gerardii - Festuca rubra community as E-F

Adjacent: Unchanged

Section G-H (Transect C)

Aquatic: Ruppia maritima - sparse and low growing
Filamentous algae - dense and extensive

Marginal: Open cover of Juncus maritimus tussocks with patchy Juncus gerardii and Agrostis stolonifera co-dominant below with salt tolerant associates. 3-4m
Grading to Juncus gerardii - Festuca rubra - Agrostis stolonifera dominated community. c.100m. Poached and grazed

Adjacent: Unchanged

Section H-I

Aquatic: Unchanged

Marginal: 1m peat cliff
Backing to Juncus gerardii - Festuca rubra - Agrostis stolonifera community as G-H.

Adjacent: Unchanged

Section I-J

Aquatic: Filamentous algae - dense and extensive

Marginal: Occasional short stretches of peat cliff of c.10m maximum extent
Otherwise as G-H

Adjacent: Unchanged

Clooncconeen Pool

Section J-K

Aquatic: Ruppia maritima - sparse, low growing
Filamentous algae - cover unchanged

Marginal: As G-H but with frequent Juncus maritimus tussocks over Juncus gerardii - Festuca rubra - Agrostis stolonifera community as Transect E

Adjacent: Unchanged

Section K-L (Transect D)

Aquatic: Unchanged

Marginal: Scirpus maritimus single species strip. 2m
Grading to open Scirpus cover with Juncus gerardii dominant below in species-poor salt tolerant vegetation. 12m

Grading to Section L-M

Section L-M

Aquatic: Ruppia maritima - dense extensive beds
Filamentous algae - sparse

Marginal: Juncus maritimus dominant with occasional patches of Scirpus maritimus, co-dominant in places. 4-5m

Grading to Section K-L

Section M-N (Transect E)

Aquatic: Unchanged

Peat substrate

Marginal: Open Phragmites swamp with sparse Ruppia maritima. 3-5m
Backing to dense cover of Juncus maritimus with frequent Phragmites shoots over species-poor salt tolerant vegetation. 4-5m
Grading to Juncus gerardii - Festuca rubra - Agrostis stolonifera saltmarsh community with open cover of Juncus maritimus. c.60m

Adjacent: Public road

Cloonconeen Pool

Section N-O

Aquatic: Unchanged

Marginal: As L-M
Grading to Juncus gerardii - Festuca rubra - Agrostis stolonifera community as
Transect C. c.100m

Adjacent: Lolium perenne pasture

Section O-P

Aquatic: Unchanged

Marginal: 1-1.5m peat cliff
Backing to Juncus gerardii - Festuca rubra - Agrostis stolonifera community as
Transect C. c.100m

Adjacent: Unchanged

Section P-Q

Aquatic: Unchanged

Marginal: Dense Juncus maritimus forming 1m strip
Grading as O-P

Adjacent: Unchanged

Section Q-R

Aquatic: Ruppia maritima - Unchanged

Marginal: Scirpus maritimus single species stand forming 1-2m strip
Grading as O-P

Adjacent: Unchanged

Section R-S

Aquatic: Ruppia maritima - sparse
Filamentous algae - extensive

Marginal: As P-Q

Adjacent: Unchanged

Clooncoeen Pool

Section S-T

Aquatic: Unchanged

Marginal: As O-P

Adjacent: Unchanged

Section T-U

Aquatic: Unchanged

Marginal: Juncus maritimus and Scirpus maritimus each locally dominant in 1-2m strip along shore. Occasional short stretches of 1-1.5m peat cliff
Grading as O-P

Adjacent: Unchanged

Section U-A

Aquatic: Unchanged

Marginal: Scirpus maritimus dominant with species-poor salt tolerant understorey. 1-6m
Grading as O-P

Adjacent: Unchanged

2. Transects

Site: Clooncoeen Pool	Transect code: A	
Location: Barrier	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Peat	
Depth: 15 cm	Salinity: 36 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		< 1
Ruppia maritima	20	< 1
Algae		100
Filamentous algae		100
Description: Very sparse Ruppia amongst dense free-floating algal mat.		

Clonconeen Pool

Site: Clooncaneen Pool	Transect code: A	
Location: Barrier	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Atriplex hastata sub-community - Puccinellia maritima variant		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	80	30
Puccinellia maritima	20	90
Juncus gerardii	25	20
Salicornia agg.	20	5
Atriplex hastata	30	< 5
Aster tripolium	30	< 1
Spergularia marina	15	< 1
Triglochin maritima	10	< 1
Cochlearia anglica	15	< 1
Glaux maritima	10	< 1
Plantago maritima	15	< 1
Atriplex patula	20	< 1
Description: Open low growing Phragmites cover with saltmarsh community below.		
Dense cover of dominant Puccinellia with patchy Juncus gerardii and tall, sparse salt tolerant		
associates. 12m.		
Backing shingle barrier (gravel, cobbles, boulders) with very sparse vegetation.		
Tripleurospermum maritimum and Atriplex hastata most frequent with rare Glaucium flavum.		

Site: Clooncaneen Pool	Transect code: B	
Location: Spartina and Salicornia stands	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 10 cm	Salinity: 35 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		20
Filamentous algae		20
Description: Patchy cover of free-floating filamentous algae only.		

Cloonconeen Pool

Site: Cloonconeen Pool	Transect code: B	
Location: Spartina and Salicornia stands	Sample point: 2 Marginal	
Sample area: 30m2 (10x3)	Substrate: Silt	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Spartina anglica		100
Description: Dense single species stand of Spartina. 3m		

Site: Cloonconeen Pool	Transect code: B	
Location: Spartina and Salicornia stands	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Mud	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		25
Salicornia agg.	10	25
Spartina anglica	15	< 1
Description: Open cover of dominant Salicornia with rare low growing Spartina shoots. 12m.		
Salicornia cover varying from < 1% on lower shore to c.70% on upper shore.		

Clooconeen Pool

Site: Clooconeen Pool	Transect code: B	
Location: Spartina and Salicornia stands	Sample point: 4 Marginal	
Sample area: 16m2 (4x4)	Substrate: Mud	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Puccinellia maritima	10	80
Agrostis stolonifera	10	25
Aster tripolium	35	10
Atriplex hastata	20	5
Cochlearia anglica	10	< 5
Scirpus maritimus	40	< 1
Salicornia agg.	15	< 1
Juncus gerardii	30	< 1
Triglochin maritima	15	< 1
Spergularia marina	20	< 1
Description: Dense cover of dominant Puccinellia with sparse, fairly tall growing salt tolerant		
species. Agrostis stolonifera patchy and very locally co-dominant. 10m.		

Site: Clooconeen Pool	Transect code: B	
Location: Spartina and Salicornia stands	Sample point: 5 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	80	25
Festuca rubra	20	75
Juncus gerardii	25	25
Agrostis stolonifera	15	10
Potentilla anserina	8	10
Aster tripolium	30	< 5
Leontodon autumnalis	20	< 1
Triglochin maritima	15	< 1
Plantago maritima	10	< 1
Cochlearia anglica	6	< 1
Atriplex hastata	10	< 1
Description: Open cover of Juncus maritimus tussocks. Festuca rubra dominant below with		
Juncus gerardii very locally co-dominant, Agrostis stolonifera and Potentilla anserina patchy.		
Other species sparse. c.200m.		

Cloonconeen Pool

Site: Cloonconeen Pool	Transect code: C	
Location: Marginal Juncus maritimus	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 30 cm	Salinity: 35 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		< 1
Ruppia maritima	20	< 1
Algae		100
Filamentous algae		100
Description: Very sparse Ruppia amongst dense free-floating filamentous algae. Older parts of Ruppia plants coated by algae. Some plants in flower.		

Site: Cloonconeen Pool	Transect code: C	
Location: Marginal Juncus maritimus	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Juncus maritimus	80	30
Juncus gerardii	15	40
Agrostis stolonifera	8	20
Aster tripolium	15	5
Triglochin maritima	15	< 5
Glaux maritima	6	< 5
Spergularia marina	5	< 5
Atriplex hastata	20	< 1
Cochlearia anglica	5	< 1
Puccinellia maritima	10	< 1
Scirpus maritimus	30	< 1
Plantago maritima	15	< 1
Salicornia agg.	6	< 1
Description: Open cover of Juncus maritimus tussocks with salt tolerant vegetation dominated by patchy cover of Juncus gerardii with Agrostis stolonifera locally co-dominant. All other species sparse. Lightly poached, grazed. 4m strip along shore. Backing low peat bank (slope c.80 degrees, average height 50cm).		

Cloonconeen Pool

Site: Cloonconeen Pool	Transect code: C	
Location: Marginal Juncus maritimus	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Festuca rubra	15	75
Agrostis stolonifera	10	60
Juncus gerardii	15	20
Trifolium repens	4	5
Potentilla anserina	3	5
Glaux maritima	4	< 5
Triglochin maritima	10	< 1
Plantago maritima	10	< 1
Aster tripolium	10	< 1
Leontodon autumnalis	6	< 1
Cochlearia anglica	5	< 1
Atriplex hastata	10	< 1
Description: Festuca rubra and Agrostis stolonifera co-dominant with patchy Juncus gerardii		
very locally so. Associated salt tolerant species more or less sparse and low growing.		
Grazed. 100m.		
Backing 45 degree bank to c.2m height with Rubus fruticosus and Salix cinerea.		
Backing public road.		

Clonconeen Pool

Site: Coonconeen	Transect code: D	
Location: Scirpus swamp - sheltered bay	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 40 cm	Salinity: 33 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		< 1
Ruppia maritima	30	< 1
Algae		100
Filamentous algae		100
Description: Sparse Ruppia amongst dense cover of free-floating filamentous algae.		

Site: Cloonconeen Pool	Transect code: D	
Location: Scirpus swamp - sheltered bay	Sample point: 2 Marginal	
Sample area: 20m2 (10x2)	Substrate: Silt	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		75
Scirpus maritimus	80	75
Description: Fairly dense Scirpus maritimus single species swamp. 2m.		

Cloonconeen Pool

Site: Cloonconeen Pool	Transect code: D	
Location: Scirpus swamp - sheltered bay	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		85
Scirpus maritimus	60	30
Juncus maritimus	80	5
Juncus gerardii	40	40
Aster tripolium	40	20
Atriplex hastata	30	< 1
Cochlearia anglica	10	< 1
Description: Patchy cover of Juncus gerardii and low growing Scirpus, each locally dominant over a few tall salt tolerant associates. Occasional Juncus maritimus tussocks forming very open cover. Small bare patches of water-logged substrate. 12m.		

Site: Cloonconeen Pool	Transect code: E	
Location: Phragmites swamp & isolated pool	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Peat	
Depth: 20 cm	Salinity: 34 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		70
Ruppia maritima	40	70
Algae		100
Filamentous algae		100
Description: Substrate covere by filamentous algae with abundant Ruppia growing through to the surface. Many Ruppia plants in flower and fruit.		

Clooncoheen Pool

Site: Clooncoheen Pool	Transect code: E	
Location: Phragmites swamp & isolated pool	Sample point: 2 Marginal	
Sample area: 30m2 (10x3 - whole stand)	Substrate: Peat	
Depth: 20 cm	Salinity: 30 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		5
Phragmites australis	70	5
Ruppia maritima	40	< 1
Algae		100
Filamentous algae		100
Description: Sparse low growing Phragmites with dense cover of submergent filamentous		
algae and sparse Ruppia growing through. Only the few tallest Phragmites shoots in flower.		
3m.		

Site: Clooncoheen Pool	Transect code: E	
Location: Phragmites swamp & isolated pool	Sample point: 3 Marginal	
Sample area: 40m2 (10x4 - whole stand)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	90	90
Phragmites australis	90	5
Aster tripolium	60	5
Glaux maritima	30	< 5
Atriplex hastata	40	< 5
Agrostis stolonifera	30	< 1
Plantago maritima	25	< 1
Cochlearia anglica	10	< 1
Description: Dense cover of Juncus maritimus tussocks with sparse salt tolerant species		
including low growing Phragmites shoots. 4m.		

Clooncooneen Pool

Site: Clooncooneen Pool	Transect code: E	
Location: Phragmites swamp & isolated pool	Sample point: 4 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	100	40
Festuca rubra	60	80
Agrostis stolonifera	40	5
Juncus gerardii	20	5
Potentilla anserina	30	5
Atriplex hastata	40	< 1
Glaux maritima	30	< 1
Aster tripolium	50	< 1
Cochlearia anglica	15	< 1
Plantago maritima	30	< 1
Description: Open cover of frequent Juncus maritimus tussocks with Festuca rubra dominant amongst tall growing salt tolerant species. Agrostis, Potentilla and Juncus gerardii all patchy in cover and very locally co-dominant. 12m.		

Site: Clooncooneen Pool	Transect code: E	
Location: Phragmites swamp & isolated pool	Sample point: 5 Marginal - Pool	
Sample area: 20m2 (10x2)	Substrate: Peat	
Depth: 0 - 30cm	Salinity: 15 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Atriplex hastata sub-community		
	Height (cm)	Cover (%)
Total Plant		95
Scirpus maritimus	130	90
Atriplex hastata	20	5
Description: Tall dense Scirpus maritimus swamp with sparse Atriplex the only associated species. 2m.		

Clooconeen Pool

Site: Clooconeen Pool	Transect code: E	
Location: Phragmites swamp & isolated pool	Sample point: 6 Marginal - Pool	
Sample area: 125m2 (25x5 - whole stand)	Substrate: Peat	
Depth: 30 cm	Salinity: 15 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		70
Ruppia maritima	40	70
Algae		100
Filamentous algae		100
Description: Dense extensive patches of Ruppia growing through filamentous algae in isolated		
pool 25x5m. Both flowering and fruiting Ruppia plants present.		
Backing 50cm peat cliff.		

Site: Clooconeen Pool	Transect code: E	
Location: Phragmites swamp & isolated pool	Sample point: 7 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		
Juncus maritimus	90	5
Festuca rubra	20	50
Agrostis stolonifera	20	40
Juncus gerardii	20	20
Potentilla anserina	15	5
Atriplex hastata	20	< 1
Glaux maritima	15	< 1
Aster tripolium	25	< 1
Leontodon autumnalis	20	< 1
Cochlearia anglica	6	< 1
Description: Sparse cover of Juncus maritimus tussocks. Festuca and Agrostis co-dominant		
below with patchy Juncus gerardii locally so. Associated salt tolerant species all more or less		
sparse. 50m.		
Backing to public road.		

8.3.4 Evaluation

'Not Valuable'

This is a small peaty lagoon of high salinity at time of survey (33 -36 parts per thousand).

Ruppia maritima was the only aquatic higher plant species. It is more or less sparse but frequent around most shores and forms fairly dense beds in the south eastern bay. It has a wide distribution, but is absent from the vicinity of the inflow channel.

Marginal communities and species show some diversity. Scirpus maritimus and Juncus maritimus are the dominant species around most shores, typically associated with a sparse
understorey of salt tolerant species and grading to Juncus gerardii - Festuca rubra saltmarsh.

Puccinellia maritima saltmarsh occurs at the western end, including one stand on the barrier shore with an open Phragmites cover. Spartina anglica is locally dominant on the north western shore and there is one small area of open Salicornia cover on a muddy shore in the same area.

Extensive stands of Phragmites and Spartina lie to the west of the site, associated with the inflow channel which joins the lagoon at its western end.

This seems to be a particularly species-poor lagoon.

Further survey is not recommended.

8.4 ECOTONAL COLEOPTERA

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Terrascope Environmental Consultancy, Riverstick, Co. Cork

8.4.1 Site Description

Small coastal lagoon formed by sea flooding partially cut peat bog, with percolation through, and spring tide overtopping of, shingle barrier on eroded peat shore with exposed c. 4000 year-old pine stumps (Plates 1-3). Salt-marsh vegetation on peat; water salinity c. 30 ‰.

Subsites (Fig. 8.4.1)

1. *Festuca rubra* (Q 834496) Plate 4
Approx. 1 ha salt-marsh vegetation (*Festuca rubra*, *Juncus* spp, *Aster tripolium*, *Plantago maritima*, etc.) on peat (Plate 5), saturated at surface after spring tides. Ungrazed, with peat islands, but main area separated from surrounding grazed vegetation and cattle pasture by channels. Includes occasional peat cuttings isolated from the lagoon margin with c. 1m high cliff walls, flooded at spring tide.

2. Overtopping inlet (Q 835495) Plate 6
Small (c. 250 m^2) tongue of cobbles and coarse sand behind barrier with extensive algal growth near water margin, and surface deposits of seaweed debris.

3. *Phragmites* (Q 835495)
Small area (c. 0.1 ha) behind barrier with moderately sparse regenerating *Phragmites communis* with *Festuca rubra, Aster tripolium, Salicornia* sp, etc., on peat, ungrazed.

8.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

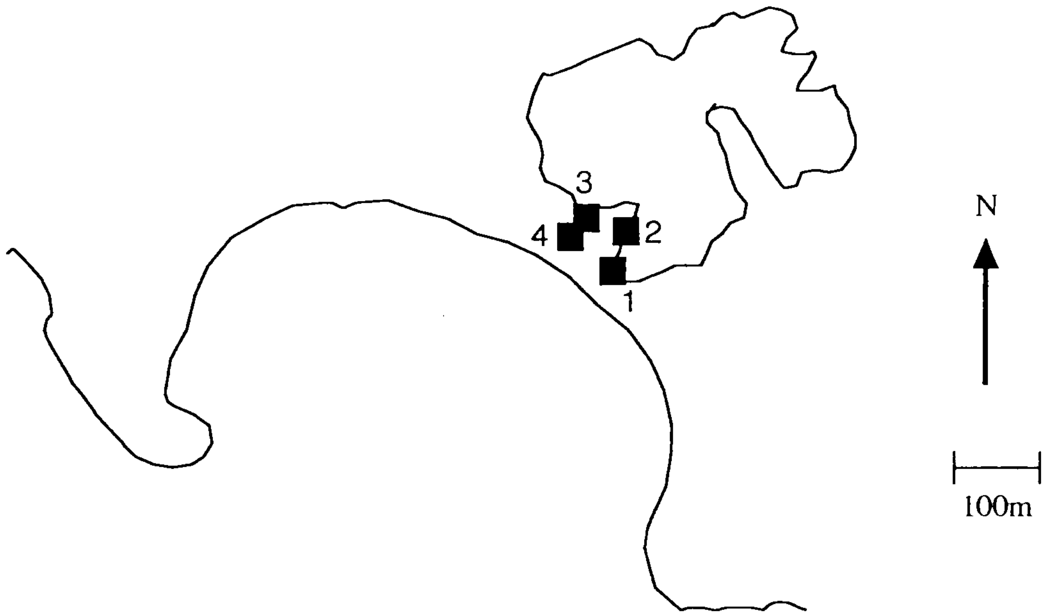

Fig. 8.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Cloonconeen Pool, Co. Clare.

1 - Pitfall traps, Cobble search
2 - Ground search
3 - Pitfall traps, S-vac
4 - Flotation

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Clooncoeen Pool

Sampling Techniques

The sampling methods used are listed in Table 8.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 8.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling

The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification

Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

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Cloonconeen Pool

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Festuca rubra* area - S-vac suction sampler (4 ix 1996), c. 2 m^2;
(2) *Festuca rubra* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (4 - 21 ix 1996);
(3) Flotation sampling of peat cliffs of peat cutting (24 subsamples of 5 x 5 x 10 cm, 21 vii 1996);
(4) Overtopping inlet - cobble search (30 cobbles, 21 vii 1996);
(5) *Phragmites* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (4 - 21 ix 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

8.4.3 Results

Five species of carabid and five species of staphylinid were recorded, two species of which are regarded as indicator species (Table 8.4.2).

TABLE 8.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Cloonconeen Pool. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

	Species	No. individuals	
Carabidae			
*	*Bembidion aeneum* Germ.	2	**Indicator species**
	Bembidion assimile Gyll.	1	
	Bembidion minimum (F.)	3	
	Bembidion varium (Ol.)	5	
	Pterostichus niger (Schall.)	1	
Staphylinidae			
*	*Brundinia meridionalis* (Muls. Rey)	22	**Indicator species**
	Ocypus ater (Grav.)	7	
	Philonthus marginatus (Ström)	2	
	Polystomota grisea (Kr.)	1	
	Stenus canaliculatus Gyll.	3	

Clooonconeen Pool

Bembidion aeneum is a stenotopic halobiont species, occurring in the salt spray zone above the upper shore and near brackish pools (Koch 1989). Although it is not listed as rare or notable in Great Britain (Hyman and Parsons 1992), and is listed as Irish without annotation by Speight *et al.* (1982), it is local in Britain and Ireland according to Lindroth (1974).

Brundinia meridionalis occurred in all samples, and was the most abundant species recorded. It has not been previously recorded from Ireland. Although it is not listed in Hyman and Parsons (1994) as rare or notable in Great Britain, it appears to be rare or local in many parts of Europe (Porta 1926, Palm 1970, Benick & Lohse 1974, Mahler 1987, Koch 1989). *B. meridionalis* is a halophilous species, recorded from tidal refuse and silty soils on the coast and also on inland saline soils in Austria and other countries (Steel 1970, Koch 1989). Tidally undisturbed lagoons with stagnant water are favoured by this species - relatively large populations were recorded on organic-rich soils with dense algal growth at three lagoons in this survey (also at Bridge Lough and Lough Murree), but not at other sites.

Although the staphylinid assemblage recorded from the *Festuca rubra* area had low numbers of species, most of these were halophilous or occur in sea shore habitats (Table 8.4.3). Of the five carabid species (Table 1), three *Bembidion* are halophilous, and another (*Bembidion assimile*) is stenotopic, occurring in marshy shores and flooded meadows (Koch 1989).

TABLE 8.4.3. Staphylinid assemblage from *Festuca rubra* area, Clooncooneen Pool (S-vac suction sample and pitfall traps combined). Abund. Cat. refers to category of relative abundance (no. individuals: 1, 2-10, 11+).

Abund. Cat.	Species	No.	Main biotope
Dominant	*Brundinia meridionalis*	22	Halophilous, coastal
Intermediate	*Ocypus ater*	7	Eurytopic, incl. sea shores
	Philonthus marginatus	2	Grassland (cattle dung)
	Stenus canaliculatus	3	Eurytopic, incl. muddy sea shores
Present	*Polystomota grisea*	1	Halobiont

8.4.4 Evaluation

Of <u>average</u> conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of two indicator species indicates conservation value, especially when the following are also considered: (1) the majority of the non-indicator species are halophilous or breed in sea-shore habitats; (2) regularly salt-saturated peat is a difficult habitat for terrestrial soil insects, so few non-specialised species would be expected to occur; (3) the site is small and, unlike other peat sites in this survey, is not connected to peatland, but to marine littoral and pasture biotopes, so peatland species are likely to be infrequent. This indicates that the site is an ecologically well-developed example of isolated salt-inundated peat, and its conservation value depends on whether such sites are threatened in Ireland. The upper zone of isolated peat in tidal salt-marsh may provide different physico-chemical soil conditions, because of regular tidal cycles.

8.4.5 References

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Plate 1 Shingle barrier at Clooncooneen Pool, Co. Clare

Plate 2 Eroded peat shore at Clooncooneen Pool, Co. Clare

Plate 3 Exposed old pine stumps at Cloonconeen Pool, Co. Clare

Plate 4 Subsite 1 - *Festucarubra* area at Cloonconeen Pool, Co. Clare

Plate 5 Salt marsh vegetation on peat at Clooncoreen Pool, Co. Clare

Plate 6 Subsite 2 - overtopping inlet at Clooncoreen Pool, Co. Clare

8.5 SUMMARY AND EVALUATION

Cloonconeen Pool is small (4-5 ha.) but is a **natural sedimentary lagoon** with a cobble barrier on peat and is therefore of international importance based on the Habitats Directive.

Very little is known about this lagoon and it does not lie in or near a proposed NHA.

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	Exceptional
Aquatic Fauna	High
Vegetation	No Value
Ecotonal Coleoptera	Average

Geomorphology.

Although small, and probably originating partly from peat-cutting, the pool is a true lagoon with a low cobble barrier which has not been modified by installation of a drainage pipe as is usually the case.

The cobble barrier is over-topped during spring tides and seepage areas can be seen along the landward side of the barrier. Cloonconeen can be regarded as an unusual type of lagoon formed in peat. The barrier itself is transgressive and the peat exposed on the seaward side of the barrier has been eroded to reveal a drowned forest of pine, some 4,000 years old which Mitchell (1990) describes as the finest example of coastal "submerged forest' that he knows.

It represents a type which may be unique to Ireland (and possibly Scotland) in that the substrate is composed almost entirely of peat which also underlies the barrier and extends onto the shore.

The lagoon and barrier, together with the drowned forest is regarded as of <u>exceptional</u> conservation value.

Aquatic Fauna

A total of 14 taxa was recorded: 13 are identified to species, of which six are listed as a lagoonal specialists in Britain (Lady's Island had only 8 lagoonal specialists and is 100 times larger !)

Cloonconeen Pool

Salinity and substrate were similar throughout the pool and most species were recorded at all stations. However, *Jaera ?nordmanni* (females only and therefore not positively identified) and *Gammarus locusta*, which live mainly under stones, were only present at station A where cobbles from the barrier were present.

A noteworthy feature of the pool was the abundance of juvenile *Cerastoderma glaucum*. Adults were searched for but none was found and shells were rare.

The aquatic fauna is not diverse but is typical of a brackish lagoon with a high salinity, and includes a high proportion of lagoonal specialists.

The lagoon is rated as of high conservation value for the high number of lagoonal specialists in relation to the size of the pool.

Vegetation

Ruppia maritima was the only aquatic higher plant species. It is more or less sparse but frequent around most shores and forms fairly dense beds in the south eastern bay. It has a wide distribution, but is absent from the vicinity of the inflow channel.

Marginal communities and species show some diversity. *Scirpus maritimus* and *Juncus maritimus* are the dominant species around most shores, typically associated with a sparse understorey of salt tolerant species and grading to *Juncus gerardii* - *Festuca rubra* saltmarsh.

Puccinellia maritima saltmarsh occurs at the western end, including one stand on the barrier shore with an open *Phragmites* cover. *Spartina anglica* is locally dominant on the north western shore and there is one small area of open *Salicornia* cover on a muddy shore in the same area.

Extensive stands of *Phragmites* and *Spartina* lie to the west of the site, associated with the inflow channel which joins the lagoon at its western end.

This seems to be a particularly species-poor lagoon and rated as of no conservation value.

Further survey is not recommended.

Ecotonal Coleoptera

Five species of carabid and five species of staphylinid were recorded, two species of which are regarded as indicator species

Bembidion aeneum is a stenotopic halobiont species, occurring in the salt spray zone above the upper shore and near brackish pools. Although it is not listed as rare or notable in Great Britain, and is listed as Irish without annotation by Speight *et al.* (1982), it is local in Britain and Ireland according to Lindroth (1974).

Cloonconeen Pool

Brundinia meridionalis occurred in all samples, and was the most abundant species recorded. It has not been previously recorded from Ireland. Although it is not listed as rare or notable in Great Britain, it appears to be rare or local in many parts of Europe. This species is an halophilous species, recorded from tidal refuse and silty soils on the coast and also on inland saline soils in Austria and other countries. Tidally undisturbed lagoons with stagnant water are favoured by this species - relatively large populations were recorded on organic-rich soils with dense algal growth at three lagoons in this survey (also at Bridge Lough and Lough Murree), but not at other sites.

Although the staphylinid assemblage recorded from the *Festuca rubra* area had low numbers of species, most of these were halophilous or occur in sea shore habitats. Of the five carabid species, three *Bembidion* are halophilous, and another (*Bembidion assimile*) is stenotopic, occurring in marshy shores and flooded meadows.

The presence of two indicator species indicates conservation value, especially when the following are also considered: (1) the majority of the non-indicator species are halophilous or breed in sea-shore habitats; (2) regularly salt-saturated peat is a difficult habitat for terrestrial soil insects, so few non-specialised species would be expected to occur; (3) the site is small and, unlike other peat sites in this survey, is not connected to peatland, but to marine littoral and pasture biotopes, so peatland species are likely to be infrequent. This indicates that the site is an ecologically well-developed example of isolated salt-inundated peat, and its conservation value depends on whether such sites are threatened in Ireland. The upper zone of isolated peat in tidal salt-marsh may provide different physico-chemical soil conditions, because of regular tidal cycles.

As a result of the above, the site is rated as of average conservation value for terrestrial ecotonal community.

Summary

Very little is known about this lagoon. There appear to be no previous studies and very little disturbance to the site other than that caused by cattle-grazing.

The pool and shoreline are worthy of conservation for their unusual geomorphology, the presence of the drowned forest, the pool with its typical lagoonal fauna and the presence of a rare species of beetle, found in abundance.

In conclusion, although small, Cloonconeen is rated as of high conservation value based on geomorphology and fauna.

Designation as a proposed SAC is recommended

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

9. LOUGH DONNELL

Brenda Healy
Geoff Oliver
Pat Hatch
Jervis Good

February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

9. LOUGH DONNELL

CONTENTS

9. LOUGH DONNELL, Co. Clare.

OS Grid Reference: R 002 707, 1:50,000 Sheet No. 57
Alternative names: ?

9.1 Study Area

General features

Lough Donnell is situated on the Atlantic coast of County Clare, 4 km south of Quilty (Fig. 9.1.1). This shallow lagoon is impounded by an impressive cobble barrier, approximately 7 metres high and 40 metres wide. A small river, the Annageeragh River, enters the lagoon in the east and a pipe has been constructed through the barrier to prevent excessive flooding of the surrounding agricultural land.

The lagoon is an ASI and a proposed NHA (site code 01018) largely due to its ornithological value. No large numbers of wildfowl are recorded but it is mentioned by Sheppard (1993) as being of major interest for waders.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6.5°C in January and 15.5°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 10.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1100 mm, and the number of rain days (1 mm or more) is 175-200. Winds are mainly from the west and southwest. Mean annual hourly wind speeds are about 5.6 m/s and a maximum wind speed of 49 /s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Liscannor is 4.1 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology The lagoon lies on the flat coastal plain of Clare consisting mostly of glacial drift. Relief of the area is broken by small moraines and the entire stretch of coastline is bordered by cobble storm beaches, presumably derived from the glacial deposits. Solid geology is described as Namurian Carboniferous and soils are poorly drained and mostly acid brown earths and peat (R.I.A. 1979). A large area of *Phragmites* borders the eastern shore, surrounding land is mostly acid grassland used for cattle grazing.

Lake Topography The lagoon is approximately 600 m from north to south, 3-400 m across and has an approximate area of 20 ha. Most of the lake is very shallow and

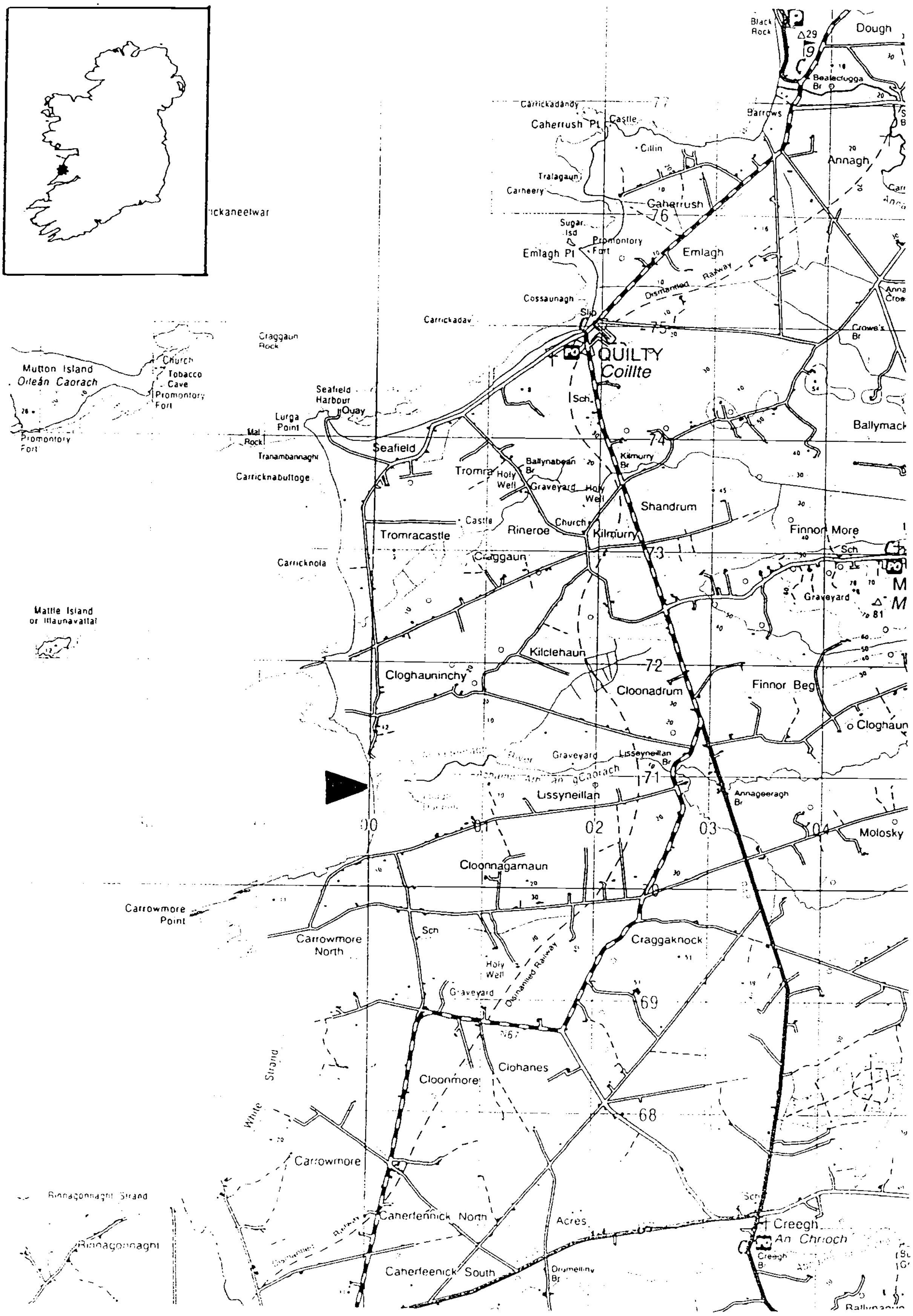

Fig. 9.1.1 Section of 1:50 000 map showing locality of Lough Donnell

the substrate is sand with very few stones, except along the edge of the barrier. Water depth is deeper in the channels which have been dredged through the reedbeds and in these areas the substrate contains more organic silt.

Hydrology A small river (Annageragh River) enters the lake in the east and a channel meanders across the lagoon to the outlet pipe (dated 1929) in the barrier. There is no sluice or attempt to control seawater entering the lagoon, but water levels in the lake appear to be high enough to prevent seawater entering on most tides.

There is no noticeable daily tidal fluctuation in water level of the lake, but a seasonal pattern is likely, whereby water levels rise in the winter with the increased rainfall, and gradually decline to sometimes very low levels in the summer.

Salinity and water quality No historical information concerning salinity or water quality is available. It seems likely that the lagoon is brackish throughout most of the year. Cattle graze the surrounding areas of the lake, but there are no obvious signs or apparent history of eutrophication within the lagoon.

9.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin.

9.2.1 Methods

Environmental variables

A transverse profile of the barrier was drawn using heights measured with a builders level and staff. Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰. precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988).. Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and B in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (eg *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

9.2.2 Results

Lough Donnell was sampled on 24.vi.96 during the first part of the survey, and from 8-9.viii.96 during the more intensive survey.

Five sampling stations were selected in the lake to reflect the influences of substrate, freshwater and tidal inflows. Positions of the sampling stations are shown in Fig. 9.2.1

Environmental Variables

Fig. 9.2.2 shows a profile of the barrier.

Station A (OS 0041 7092) was located at the northwest corner of the lagoon near the outlet pipe from the lagoon (Plates 9.2.3 & 6). In this area water depth varied from 0 cm to 1 m, substrate was mostly sand with occasional stones, and salinity measured 2-6‰.

Station B (OS 0441 7092) was located on the eastern shore where the River Annageera enters the lagoon through a dense bed of *Phragmites*. The channel of the river has been dredged and the sampling area was restricted to the margins of this channel where depth varied from 25 cm to 1 m. Substrate was largely soft organic silts, with no stones and salinity measured 3-4‰.

Station C (OS 0399 7068) was located in the southeastern corner of the lagoon, close to an area of *Scirpus* . Substrate consisted mostly of firm sand, depth varied from 25-50 cm, and salinity measured 3‰.

Station D (OS 0022 7065) was located in the open water area in the southwest corner of the lagoon, depth varied from 25-50 cm, substrate consisted of sand, and salinity measured 5‰.

Station E (OS 0056 7075) was located on the western shoreline of the lagoon against the barrier (Plate 9.2.4). Small seepage zones were observed on the lagoon side of the

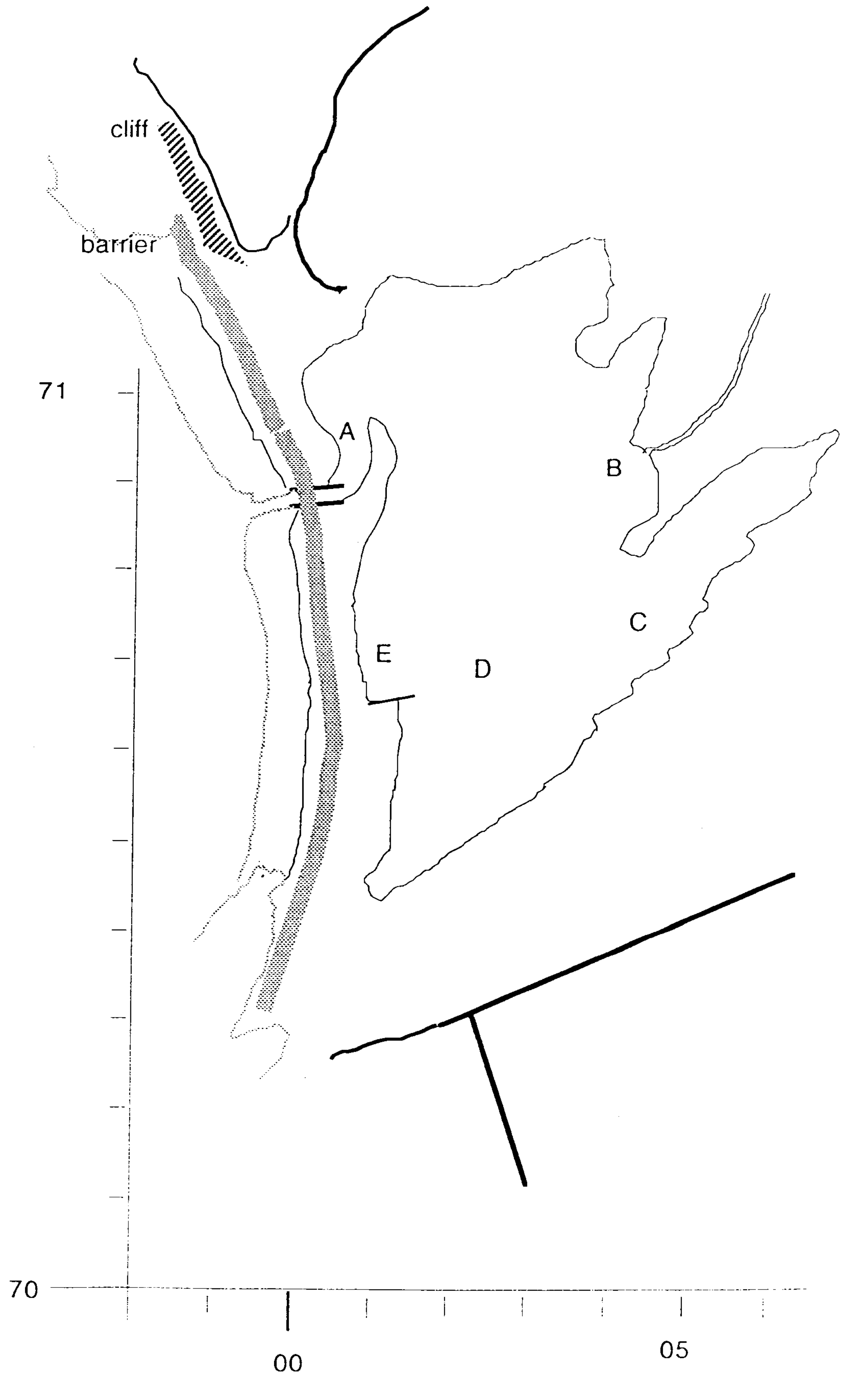

Fig. 9.2.1 Location Map of Sampling Stations in Lough Donnell, Co. Clare

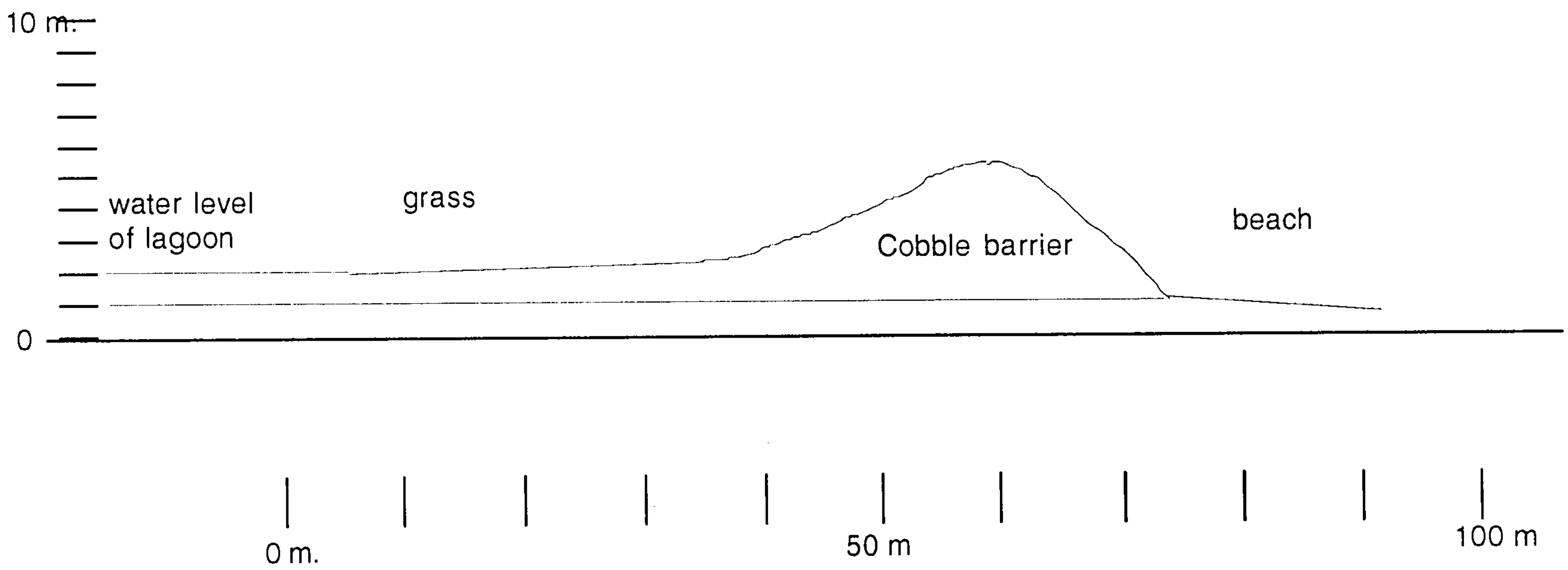

Figure 9.2.2. Profile of Barrier at Lough Donnell, Co. Clare.

Table 9.2.1 Fauna Recorded at Lough Donnell, Co. Clare. June and September, 1996.
( ) = records for June.

		Sampling Stations	(L.T. = light-trap)							
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E
Porifera										
Cnidaria										
Turbellaria										
Nemertea										
Annelida										
Crustacea										
Ostracoda										
Copepoda										
Cirripedia										
Mysidacea	*Neomysis integer*	+		c		c	c100	a	a	
Isopoda	*Ligia oceanica*	+								+
	Jaera nordmanni	+						+		
Amphipoda	*Gammarus duebeni*	+		+						+
	Orchestia gammarella									+
Tanaidacea										
Decapoda	*Carcinus maenas*	+		+						
	Crangon crangon	+		(+)						
	Palaemonetes varians	1								
Arachnida						+				
Insecta										
Thysanura										
Ephemeroptera										
Odonata	*Ischnura elegans*			o						
	sp. 2			1						
Plecoptera										
Trichoptera	(cases)	+		+						
Hemiptera	Corixidae	a	150	o	2	a	50	a	40	
	Sigara stagnalis	+		+		+		+		
	S. dorsalis			+						
	Notonecta viridis			o						
Coleoptera	*Dryops luridus*	+								
	**Gyrinus caspius*									
	Haliplus flavicollis							+		
	H. lineatocollis				+					
	H. ruficollis				+	+				
	H. wehnckei	+			+					
	Helophorus brevipalpis	+								
	Hygrotus inaequalis				+					
	Noterus clavicornis			+						
Diptera	Chironomidae	+		+		o		a		
	Culicidae	+	10							
	Ephydridae	+								
Mollusca										
Prosobranchia	Hydrobiidae	a		a		o		o		
	Potamopyrgus antipodarum	+		+		+		+		

+ = present; o = occasional; c = common; a = abundant; F = fyke net
* = Station not known

Table 9.2.1 cont.. Fauna Recorded at Lough Donnell, Co. Clare. June and September, 1996.
( ) = records for June.

		Sampling Stations (L.T. = light-trap)								
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E
Pulmonata										
Opisthobranchia										
Bivalvia										
Bryozoa										
Echinodermata										
Tunicata										
Teleostei	*Anguilla anguilla*			F, 4						
	Dicentrarchus labrax			F, 1						
	Gasterosteus aculeatus	+	5	+		+	15	o	7	
	Mugilidae	F, 1		F, 7						
	Platichthys flesus	F, 1		F, 6		+				
	Pomatoschistus microps	+	2	+		+	1	+	2	

+ = present; o = occasional; c = common; a = abundant; F = fyke net

barrier where salinities of up to 25‰. were recorded, but in the sample area itself salinity measured 5-6‰., substrate consisted of sand and cobbles, depth varied from 10-40 cm..

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 9.2.1. Among 32 taxa listed, 27 are identified to species. No attempt will be made to identify other groups. The list (excluding marginal species) comprises one marine species, 2 poly-mesohaline, 10 euryhaline, and 4 oligo-mesohaline, and 8 limnic species were recorded (Table 9.2.2). Two species (*Sigara stagnalis* and *Palaemonetes varians)* are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Differences between stations are mainly correlated with habitat as the salinity was similar at all stations. *Sigara dorsalis*, *Notonecta viridis*, *Ischnura elegans* and four of the Coleoptera were only taken at B at the edge of the reed beds, while *Jaera nordmanni* and *Ligia oceanica* were confined to the seaward shore where they were found under cobbles. *Crangon crangon*, and *Palaemonetes varians* were only found at A, near the main tidal stream. *Potamopyrgus antipodarum*, *Neomysis integer* and *Sigara stagnalis* were common throughout the lake. Chironomid larvae constituted the only fauna in the sediment.

Table 9.2.2 Ecological categories of the recorded taxa in Lough Donnell L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Dicentrarchus labrax*	
Poly-mesohaline	*Crangon crangon*	
	Mugilidae	
Euryhaline	*Neomysis integer*	
	Jaera nordmanni	
	Gammarus duebeni	
	Palaemonetes varians	L
	Carcinus maenas	
	Sigara stagnalis	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
	Platichthys flesus	
Oligo-mesohaline	*Gyrinus caspius*	
	Notonecta viridis	
	Ischnura elegans	
	Potamopyrgus antipodarum	
Limnic	*S. dorsalis*	
	Haliplus flavicolis	
	H. lineatocollis	
	H. ruficollis	
	H. wehnckei	
	Helophorus brevipalpis	
	Hygrotus inaequalis	
	Noterus clavicornis	

9.2.3 Discussion

The faunal assemblage reflects the predominance of freshwater over marine influence throughout the lake. Although seawater may enter on most tides, it is flushed out by the river water and no fucoids or marine fauna were established near the sea inlet. The fauna was moderately rich and typical of a lagoon with persistently low salinity but with an open inlet allowing some colonisation from the sea.

According to Southwood and Leston (1959), *Notonecta viridis* was only reported for Wexford and north Kerry. It has since been recorded at Lady's Island L. by Healy *et al.* (1982) and Galvin (1992) and at the North Slob by Galvin (1992). It was found at Lady's Island L., Tacumshin L., Kilkeran L. and at the North Slob during this survey. The record for L. Donnell is thus the most northerly for Ireland.

Dryops luridus and *Haliplus flavicollis* were not recorded at any other site during the survey.

9.2.4 Threats

According to local information there are problems of disturbance to waterfowl caused by shooting.

Any problems caused by eutrophication are likely to be small due to the regular flushing of the lagoon either by fresh- or seawater.

There are no other apparent threats.

9.2.5 Evaluation

Lough Donnell is a **natural sedimentary lagoon** impounded by an impressive cobble barrier through which seawater percolates and it is therefore of international importance based on geomorphology.

There is an unsluiced artificial outlet pipe through which seawater enters.

The aquatic faunal assemblage is typical of a system with persistently low salinity. It is moderately diverse but no species of special interest were found.

The lagoon is of fairly high ornithological interest for wildfowl and waders. A small colony of sand martins (*Riparia riparia*) breed in the low cliffs to the north of the lake.

The lake is a proposed NHA (Site Code No. 1018).

In conclusion, Lough Donnell is of relatively low conservation value based on its invertebrate fauna. It is of higher value ornithologically and perhaps for commercially valuable fish species. Its highest conservation value is based on the geomorphological and scenic value of the lagoonal barrier and for these reasons its designation as a proposed SAC is recommended.

9.2.6 References and Additional Sources of Information

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Plate 9.2.1 View along seaward side the barrier of Lough Donnell

Plate 9.2.2 View looking south along the barrier of Lough Donnell, showing the outlet pipe.

Plate 9.2.3 View of outlet pipe through barrier of Lough Donnell.

Plate 9.2.4 View of the western shore of Lough Donnell, Station E.

Plate 9.2.5 View of seepage area and saltmarsh in Lough Donnell

Plate 9.2.6 View looking south across Lough Donnell, Station A (foreground).

9. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

9.3.1 Site Description (Fig. 9.3.1)

This is a shallow sandy lagoon set in a fairly low-lying landscape. Land to the north, south and south east is used for pasture. The shingle barrier lies to the west, through which a pipe connects the lagoon with the sea.

The valley of the River Annageeragh, at the end of which the lagoon lies, comes in from the east and discharges its waters into the lough. There is no other freshwater inflow stream.

Swamp vegetation occurs all around the eastern and southern shores, being fairly extensive in the east where it grades to fen and rush pasture, which extends some way back up the river valley. The north shore and the western, stony barrier shore are open in contrast. Shore slope is generally gradual except for short stretches of very low sandy cliff in the north east.

9.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

1. <u>Transects:</u>

The locality of these is shown in Fig. 9.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

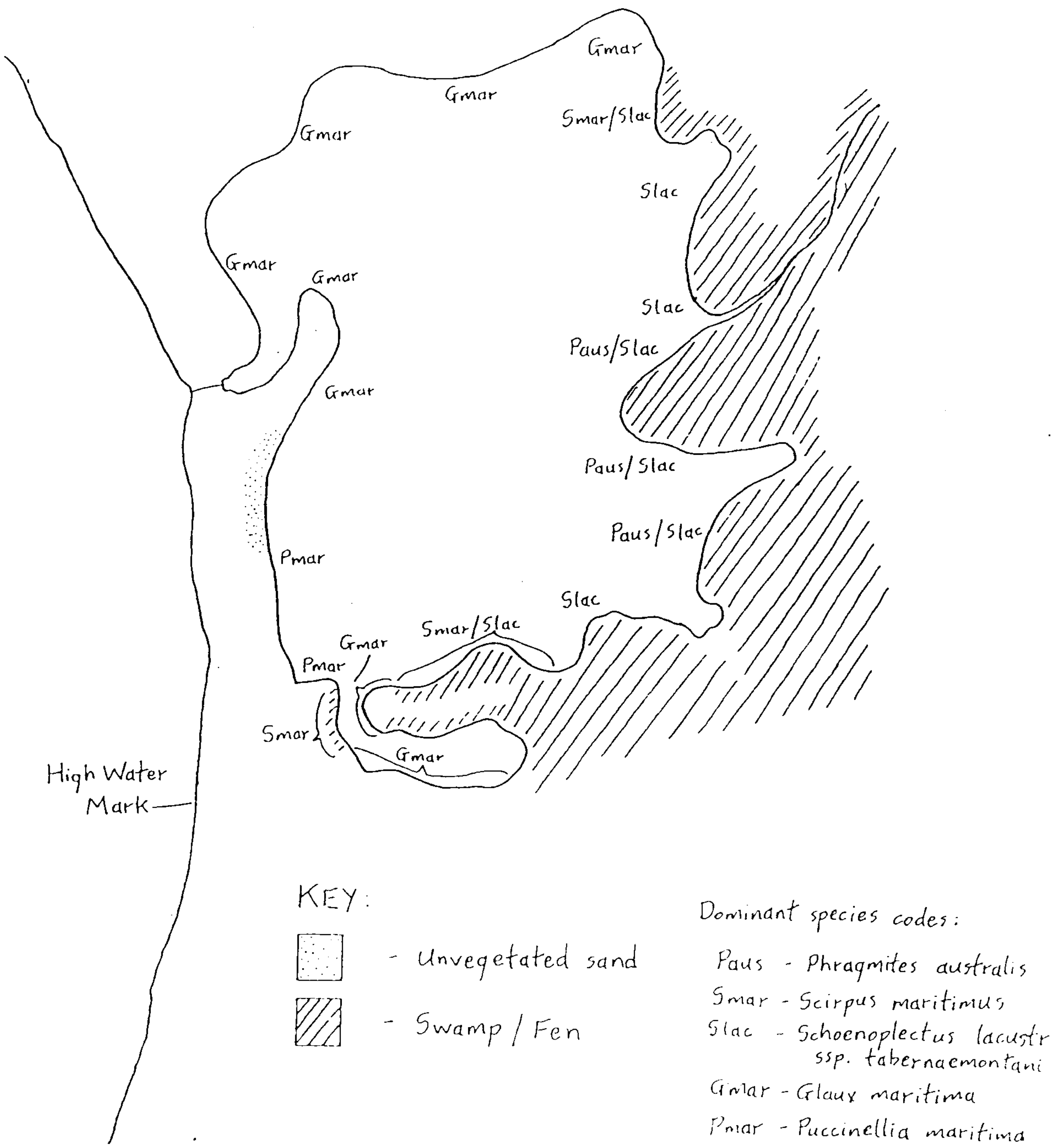

Fig. 9.3.1 Lough Donnell, Co. Clare - Marginal Vegetation

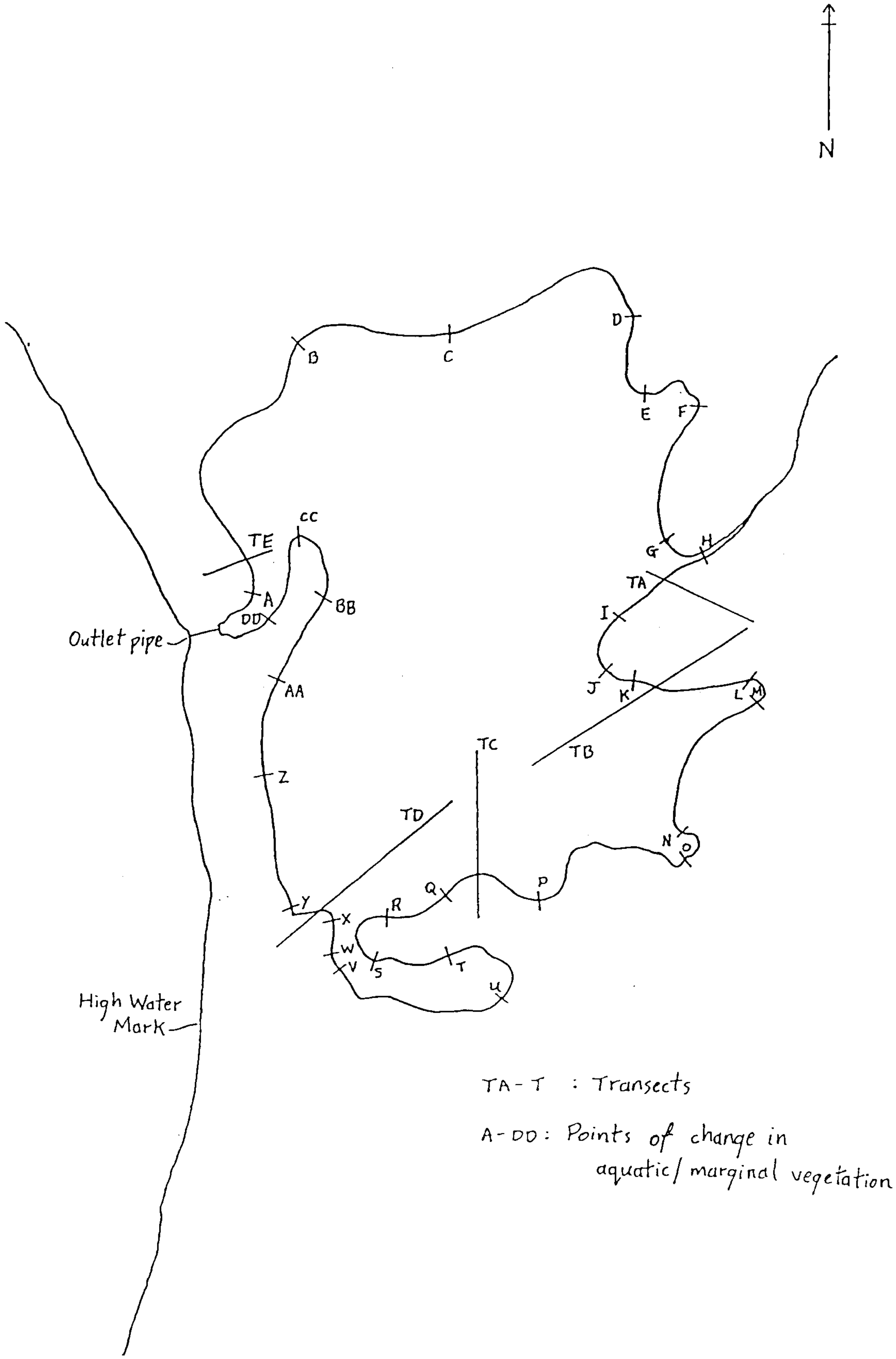

Fig. 9.3.2 Lough Donnell, Co.Clare: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

<u>Cover/Abundance Values</u>
Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency V	81-100 %
IV	61-80 %
III	41-60 %
II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

9.3.3 Results

1. Shore-based survey

Section A-B (Transect D)

Aquatic: Enteromorpha - patchy

Sand substrate with occasional cobbles

Marginal: Sparse cover of Glaux maritima, Spergularia marina and Triglochin maritima.

1-2m strip

Adjacent: Festuca rubra - Trifolium repens grassland

Section B-C

Aquatic: Unchanged

Marginal: Unchanged

Adjacent: Lolium perenne - Cynosaurus cristatus - Agrostis stolonifera pasture

Section C-D

Aquatic: Ruppia maritima - occasional small low growing patches - maximum 2m2
Enteromorpha - sparse

Marginal: Unchanged

Adjacent: Unchanged

Section D-E

Aquatic: Unchanged

Marginal: Schoenoplectus lacustris ssp tabernaemontani single species swamp. 4-8m
Backing to Schoenoplectus - Scirpus maritimus co-dominant stand. 2-8m. Grazed
Backing to 50cm sandy cliff

Adjacent: Unchanged

Section E-F

Aquatic: Unchanged

Marginal: Scirpus maritimus single species swamp. 6-12m. Sparse Ruppia to 2m in
Grading to Scirpus - Schoenoplectus co-dominant stand. 2-7m
Backing to Agrostis stolonifera - Eleocharis uniglumis dominated community as Transect C. 1m
Backing to 30-60cm sandy cliff

Adjacent: Unchanged

Section F-G

Aquatic: Ruppia maritima - very sparse - no longer in patches
Enteromorpha - sparse

Marginal: Schoenoplectus lacustris ssp tabernaemontani single species swamp. 3-10m
Backing to 30-50cm sandy cliff

Adjacent: Unchanged

Section G-H

Aquatic: No aquatic vegetation

Silt substrate

Marginal: Schoenoplectus single species swamp. 15m
Backing to Agrostis stolonifera - Eleocharis uniglumis community as Transect C. 8-15m

Adjacent: Unchanged

Section H-I (Transect A)

Aquatic: Unchanged

Marginal: Phragmites australis dominated swamp with abundant Schoenoplectus. 8-10m
Grading to dense Phragmites with sparse understorey of salt tolerant - species. 2m
Grading to dense Phragmites fen with sparse understorey of freshwater species. c.100m

Adjacent: Juncus effusus - Agrostis stolonifera dominated wet grassland

Section I-J

Aquatic: Ruppia maritima - frequent low growing patches - maximum 2m2

Silt and sand substrate with occasional cobbles

Marginal: Schoenoplectus single species swamp. c.8m
Grading to Phragmites single species swamp. c.10m
Grading to Phragmites fen community as H-I

Adjacent: Unchanged

Section J-K

Aquatic: Unchanged

Marginal: As H-I

Adjacent: Unchanged

Section K-L (Transect B)

Aquatic: Ruppia maritima - fairly extensive, low growing
Enteromorpha - >50m out only

Marginal: Schoenoplectus single species swamp. c.20m. Occasional pools with sparse Ruppia maritima
Grading to open Schoenoplectus cover with abundant Phragmites shoots and salt-tolerant understorey. 8-10m
Grading to dense Phragmites with freshwater fen vegetation. c.100m

Adjacent: Unchanged

Section L-M

Aquatic: Unchanged

Marginal: Schoenoplectus single species swamp. c.20m

Adjacent: Unchanged

Section M-N

Aquatic: Ruppia maritima - almost continuous cover
Enteromorpha - sparse

Marginal: Schoenoplectus single species swamp. 10-60m, average c.50m
Grading to Phragmites swamp and fen communities as I-J. c.100m

Adjacent: Unchanged

Section N-O

Aquatic: Ruppia maritima - open cover - c.30%
Enteromorpha - sparse

Marginal: Scirpus maritimus single species swamp. 10m
Backing to Schoenoplectus single species swamp. 20m
Grading to Phragmites swamp and fen communities as I-J.

Adjacent: Unchanged

Section O-P

Aquatic: Unchanged

Marginal: Schoenoplectus single species swamp. 20-80m
Grading to Schoenoplectus with salt tolerant species as K-L. 5-10m

Adjacent: 1m dry stone wall
Agrostis stolonifera - Potentilla anserina pasture

Section P-Q (Transect C)

Aquatic: Ruppia maritima - extensive 50-100m out, less so 0-50m out, low growing
Enteromorpha - sparse

Marginal: Mosaic of Scirpus maritimus single species swamps and Scirpus - Schoenoplectus co-dominant swamps. 40-50m
Grading to Scirpus maritimus with species-poor salt tolerant vegetation. 4m
Backing 30cm-1m sandy cliff

Adjacent: Agrostis stolonifera - Potentilla anserina - Eleocharis uniglumis dominant with salt tolerant species

Section Q-R

Aquatic: Ruppia maritima - occasional patches - <1m2
Enteromorpha - sparse

Marginal: Mosaic of Schoenoplectus single species swamps and Scirpus - Schoenoplectus co-dominant swamps. 12m
Grading as P-Q

Adjacent: Unchanged

Section R-S

Aquatic: No aquatic vegetation

Silt substrate

Marginal: Open cover of Glaux maritima, Spergularia marina, Triglochin maritima. 4-6m

Adjacent: Unchanged

Section S-T

Aquatic: Unchanged

Marginal: As Q-R

Adjacent: Unchanged

Section T-U

Aquatic: Unchanged

Marginal: As P-Q

Adjacent: Unchanged

Section U-V

Aquatic: Unchanged

Marginal: Open cover of Glaux maritima, Spergularia marina and Triglochin maritima.
2-8m
Grading to Agrostis stolonifera - Potentilla anserina - Eleocharis uniglumis community as Transect C

Adjacent: Lolium Perenne - Holcus lanatus - Cynosaurus cristatus pasture

Section V-W

Aquatic: Unchanged

Marginal: Scirpus maritimus dominated swamp with occasional Schoenoplectus shoots.
4-8m
Backing to open Glaux maritima community as U-V. 1-2m strip

Adjacent: Festuca rubra - Trifolium repens sandy grassland. 40m
Backing to unvegetated shingle barrier

Section W-X

Aquatic: Ruppia maritima - sparse
Enteromorpha - sparse

Silt and sand substrate with occasional cobbles

Marginal: Open Glaux maritima community as above with occasional Scirpus maritimus shoots. 1m strip

Adjacent: Unchanged

Section X-Y (Transect D)

Aquatic: Ruppia maritma - faily dense and extensive, increasingly so to landward
Enteromorpha - patchy

Marginal: Puccinellia maritima dominant with patchy Agrostis stolonifera, frequent Glaux maritima and more or less sparse salt tolerant associates. 20m

Adjacent: Unvegetated shingle barrier

Section Y-Z

Aquatic: Unchanged

Marginal: Patches of Puccinellia dominated community as X-Y - maximum area c.20m2 - with occasional single species patches of Puccinellia and Glaux maritima on sand substrate. 10m

Adjacent: Unchanged

Section Z-AA

Aquatic: Unchanged

Marginal: Unvegetated sand

Adjacent: Unchanged

Section AA-BB

Aquatic: Unchanged

Marginal: Glaux maritima - Spergularia marina - Triglochin maritima community. 1-4m

Adjacent: Festuca rubra - Trifolium repens sandy grassland
Backing to unvegetated shingle barrier

Section BB-CC

Aquatic: Ruppia maritima - absent to 50m out, then occurring in occasional low growing patches - maximum 2m2
Enteromorpha - sparse

Marginal: Unchanged

Adjacent: Unchanged

Section CC-DD

Aquatic: Enteromorpha - extensive cover

Marginal: Unchanged

Adjacent: Unchanged

2. Transects

Site: Lough Donnell	Transect code: A	
Location: Freshwater inflow	Sample point: 1 Aquatic - 5m out	
Sample area: 16m2 (4x4) + grapnel	Substrate: Silt	
Depth: 60 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		0
Description: No aquatic vegetation present.		

Site: Lough Donnell	Transect code: A	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 30 cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	200	85
Schoenoplectus lacustris ssp tabernaemontani	100	20
Description: Dense Phragmites dominated swamp with frequent Schoenoplectus. 10m.		

Site: Lough Donnell	Transect code: A	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 20m2 (10x2)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - sub-community undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	230	100
Samolus valerandi	20	< 1
Triglochin maritima	30	< 1
Aster tripolium	40	< 1
Mentha aquatica	30	< 1
Description: Phragmites dominant in species-poor stand with sparse, mostly salt tolerant, associates. 2m.		

Site: Lough Donnell	Transect code: A	
Location: Freshwater inflow	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Galium palustre sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	230	100
Lythrum salicaria	80	15
Agrostis stolonifera	20	< 1
Mentha aquatica	40	< 1
Potentilla anserina	15	< 1
Galium palustre	40	< 1
Description: Dense species-poor Phragmites dominated fen community. c.100m. Grading to Juncus effusus - Agrostis stolonifera dominated community.		

Site: Lough Donnell	Transect code: B	
Location: Marginal swamp	Sample point: 1 Aquatic - 70m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles, boulders	
Depth: 40 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		10
Enteromorpha	20	10
Substrate		
Silt and sand		90
Cobbles and boulders		10
Description: Open cover of Enteromorpha. Restricted to submerged rocks.		

Site: Lough Donell	Transect code: B	
Location: Marginal swamp	Sample point: 2 Aquatic - 50m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 30 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Ruppia maritima	15	60
Description: Fairly open cover of low growing Ruppia. Same species at more or less same		
cover from 20 - 60m out.		

Site: Lough Donnell	Transect code: B	
Location: Marginal swamp	Sample point: 3 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand	
Depth: 15 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Ruppia maritima	15	80
Description: Fairly dense cover of low growing Ruppia. Both flowering and fruiting plants present. Same species at more or less same cover from marginal swamp to 20m out.		

Site: Lough Donnell	Transect code: B	
Location: Marginal swamp	Sample point: 4 Marginal	
Sample area: 50m2 (10x5)	Substrate: Silt	
Depth: 5 cm	Salinity: 4 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Schoenoplectus lacustris ssp tabernaemontani	130	90
Description: Tall dense single species Schoenoplectus swamp. 6m.		

Site: Lough Donnell	Transect code: B	
Location: Marginal swamp	Sample point: 5 Marginal	
Sample area: 96m2 (12x8 - whole stand)	Substrate: Silt	
Depth: 5 cm	Salinity: 5 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		5
Scirpus maritimus	50	5
Schoenoplectus lacustris ssp tabernaemontani	15	< 1
Ruppia maritima	5	< 1
Description: Shallow pool with sparse Scirpus dominant and very sparse low growing		
Schoenoplectus shoots. Ruppia sparse and low growing, a few plants in bud.		

Site: Lough Donnell	Transect code: B	
Location: Marginal swamp	Sample point: 6 Marginal	
Sample area: 50m2 (10x5)	Substrate: Silt	
Depth: 0 - 5 cm	Salinity: 4 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Schoenoplectus lacustris ssp tabernaemontani	80	90
Description: Dense single species Schoenoplectus swamp. 5m.		

Site: Lough Donnell	Transect code: B	
Location: Marginal swamp	Sample point: 7 Marginal	
Sample area: 80m2 (10x8)	Substrate: Silt	
Depth: 0 cm	Salinity: -----	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		95
Schoenoplectus lacustris ssp tabernaemontani	50	25
Phragmites australis	100	25
Agrostis stolonifera	15	25
Eleocharis uniglumis	10	25
Glaux maritima	15	5
Triglochin maritima	15	5
Atriplex hastata	15	< 1
Description: Open cover of co-dominant Schoenoplectus and Phragmites with Agrostis stolonifera and Eleocharis uniglumis co-dominant among species-poor understorey of salt tolerant species. 8m.		

Site: Lough Donnell	Transect code: B	
Location: Marginal swamp	Sample point: 8 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Atriplex hastata sub-community - Agrostis stolonifera variant		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	200	100
Agrostis stolonifera	15	70
Lythrum salicaria	40	< 5
Triglochin maritima	20	< 1
Atriplex hastata	15	< 1
Galium palustre	10	< 1
Bare substrate		20
Description: Dense Phragmites fen with Agrostis stolonifera dominant amongst species-poor understorey. c.100m.		
Grading to Juncus effusus - Agrostis stolonifera dominated community.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 1 Aquatic - 100m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles	
Depth: 30 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		75
Higher Plant		70
Ruppia maritima	8	70
Algae		
Enteromorpha	20	5
Substrate		
Silt and sand		95
Cobbles		5
Description: Fairly dense low growing Ruppia dominant with Enteromorpha restricted to scattered submerged rocks. Same species at more or less same cover 60 - 100m out.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 2 Aquatic - 50m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles	
Depth: 15 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		35
Higher Plant		30
Ruppia maritima	8	30
Algae		
Enteromorpha	20	5
Substrate		
Silt and sand		95
Cobbles		5
Description: Open cover of low growing Ruppia dominant with Enteromorpha restricted to submerged rocks. Same species at more or less same cover 15 - 60m out.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 3 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles	
Depth: 5 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		15
Higher Plant		15
Ruppia maritima	6	15
Algae		< 1
Enteromorpha	15	< 1
Substrate		
Silt and sand		100
Cobbles		< 1
Description: Open cover of dominant low growing Ruppia with very sparse Enteromorpha restricted to submerged rocks. Same species at more or less same cover 5 - 15m out.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 4 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles	
Depth: 5 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Ruppia maritima	6	60
Substrate		
Silt and sand		95
Cobbles		5
Description: Fairly open cover of low growing Ruppia only.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 5 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt, sand, cobbles	
Depth: 5 cm	Salinity: 4 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		100
Scirpus maritimus	70	50
Ruppia maritima	5	70
Algae		10
Enteromorpha		10
Substrate		
Silt and sand		95
Cobbles		5
Description: Open Scirpus swamp with fairly dense cover of low growing Ruppia. Sparse free-floating Enteromorpha. Some Ruppia plants in fruit. 10m.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 6 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 5 cm	Salinity: 5 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		85
Scirpus maritimus	80	75
Schoenoplectus lacustris ssp tabernaemontani	80	10
Description: Fairly dense swamp vegetation dominated by Scirpus with open Schoenoplectus cover. 15m.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 7 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 5 cm	Salinity: 5 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Scirpus maritimus	70	80
Description: Fairly dense single species Scirpus maritimus swamp. 18m.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 8 Marginal	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		55
Scirpus maritimus	60	50
Triglochin maritima	30	10
Spergularia marina	8	< 5
Glaux maritima	6	< 1
Description: Open Scirpus cover over very open ground cover of salt tolerant associates. 4m.		
Backing sandy cliff - average height 60 cm.		

Site: Lough Donnell	Transect code: C	
Location: Marginal swamp	Sample point: 9 Marginal	
Sample area: 16m2 (4x4)	Substrate: Not known	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Agrostis stolonifera	10	90
Potentilla anserina	5	10
Eleocharis uniglumis	10	< 5
Glaux maritima	5	< 5
Triglochin maritima	10	< 5
Leontodon autumnalis	10	< 1
Spergularia marina	5	< 1
Hydrocotyle vulgaris	4	< 1
Description: Dense cover of Agrostis stolonifera dominant with frequent Potentilla anserina		
among sparse associates. 32m. Grazed.		
Grading to Scirpus maritimus dominated stands 25m.		
Backing unvegetated flooded area 40m. Salinity 5.		
Grading to Agrostis stolonifera - Potentilla anserina community (as above). 30m.		
Grading to Lolium perenne - Holcus lanatus - Cynosaurus cristatus pasture.		

Site: Lough Donnell	Transect code: D	
Location: Open shore - barrier	Sample point: 1 Aquatic - 125m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles	
Depth: 25 cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		40
Higher Plant		20
Ruppia maritima	8	20
Algae		20
Enteromorpha	10	20
Substrate		
		85
Silt and sand		15
Cobbles		
Description: Patchy cover of co-dominant Ruppia and Enteromorpha, the latter restricted to		

Site: Lough Donnell	Transect code: D	
Location: Open shore - barrier	Sample point: 2 Aquatic - 100m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles	
Depth: 25 cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		30
Ruppia maritima	8	30
Algae		30
Enteromorpha	10	30
Substrate		
Silt and sand		70
Cobbles		30
Description: Patchy cover of co-dominant low growing Ruppia and rupicolous Enteromorpha.		

Site: Lough Donnell	Transect code: D	
Location: Open shore - barrier	Sample point: 3 Aquatic - 75m out	
Sample area: 25m2 (5x5)	Substrate: Silt, sand, cobbles	
Depth: 15 cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		90
Higher Plant		70
Ruppia maritima	15	70
Algae		20
Enteromorpha	20	20
Substrate		
Silt and sand		80
Cobbles		20
Description: Fairly dense cover of low growing Ruppia dominant with Enteromorpha		
restricted to submerged rocks. Same species at more or less same cover to shore.		
Shoreline - 50m out from the vegetation line at time of survey.		
Backing 50m unvegetated sand.		

Site: Lough Donnell	Transect code: D	
Location: Open shore - barrier	Sample point: 4 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Puccinellia maritima	8	90
Agrostis stolonifera	10	15
Glaux maritima	5	15
Triglochin maritima	10	5
Aster tripolium	6	< 5
Atriplex hastata	10	< 1
Spergularia marina	5	< 1
Cochlearia anglica	4	< 1
Leontodon autumnalis	10	< 1
Suaeda maritima	8	< 1
Description: Dense cover of dominant Puccinellia in fairly low growing salt tolerant		
community with Glaux and patchy Agrostis stolonifera the only frequently occuring associates.		
20m.		
Backing shingle barrier of unvegetated boulders and cobbles.		

Site: Lough Donnell	Transect code: E	
Location: Outlet channel	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Sand and cobbles	
Depth: c.1 m	Salinity: 8 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		10
Enteromorpha	30	10
Description: Patchy cover of Enteromorpha in narrow channel leading from outlet pipe.		

Site: Lough Donnell	Transect code: E	
Location: Outlet channel	Sample point: 2 Marginal	
Sample area: 40m2 (10x4)	Substrate: Sand	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		10
Glaux maritima	10	5
Spergularia marina	6	< 5
Triglochin maritima	15	< 5
Description: Sparse cover of species-poor community on open sandy shore. 4m		
Grading to Festuca rubra - Trifolium repens grassland		

9.3.4 Evaluation

'Not Valuable'

This is a shallow sandy lagoon with low salinity (0-5 parts per thousand) at time of survey. Water depth exceeded 50cm at the outlet and the freshwater inflow only. Therefore, the aquatic species of this lagoon were more comprehensively surveyed than those of most sites.

Ruppia maritima is the only aquatic higher plant species. It is widely distributed across the site, being completely absent from the vicinities of the outlet pipe and the freshwater inflow and the area of periodic flooding to the south only. Ruppia has a patchy cover to the north of the freshwater inflow and a more extensive cover to the south. It is typically low-growing.

There is a high diversity of swamp and other marginal communities. Scirpus maritimus, Schoenoplectus and Phragmites occur in mixed and single species stands on the eastern and southern shores. These are all fairly extensive in places. Eastern swamps grade to freshwater Phragmites fen.

A community of salt tolerant species with dominant Eleocharis uniglumis and Agrostis stolonifera occurs in the south. An open shore community consisting of Glaux maritima, Spergularia marina and Triglochin maritima is found in the north and south of the site and Puccinellia maritima dominated saltmarsh vegetation borders part of the barrier shore.

Lough Donnell is an interesting site in terms of the diversity of its marginal communities.

However, aquatic species composition is poor.

Further survey is not recommended.

Site: Lough Donnell	Transect code: E	
Location: Outlet channel	Sample point: 2 Marginal	
Sample area: 40m2 (10x4)	Substrate: Sand	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		10
Glaux maritima	10	5
Spergularia marina	6	< 5
Triglochin maritima	15	< 5
Description: Sparse cover of species-poor community on open sandy shore. 4m		
Grading to Festuca rubra - Trifolium repens grassland		

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Lough Donnell is an interesting site in terms of the diversity of its marginal communities.
However, aquatic species composition is poor.
Further survey is not recommended.

9.4 ECOTONAL COLEOPTERA

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9.4.1 Site Description

Coastal brackish lake with cobble/boulder shingle barrier on sand (Plate 1) breached by concrete inflow/outflow tunnel to beach, with seawater incursion at high spring tide, and inward percolation at base of barrier. Barrier shore with c. 0.6 ha (summer) medium-textured aerobic and anaerobic sandflats, flooded at least during winter. Sand and loam margins to pasture, grading to large (> 2 ha) beds of *Schoenoplectus lacustris*, *Phragmites communis* and *Scirpus lacustris*, and upstream to extensive marsh area. Margins grazed by cattle. Inflow river with large watershed.

Subsites (Fig 9.4.1)

1. Grass/*Potentilla* margin (R 001704)
Lake margin pasture with grass and *Potentilla anserina*, *Triglochin maritima* and very sparse *Schoenoplectus lacustris*.

2. Pasture above cliff (R 002704)
Short-turf pasture above c. 0.3 m loam cliff at lake margin with *Scirpus maritimus*. *Scirpus* below cliff flooded durng spring high tide.

3. Sandflat (R 001706, R 001709) Plate 9.4.2
Aerobic moist sandflats similar to intertidal sandflats in texture and porosity, behind barrier, between dry sandflat and standing water.

4. Pocket beach (R 004710) Plate 9.4.3
Small (c. 100 m^2) sandy pocket beach to north of river outflow, with relatively high organic matter compared to sandflats above. Thousands of hydraenids active and burrowing in sand (Plate 4). Surrounded by c. 0.5 m sand cliffs to pasture.

5. Sandy shore (R 000707, R 001711, R 004711)
Gently sloping exposed sandy shore with cobbles, dried cow dung, rush and sedge litter in different parts of northern and interior shores.

9.4.2 Methods

Site Rating using Indicator Species
Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that

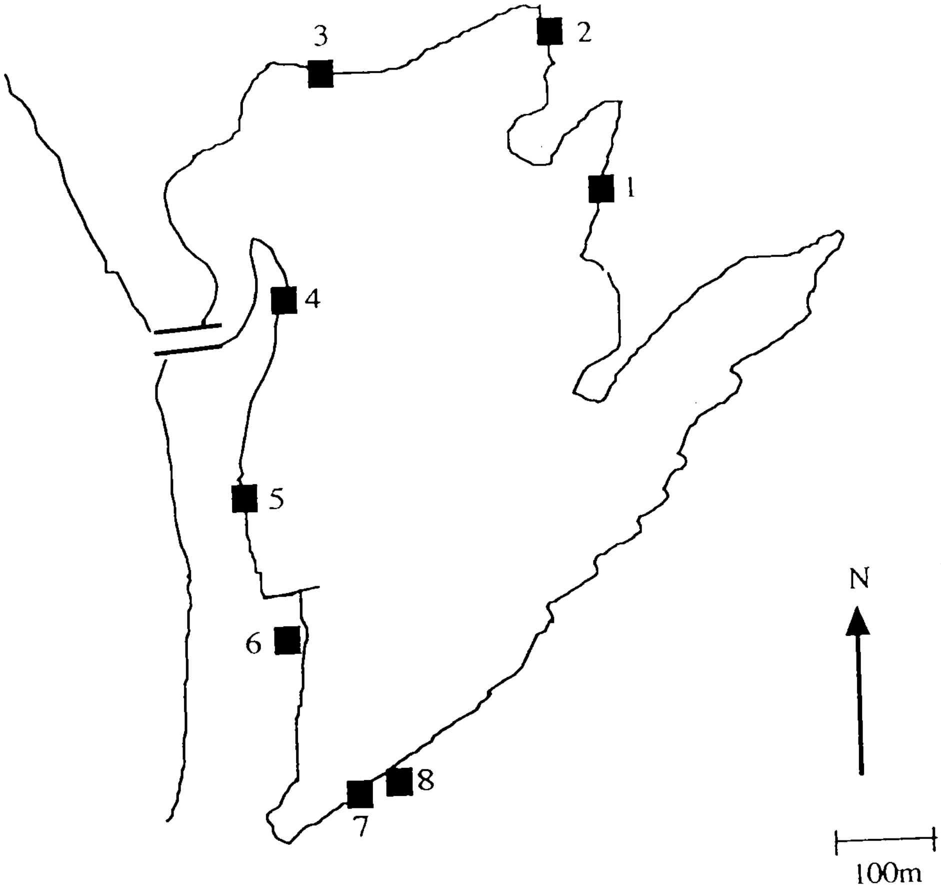

Fig. 9.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Lough Donnell, Co. Clare

1 - Flotation, Ground search
2 - Ground search
3 - Cobble search
4 - Flotation
5 - Ground search
6 - Flotation
7 - Pitfall traps, S-vac
8 - Pitfall traps

this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with

freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 9.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

TABLE 9.4.1. Details of sampling methods.

Method	**Details**	**No. replicates per unit sample**	**Sampling period, etc.**
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Variety of sampling techniques
Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

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Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) Grass/*Potentilla* margin - S-vac suction sampler (5 ix 1996), c. 2 m^2;

(2) Grass/*Potentilla* margin - 6 plastic pitfall traps with funnels and ethylene glycol preservative (5 - 21 ix 1996);
(3) Pasture above cliff - 6 pitfall traps (5 - 21 ix 1996);
(4) Sandflat - 2 sets of flotation samples (fast and slow infiltration sand, each sample = 24 subsamples of 5 x 5 x 10 cm, 20 vii 1996);
(5) Pocket beach - 1 set of flotation samples (21 vii 1996);
(6) Debris on interior sandy shore (cow dung, plant litter, etc.) - 1h ground search (21 vii 1996);
(7) Sandy shore - 1h ground search of cobbles (21 vii 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

9.4.3 Survey Results

Five species of carabid and twenty-four species of staphylinid were recorded, two species of which are regarded as indicator species (Table 9.4.2).

TABLE 9.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Lough Donnell. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), with the exception of Booth (1988) for *Tachyporus dispar*.

	Species	No. individuals	
Carabidae			
	Agonum marginatum (L.)	2	
	Agonum pelidnum (Payk.)	1	
*	*Bembidion bipunctatum* (L.)	9	**Indicator species**
	Nebria brevicollis (F.)	3	
	Pterostichus strenuus (Panz.)	1	
Staphylinidae			
	Aloconota gregaria (Er.)	1	
	Amischa analis (Grav.)	1	
	Atheta amplicollis (Muls. Rey)	4	
	Atheta celata (Er.)	3	
	Atheta elongatula (Grav.)	28	
	Atheta graminicola (Grav.)	17	
	Atheta volans (Scriba)	22	
	Bledius gallicus (Grav.)	1	
	Carpelimus bilineatus (Steph.)	1	
	Carpelimus corticinus (Grav.)	1	
*	*Cypha punctum* (Motsch.)	1	**Indicator species**
	Gabrius pennatus Sharp	3	
	Gabrius subnigritulus (Reitt.)	2	
	Gnypeta carbonaria (Mannh.)	5	

TABLE 9.4.2 (cont.)

Ischnopoda atra (Grav.)	1
Philonthus cognatus (Steph.)	8
Philonthus marginatus (Ström)	2
Platystethus cornutus (Grav.)	1
Quedius schatzmayri Grid.	1
Stenus canaliculatus Gyll.	14
Stenus impressus Germ.	1
Tachyporus chrysomelinus (L.)	1
Tachyporus dispar (Payk.)	2
Tachyporus pusillus Grav.	3

Bembidion bipunctatum is a halotolerant shore species, occurring inland and in coastal shingle and brackish water pools (Koch 1989, Hyman and Parsons 1992). It is widespread but local in Great Britain (Hyman and Parsons 1992), and recorded from Ireland (Speight *et al.* 1982). It occurs from North Africa to west Siberia, and is common at least in northern Germany, although rarer further west (Freude 1976).

Cypha punctum appears to be rare in Europe, with a predominantly atlantic distrbution (Horion 1967). There is one published Irish record (moss in dunes, Co. Down, Allen (1975)) and another unpublished from *Cladium* and *Carex* in a fen spring (J.A. Good, unpublished). The species has also been recorded from stream banks, wet meadows and coastal cliff flushes (Koch 1989).

Only three individuals or three species were recorded from the sandflats (Table 9.4.3), none of which were sandflat specialists.

TABLE 9.4.3 Staphylinid assemblage from aerobic sandflat, Lough Donnell (flotation samples and ground search combined).

Species	No.	Main biotope
Atheta elongatula	1	Eurytopic, incl. disturbed soil
Platystethus cornutus	1	Eurytopic, incl. sandy shores
Stenus impressus	1	Eurytopic, incl. pasture

9.4.4 Evaluation

Of low conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of two indicator species indicates conservation interest: *Bembidion bipunctatum* has been associated with shingle and brackish water habitats, and *Cypha punctum* with wet coastal soils. However, the latter species, which was represented by only one individual may breed in the freshwater marsh upstream from this lagoon.

The sandflats at this site have little value, probably due to disturbance by irregularly fluctuating water levels and possibly the lack of interstitial algae which provide a food source for *Bledius* communities. Two sets of pitfall traps in the *Schoenoplectus* and *Scirpus* stands were flooded in September. The site is possibly of average value for wetland invertebrates, but the effect of this water-level disturbance needs to be investigated before this can be confirmed.

9.4.5 References

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Plate 1 Shingle barrier at Lough Donnell, Co. Clare

Plate 2 Sandflat at Lough Donnell , Co. Clare

Plate 3 Sandy pocket beach at Lough Donnell, Co. Clare

Plate 4 Hydraenid burrow casts at Lough Donnell , Co. Clare

9.5 SUMMARY AND EVALUATION

Lough Donnell is a medium-sized (20 ha) **natural sedimentary lagoon** and it is therefore of international importance based on the Habitats Directive

This shallow lagoon is impounded by an impressive cobble barrier, approximately 7 metres high and 40 metres wide. A small river, the Annageeragh River, enters the lagoon in the east and a pipe has been constructed through the barrier to prevent excessive flooding of the surrounding agricultural land.

The lagoon is an ASI and a proposed NHA (Site 1018) largely due to its ornithological value. No large numbers of wildfowl are recorded but it is mentioned by Sheppard (1993) as being of major interest for waders.

Geomorphology	Exceptional
Aquatic Fauna	Moderate
Vegetation	No Value
Ecotonal Coleoptera	Low

Geomorphology

Lough Donnell is a classic coastal lagoon and although there is an artificial outlet pipe through which seawater enters, the cobble barrier which impounds the lagoon was one of the most impressive of those encountered along the entire coastline. For this reason it is rated as of exceptional conservation value based on geomorphology

Aquatic Fauna

Among 32 taxa listed, 27 are identified to species, two of which (*Sigara stagnalis* and *Palaemonetes varians*) are listed as a lagoonal specialists.

Differences between stations are mainly correlated with habitat as the salinity was similar at all stations. *Sigara dorsalis*, *Notonecta viridis*, *Ischnura elegans* and four of the Coleoptera were only taken at the edge of the reed beds, while *Jaera nordmanni* and *Ligia oceanica* were confined to the seaward shore where they were found under cobbles. *Crangon crangon*, and *Palaemonetes varians* were only found near the main tidal stream. *Potamopyrgus antipodarum*, *Neomysis integer* and *Sigara stagnalis* were common throughout the lake. Chironomid larvae constituted the only fauna in the sediment.

This is the most northerly locality for *Notonecta viridis* in Ireland. *Dryops luridus* and *Haliplus flavicollis* were not recorded at any other site during the survey.

The faunal assemblage reflects the predominance of freshwater over marine influence throughout the lake. Although seawater may enter on most tides, it is flushed out by the river water and no fucoids or marine fauna were established near the sea inlet. The fauna was moderately rich and typical of a lagoon with persistently low salinity but with an open inlet allowing some colonisation from the sea.

Based on the aquatic fauna and the relatively low number of lagoonal specialists, Lough Donnell is rated as of only moderate conservation value as a coastal lagoon.

Vegetation

Water depth exceeded 50cm at the outlet and the freshwater inflow only. Therefore, the aquatic species of this lagoon were more comprehensively surveyed than those of most sites.

Ruppia maritima is the only aquatic higher plant species. It is widely distributed across the site, being completely absent from the vicinities of the outlet pipe and the freshwater inflow and the area of periodic flooding to the south only. *Ruppia* has a patchy cover to the north of the freshwater inflow and a more extensive cover to the south. It is typically low-growing.

There is a high diversity of swamp and other marginal communities. *Scirpus maritimus, Schoenoplectus* and *Phragmites* occur in mixed and single species stands on the eastern and southern shores. These are all fairly extensive in places. Eastern swamps grade to freshwater *Phragmites* fen.

A community of salt tolerant species with dominant *Eleocharis uniglumis* and *Agrostis stolonifera* occurs in the south. An open shore community consisting of *Glaux maritima, Spergularia marina* and *Triglochin maritima* is found in the north and south of the site and *Puccinellia maritima* dominated saltmarsh vegetation borders part of the barrier shore.

Lough Donnell is an interesting site in terms of the diversity of its marginal communities. However, aquatic species composition is poor and the lagoon is rated as of no conservation value.

Further survey is not recommended.

Ecotonal Coleoptera

Five species of carabid and twenty-four species of staphylinid were recorded, two species of which are regarded as indicator species

Bembidion bipunctatum is a halotolerant shore species, occurring inland and in coastal shingle and brackish water pools. It is widespread but local in Great and recorded from Ireland

(Speight *et al.* 1982). It occurs from North Africa to west Siberia, and is common at least in northern Germany, although rarer further west.

Cypha punctum appears to be rare in Europe, with a predominantly atlantic distrbution. There is one published Irish record (moss in dunes, Co. Down, Allen (1975)) and another unpublished from *Cladium* and *Carex* in a fen spring (J.A. Good, unpublished). The species has also been recorded from stream banks, wet meadows and coastal cliff flushes.

The presence of two indicator species indicates conservation interest: *Bembidion bipunctatum* has been associated with shingle and brackish water habitats, and *Cypha punctum* with wet coastal soils. However, the latter species which was represented by only one individual, may breed in the freshwater marsh upstream from this lagoon.

The sandflats at this site have little value, probably due to disturbance by irregularly fluctuating water levels and possibly the lack of interstitial algae which provide a food source for *Bledius* communities. Two sets of pitfall traps in the *Schoenoplectus* and *Scirpus* stands were flooded in September. The site is possibly of average value for wetland invertebrates, but the effect of this water-level disturbance needs to be investigated before this can be confirmed.

Only three individuals of three species were recorded from the sandflats, none of which were sandflat specialists.

For the above reasons, Lough Donnell is rated as of <u>low</u> conservation interest for terrestrial ecotonal community.

Summary

Despite the artificial inlet running through the barrier and the number of tourists visiting this part of the coast during the summer, Lough Donnell is still relatively natural and unspoilt by adverse developments.

The lagoon is of relatively low conservation value based on its invertebrate fauna, vegetation and ecotonal coleoptera. It is of higher value ornithologically and perhaps for commercially valuable fish species. It is however a classic lagoon with one of the most impressive barriers of the entire coastline.

Based on the geomorphology and scenic value of the lagoonal barrier, Lough Donnell is rated as of high conservation value.

Designation as a proposed SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

10. LOUGH MURREE

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

10 LOUGH MURREE

CONTENTS

10. LOUGH MURREE, Co. Clare.

OS Grid Reference: M255 119, 1:50,000 Sheet No. 51
Alternative names: Lough Murry, Loch Muiri

10.1 STUDY AREA

General Features

Lough Murree is situated on south side of Galway Bay, 12 km west of Kinvarra, County Clare (Fig. 10.1.1). The lake has formed in limestone bedrock on which a cobble barrier has been deposited along the coastal side. A road now runs along this barrier between the lake and the sea. There is no direct communication with the sea, Seawater may enter the lake occasionally by overtopping of the barrier but the main routes are percolation and possibly through subterranean fissures in the bedrock. The area was surveyed in 1840 and referred to as Lough Murry - salt lake. The fauna of the lake was sampled by Lansbury (1965) and an ecological survey was carried out by Pybus & Pybus (1980).

The lake has become highly eutrophic, with recurrent algal blooms but remains of interest due to its unusual geomorphology. Galway University has a research station near the lake.

L. Murree is included within a large proposed NHA referred to as the Galway Bay Complex (Site code 268)

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6°C in January and 15-15.5°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 9.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1200 mm, and the number of rain days (1 mm or more) is 175-200 . Winds are mainly from the west and southwest. Mean annual hourly wind speeds are between 5.0-5.5 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-

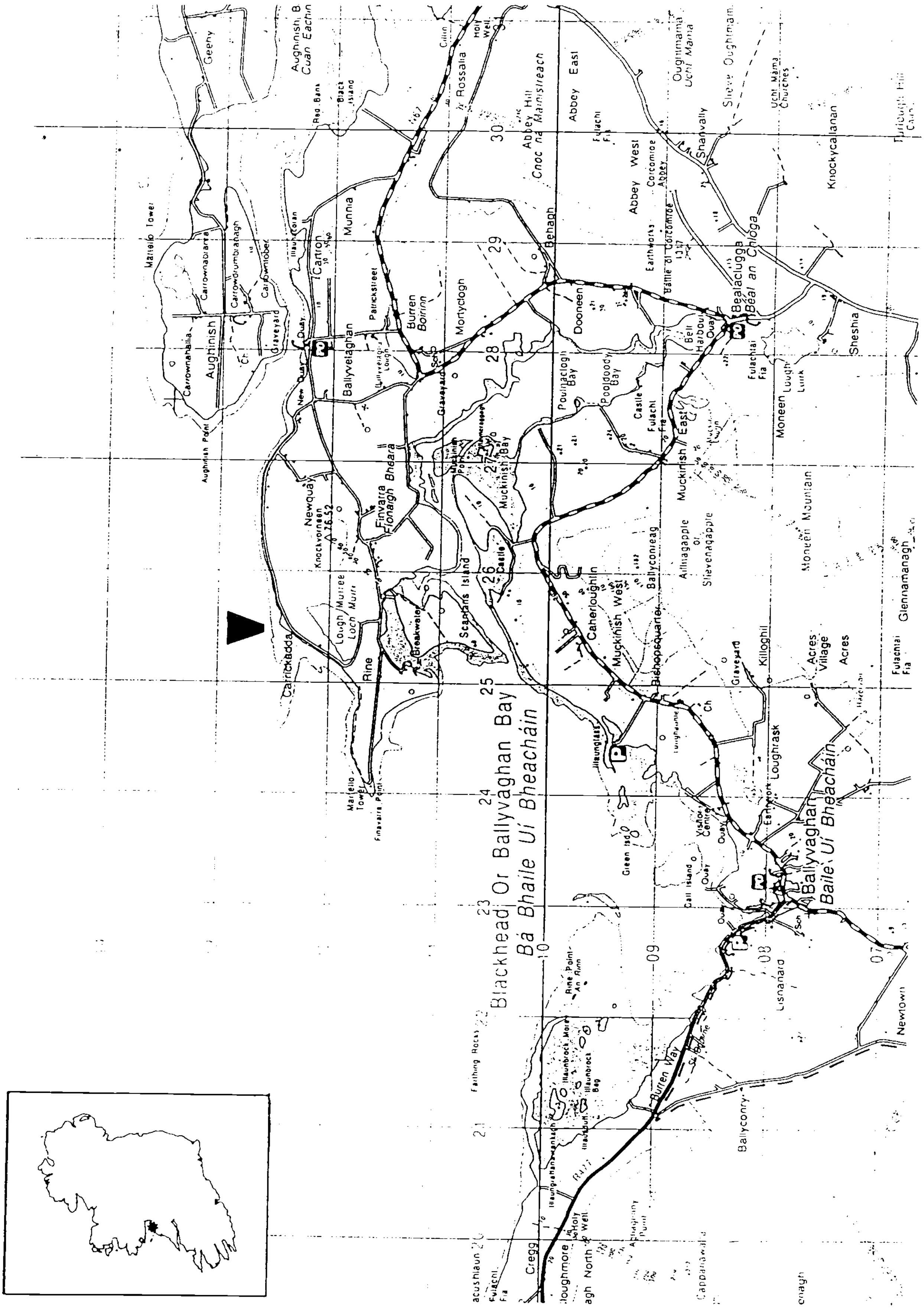

Fig. 10.1.1 Section of 1:50 000 map showing locality of Lough Murree

diurnal and the tidal range (MHWS-MLWS) at Galway is 4.5 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Topography The lagoon lies on Carboniferous limestone on the north-west side of the Burren area. Soils are lithosols and shallow rendzinas. The area is karstic, with numerous underground channels and surface drainage is low. The low areas surrounding the lake are mostly improved grassland and cereals while the hill to the east of the lake is relatively natural bare limestone and rough grazing.

Lake Topography The lagoon is approximately 600 m from southwest to northeast, 300 m across at its widest point and total area is approximately 15 ha. Most of the lake is shallow (<2m) and is divided into northern and southern basins by a shallow central area. The substrate at the northern edge of the lake is bare limestone, but deposits of sand, mud, gravel and stones are found in various mixtures along the other shorelines. In central areas the bottom is covered with a soft mud, deeper than 2 m in the centre of the southern basin (Pybus & Pybus, 1980).

Hydrology There is no direct communication with the sea, but seawater enters the lake by overtopping of the barrier, percolation and possibly through subterranean fissures in the bedrock. Seepage is evident on the grassy slope north of the lake where the salinity in puddles and trickles was in the mid 20s. A small tidal pool exists to the northeast of the lake, which "communicates with the sea via an underground fissure system.....and empties and fills during each tidal cycle" (Pybus & Pybus, 1980). Surface drainage is low due to the karstic nature of the bedrock, but there are two small springs, one on the east side and one on the west side of the lake which drain into the lake after heavy rainfall.

There is no daily tidal fluctuation in water level of the lake, but a seasonal pattern is likely, whereby water levels rise in the winter with the increased rainfall, and gradually decline in the summer.

Salinity and water quality Pybus & Pybus (1980) recorded a seasonal salinity range of 9 to 16‰. In general, salinity decreased through the winter as a result of increased precipitation but highest salinity actually occurred in February coinciding with maximum water level which followed a period of onshore gales coinciding with spring tides.

The lake was described as eutrophic in 1960 by Lansbury (1965). The situation appears to have become progressively worse with repeated algal blooms.

10.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

10.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰. precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and D in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons

between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (Nemertea).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

10.2.2 Results

Lough Murree was sampled on 23.vi.96 during the first part of the survey, and from 5-7.vii.96 during the more intensive survey.

Five sampling stations were selected in the lake to reflect the influences of substrate, freshwater and tidal inflows. Fig. 10.2.1 shows the position of these sampling stations in the lake.

Environmental Variables

Station A (OS 2542 1205) was located on the western shore where a stream from a tidal spring enters the lagoon. Salinity in the stream measured 35‰ but in the sample area was between 10 and 24 ‰. Water depth varied from 0 cm to 1 m, substrate was mostly sand with occasional stones and finer mud along the shoreline where cattle had disturbed the soil.

Station B (OS 2557 1221) was located in a larger tidal pool to the northwest of the lake. Substrate was coarse sand, soft in places with occasional rocks, water depth was 50 cm - 1 m and salinity measured 20-27‰.

Station C (OS 2566 1220) was located in the northern end of the lagoon. Substrate consisted of limestone bedrock with deep fissures and pockets of sand/silt, water depth was 0-50 cm above the bedrock and salinity measured 13‰.

Station D (OS 2562 1177) was located on the southeastern shore where substrate consisted of cobbles, occasional larger stones with anoxic sandy mud, depth varied from 0 cm - 1 m and salinity measured 15‰.

Station E (OS 0056 7075) was located on the southwestern shoreline where the lake is closest to the barrier. Substrate consisted of deep anoxic mud, depth varied from 0-80 cm and salinity measured 13‰.

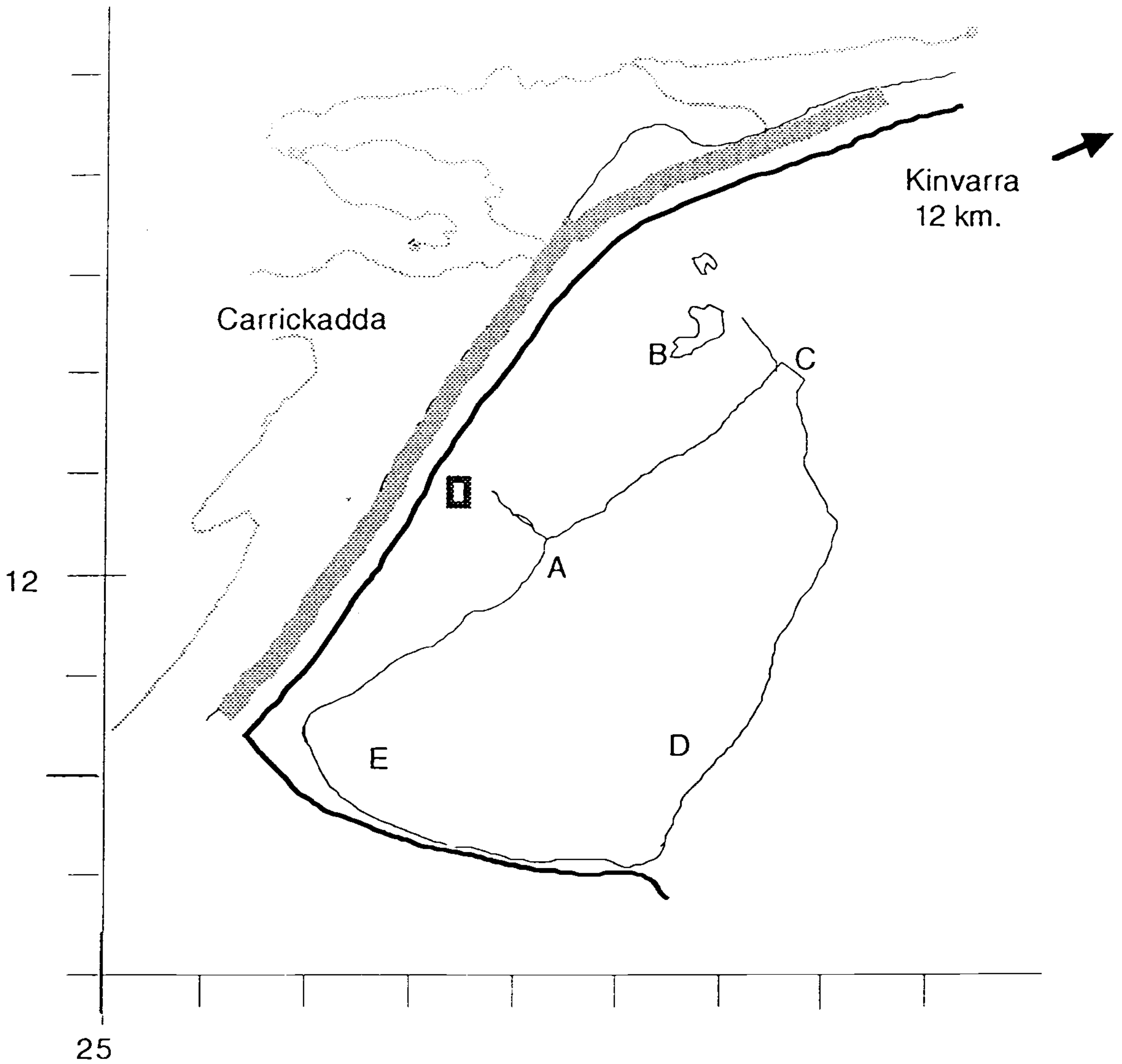

Fig. 10.2.1 Location Map of Sampling Stations in Lough Murree, Co. Clare

Table 10.2.1. Fauna Recorded at Lough Murree. June and August 1996.
( ) = records for June.

		Sampling Stations (L.T. = light-trap)								
		A	L.T.A	B	C	L.T.C	D	L.T.D	E	L.T.E
Porifera										
Cnidaria										
Turbellaria										
Nemertea	Nemertea					+				
Annelida	*Hediste diversicolor*	c		1						
	Clitellio arenarius			+						+
Ostracoda										
Copepoda										
Cirripedia										
Mysidacea	*Neomysis integer*	1	1							
Isopoda	*Jaera ischiosetosa*	12		5			+			
	Ligia oceanica	+			+					
Amphipoda	*Echinogammarus marinus*			+						
	Gammarus duebeni	+	+		c	+	+		+	
	Hyale sp.			a	a					
	Melita palmata	+					+			
	Orchestia gammarella	+								
Tanaidacea										
Decapoda	*Palaemonetes varians*	+	21		o	1			o	4
Arachnida										
Insecta										
Thysanura										
Ephemeroptera					1					
Odonata	*Ischnura elegans*				+				+	
Plecoptera										
Trichoptera	(cases)	+								
Hemiptera	Corixidae									
Coleoptera	*Enochrus bicolor*	+								
	Agabus nebulosus				+				+	
Diptera	Chironomidae	c			a		a			
	Culicidae	+								
	Syrphidae								1	
Mollusca										
Prosobranchia	Hydrobiidae	+		3	250	30	+			1
	Hydrobia ventrosa	+		+	+	+	+			
	Potamopyrgus antipodarum	+							+	+
	Littorina saxatilis	+		a						
Opisthobranchia										
Pulmonata										
Bivalvia	*Cerastoderma glaucum*	shells								
Bryozoa										
Echinodermata										
Tunicata										
Teleostei	*Anguilla anguilla*	F. 1								
	Gasterosteus aculeatus	+	29		o	2	c	c	+	10
	Pomatoschistus microps					1				

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 10.2.1. Among 25 taxa listed, 20 are identified to species; identification of remaining groups (Nemertea and larvae) will not be attempted. The list (excluding marginal species) comprises one marine species, 6 poly-mesohaline, 7 euryhaline, 3 oligo-mesohaline, and one limnic species (Table 10.2.2). Three species are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

No obvious patterns of species distribution correlated with salinity, vegetation or substrate could be detected in the lake. The pool B contained an impoverished version of the lake fauna, lacking *Gammarus duebeni, Palaemonetes varians,* insects and sticklebacks. Fish were poorly represented in collections, apart from sticklebacks and one goby, and crabs were absent.

Table 10.2.2 Ecological categories of the recorded taxa in Lough Murree (excluding marginal species). L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	Nemertea	
Poly-mesohaline	*Clitellio arenarius*	
	Jaera ischiosetosa	
	Echinogammarus marinus	
	Melita palmata	
	Hydrobia ventrosa	L
	Littorina saxatalis	
Euryhaline	*Hediste diversicolor*	
	Neomysis integer	
	Gammarus duebeni	
	Palaemonetes varians	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
Oligo-mesohaline	*Ischnura elegans*	
	Enochrus bicolor	L
	Potamopyrgus antipodarum	
Limnic	*Agabus nebulosus*	

10.2.3 Discussion

The species assemblage typifies a medium salinity lagoon which has no direct contact with the sea. The medium salinity regime, good macrophyte growth and availability of both hard and soft substrates might be expected to provide conditions favouring a wide range of species, but the faunal richness was, in fact, low due probably to the limited opportunities for colonisation. In the absence of a sea inlet or frequent overwash, marine colonists presumably enter by way of rock fissures or some form of aerial transport. It is possible also that the eutrophic conditions which resulted in a severe algal bloom in July may have depleted the fauna. Blooms are not new to this lake, however, and were reported in the 1960s (Lansbury 1965).

Lough Murree

Previous studies indicate that conditions in the lake undergo wide fluctuations resulting in important variations in faunal composition. In September 1960, the salinity had obviously been low for some time because the marginal vegetation included *Glyceria, Mentha, Nasturtium, Elodea* and other freshwater marsh plants and four species of Corixidae were identified in the lake (Lansbury 1965). The salinity in 1974 was similar to that of 1996 but the fauna indicated a less saline regime with corixids (*Sigara stagnalis)*, a beetle (*Enochrus halophilus*) (both lagoonal specialists) and a variety of insect larvae coexisting with *Neomysis, Palaemonetes, Jaera* and *Potamopyrgus*, while empty shells of barnacles and *Pomatocerus* indicated that a more marine environment had existed in the past (Pybus and Pybus 1981).

None of the species identified can be described as rare in Ireland.

10.2.4 Threats

The lake is highly eutrophic and appears to suffer from repeated algal blooms. The main threat to the lake is the continuation of this problem.

There appear to be no other immediate threats.

10.2.5 Evaluation

Lough Murree is a **rock lagoon** of a special morphological type occurring in karstic limestone and is therefore of international importance based on geomorphology.

There is a typical cobble barrier on the shore but there is no visible connection with the sea and the lagoon appears to receive seawater through underground fissures in the limestone.

The lagoon is fairly well documented. There are published accounts of algae and Hemiptera and several studies of fauna and hydrology have been carried out. The presence of a University Field Station encourages further research projects.

The lake obviously suffers from eutrophication and the invertebrate fauna recorded in this survey was poor.

The lake is part of the proposed Galway Bay NHA (Site Code No. 268)

In conclusion, based on aquatic invertebrate fauna Lough Murree is of little conservation value. However, as a representative of an unusual morphological type of coastal lagoon its conservation value is high.

Designation as a proposed SAC is recommended.

10.2.6 References and Additional Sources of Information

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Plate 10.2.1 View looking southwest along the northern shore of Lough Murree, Station A

Plate 10.2.2 View of small tidal pool near Lough Murree, Station B

Plate 10.2.3 View of tidal pool.

Plate 10.2.4 View of the southern area of Lough Murree, Station E

10.3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

10.3.1 Site Description (Fig. 10.3.1)

Lough Muree lies between Knockvorneen to the east and the sea to the west. Pastoral farmland borders the site to the north, south, south east and immediate west. A public road runs close to the southern shore.

Marginal areas are typically narrow, with fringing emergent and sparse shore vegetation backing to more or less steeply sloping ground to the south, east and west. A narrow band of Scirpus swamp is more or less continuous along the southern and eastern shores and occurs in patches along the western shore. Limestone pavement forms the north east shore.

There is no freshwater inflow stream. Two small saline streams join the lough at the north end and half way along the western shore (no flow in either at time of survey). These are associated with small unvegetated saline pools which lie between the lough and the sea.

10.3.2 Methods

Two survey methods were employed in the course of fieldwork:
1. Transects
2. Shore-based survey

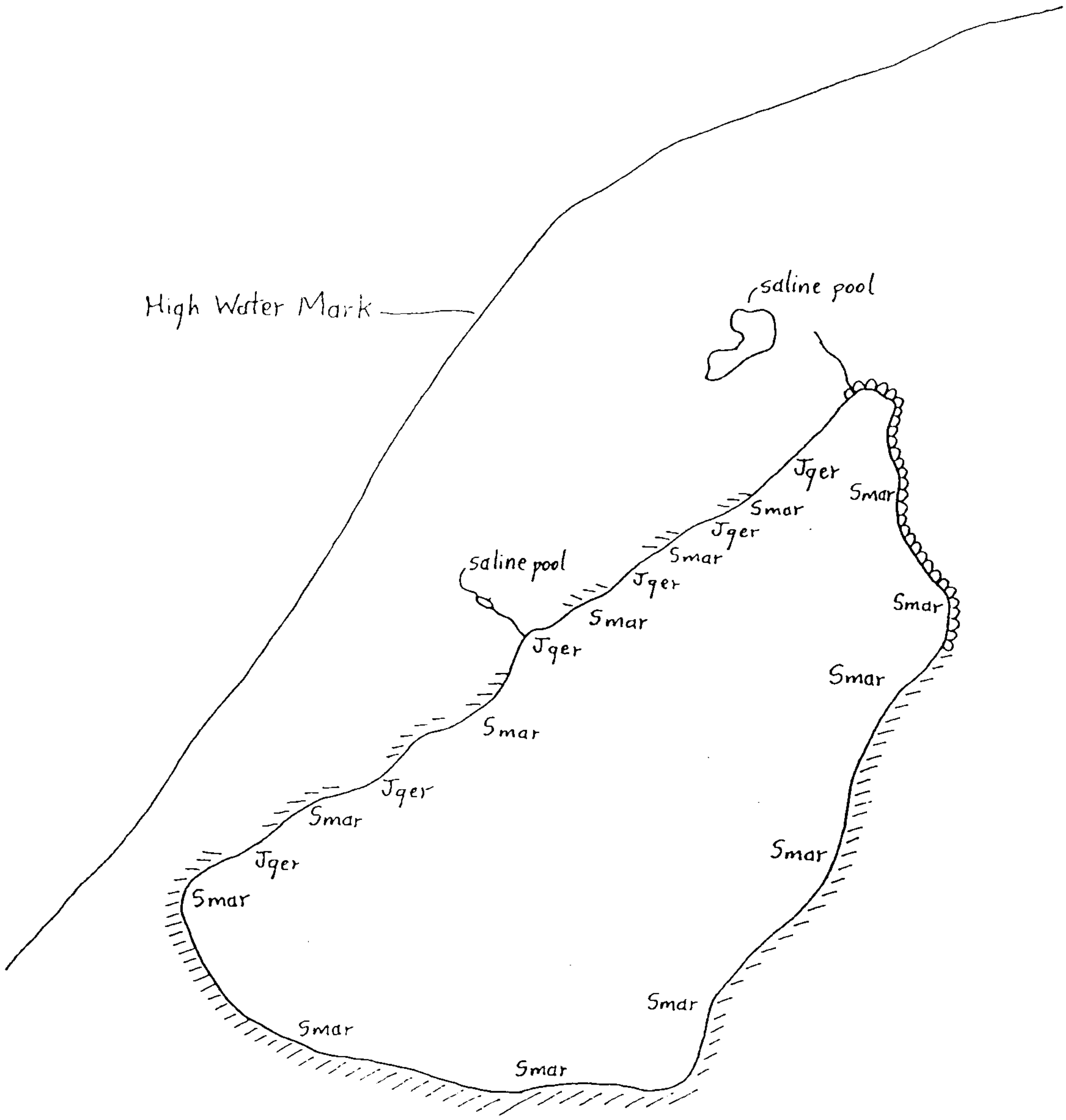
1. Transects:

The locality of these is shown in Fig. 10.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.



KEY:

- Exposed bedrock (limestone pavement)

- Swamp

Dominant species codes:

Smar - *Scirpus maritimus*

Jger - *Juncus gerardii*

Fig. 10.3.1 Lough Muree, Co. Clare - Marginal Vegetation

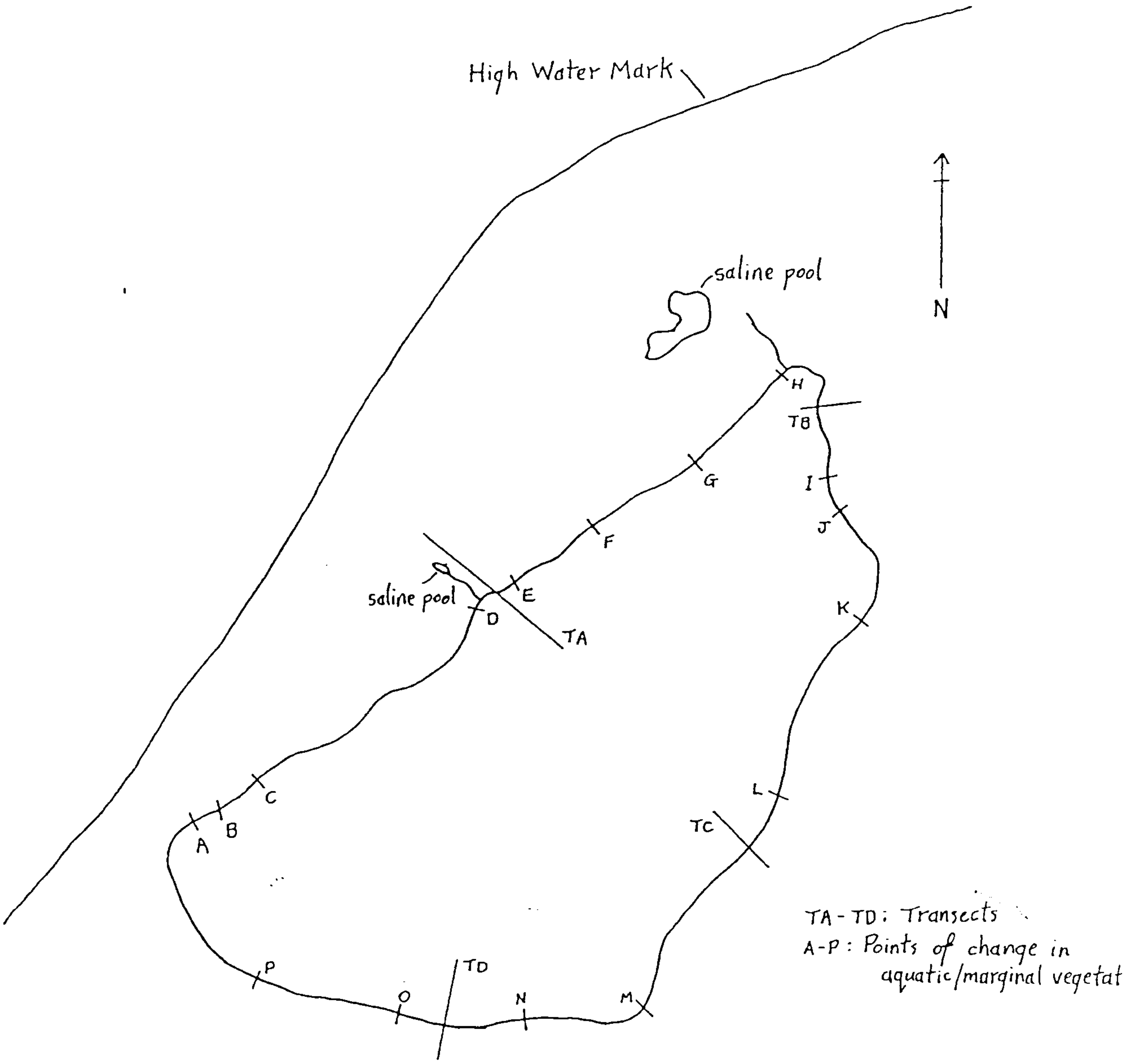


Fig. 10.3.2. Lough Muree, Co.Clare: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values
Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Lough Murree

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

Lough Murree

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

10.3.3 Results

1. Shore-based survey

Section A-B

Aquatic: Ruppia sp. - patchy cover to at least 20m out
Potamogeton pectinatus - sparse
Filamentous algae - extensive surface cover to 20m out
Enteromorpha - sparse
Chara canescens - sparse

Sand and gravel substrate with occasional cobbles

Marginal: Open Scirpus maritimus cover on gravel substrate with frequent cobbles and boulders. As Transect C. 4m
Backing to 1m strip Juncus gerardii, Glaux maritima, Potentilla anserina as Transect C

Adjacent: 1.5m dry stone embankment
Arable farmland

Section B-C

Aquatic: Unchanged

Marginal: Unvegetated stony shore. 2-4m
Backing to open cover of Juncus gerardii and Glaux maritima on stony shore. As Transect A. 1m strip

Adjacent: Unchanged

Lough Murree

Section C-D

Aquatic: Ruppia sp. - sparse
Potamogeton pectinatus - sparse
Filamentous algae - dense and extensive to c.20m out
Enteromorpha - sparse

Marginal: Scirpus maritimus stands grading to Juncus gerardii - Glaux - Potentilla (as A-B) alternating along shore with J. gerardii - Glaux community (as B-C).
Average extent of each community c.10-15m along shore

Adjacent: Unchanged

Section D-E (Transect A)

Aquatic: Ruppia sp. - sparse to c.25m out
Potamogeton pectinatus - patchy to at least 50m out
Filamentous algae - sparse
Enteromorpha - patchy to c.50m out
Lamprothamnium papulosum - sparse

Silt and sand substrate

Marginal: Open Juncus gerardii - Glaux maritima community with sparse Atriplex hastata and Suaeda maritima. 1m
Grading to J. gerardii - Agrostis stolonifera dominated species-poor community. 35m. Grazed and poached
Grading to J. gerardii - Festuca rubra - Puccinellia maritima dominated community. 40m. Grazed and poached

Adjacent: Lolium perenne pasture

Section E-F

Aquatic: Potamogeton pectinatus - dense and extensive to at least 20m out
Filamentous algae - dense and extensive surface layer to c.20m out
Enteromorpha - sparse

Sand and gravel substrate with occasional cobbles

Marginal: As C-D

Adjacent: Earth bank (height 4m) with Rubus fruticosus
Backing to Lolium perenne - Dactylis glomerata - Trifolium repens pasture

Lough Murree

Section F-G

Aquatic: Potamogeton pectinatus - as E-F
Filamentous algae - as E-F
Enteromorpha - as E-F
Lamprothamnium papulosum - sparse
Chara canescens - sparse

Marginal: Unchanged

Adjacent: Unchanged

Section G-H

Aquatic: Ruppia sp. - sparse
Potamogeton pectinatus - sparse
Filamentous algae - as E-F
Enteromorpha - as E-F

Marginal: Juncus gerardii - Glaux maritima community as B-C

Adjacent: Unchanged

Section H-I (Transect B)

Aquatic: Ruppia sp. - sparse
Potamogeton pectinatus - sparse
Enteromorpha - dense and extensive to 5m out

Bedrock substrate

Marginal: Exposed bedrock substrate with occasional boulders
Scirpus maritimus growing in fissures of limestone pavement. 10m

Adjacent: Limestone pavement with Festuca rubra, Pteridium aquilinum, Rubus fruticosus,
Hedera helix, Prunus spinosa

Section I-J

Aquatic: Potamogeton pectinatus - sparse
Enteromorpha - sparse
Filamentous algae - patchy surface cover to c.30m out

Marginal: Unchanged

Adjacent: Unchanged

Lough Murree

Section J-K

Aquatic: Unchanged

Marginal: Unchanged

Adjacent: Agrostis stolonifera - Potentilla anserina grassland on limestone pavement

Section K-L

Aquatic: Potamogeton pectinatus - dense and extensive to at least 20m out
Filamentous algae - dense and extensive surface layer to c.20m out
Enteromorpha - restricted to shoreline rocks

Silt and sand substrate with occasional boulders

Marginal: As A-B. 1-5m strip

Adjacent: Earth and rock bank (height c.5m)
Backing to heath and grassland

Section L-M (Transect C)

Aquatic: Ruppia sp. - sparse to at least 20m out
Potamogeton pectinatus - patchy to at least 20m out
Enteromorpha - dense and extensive to c.20m out
Lamprothamnium papulosum - patchy to c.5m out
Chara canescens - sparse to c.5m out

Sand and gravel substrate with cobbles and boulders

Marginal: Unchanged

Adjacent: 1.5m dry stone wall
Arable farmland

Section M-N

Aquatic: Ruppia sp. - sparse
Potamogeton pectinatus - cover unchanged
Enteromorpha - cover unchanged

Silt and sand substrate with cobbles

Marginal: Unchanged

Adjacent: Agrostis stolonifera - Potentilla anserina grassland
Backing to public road

Lough Murree

Section N-O (Transect D)

Aquatic: Ruppia sp. - dense patches from c.5m to at least 20m out
Potamogeton pectinatus - dense patches from c.5m to at least 20m out
Filamentous algae - dense and extensive surface layer to c.15m out
Lamprothamnium papulosum - sparse
Chara canescens - sparse

Marginal: Unchanged

Adjacent: Unchanged

Section O-P

Aquatic: Ruppia sp. - cover unchanged
Potamogeton pectinatus - sparse
Filamentous algae - dense and extensive to c.5m out
Chara canescens - occasional dense patches to at least 12m out

Marginal: Unchanged

Adjacent: Unchanged

Section P-A

Aquatic: Ruppia sp. - dense and extensive to at least 30m out
Filamentous algae - sparse
Enteromorpha - sparse

Silt substrate

Marginal: Dense Scirpus maritimus single species swamp. 5-12m
Grading to Juncus gerardii - Agrostis stolonifera - Potentilla anserina community
as Transect A. 5-15m. Grazed and poached

Adjacent: Unchanged

2. Transects

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 1 Aquatic - 55m out - grapnel	
Sample area: Grapnel only	Substrate: Sand and silt	
Depth: 50 cm +	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Potamogeton pectinatus		
Enteromorpha		
Filamentous algae		
Description:		

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 2 Aquatic - 50m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 40 cm	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		40
Potamogeton pectinatus	40	40
Algae		100
Enteromorpha		100
Lamprothamnium papulosum	6	< 1
Description: Open cover of Potamogeton pectinatus beneath a free-floating algal mat.		

Lough Murree

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 3 Aquatic - 25m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 30 cm	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		< 5
Ruppia sp.	10	< 5
Algae		60
Enteromorpha		60
Lamprothamnium papulosum	10	5
Description: Sparse Lamprothamnium and low growing Ruppia with a patchy cover of free-floating Enteromorpha. Both flowering and fruiting Ruppia present.		

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 4 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 30 cm	Salinity: 22 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		20
Higher Plant		5
Ruppia sp.	8	5
Algae		15
Enteromorpha		15
Description: Sparse low growing Ruppia beneath an open cover of free-floating Enteromorpha.		

Lough Murree

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 5 Aquatic - 5m out	
Sample area: 25 (5x5)	Substrate: Sand	
Depth: 20 cm	Salinity: 24 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Enteromorpha		100
Description: Complete cover of Enteromorpha. No other species present. Same cover to shore.		

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 6 Marginal	
Sample area: 5m2 (5x1)	Substrate: Sand, cobbles, boulders	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		50
Juncus gerardii	15	30
Glaux maritima	10	15
Atriplex hastata	5	5
Suaeda maritima	8	< 1
Bare substrate		50
Cobbles		20
Boulders		20
Sand		10
Description: Juncus gerardii dominant in open, species-poor community of salt tolerant species forming 1m wide strip along stony shore.		

Lough Murree

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 7 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Juncus gerardii	15	25
Agrostis stolonifera	10	70
Potentilla anserina	8	5
Leontodon autumnalis	15	< 5
Glaux maritima	6	< 5
Plantago coronopus	10	< 5
Spergularia marina	8	< 1
Plantago major	10	< 1
Lolium perenne	20	< 1
Description: Juncus gerardii and Agrostis stolonifera dominant in grazed vegetation on poached ground, extending back to 35m from the lough in a low lying area (c. 75m x 25m) bordered by higher ground to north east and south west. Saline stream passing through this community to the lough. No flow at time of survey.		

Lough Murree

Site: Lough Muree	Transect code: A	
Location: Saline stream inflow	Sample point: 8 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		70
Juncus gerardii	20	10
Festuca rubra	15	15
Puccinellia maritima	10	15
Spergularia marina	8	15
Agrostis stolonifera	15	5
Plantago coronopus	5	5
Glaux maritima	6	5
Juncus bufonius	5	< 5
Leontodon autumnalis	15	< 1
Triglochin maritima	10	< 1
Description: Juncus gerardii, Festuca rubra, Puccinellia maritima and Spergularia marina all frequent with each species locally dominant. Vegetation grazed, substrate heavily poached with up to 50% bare ground in places. This community extends back 40m (x 20m) and borders an unvegetated saline pool of 20cm depth at time of survey. Grading to Lolium perenne pasture.		

Site: Lough Muree	Transect code: B	
Location: Limestone pavement shore	Sample point: 1 Aquatic - 10m out - grapnel	
Sample area: Grapnel only	Substrate: Coarse sand	
Depth: 50 cm +	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Potamogeton pectinatus		
Enteromorpha		
Description:		

Lough Murree

Site: Lough Muree	Transect code: B	
Location: Limestone pavement shore	Sample point: 2 Aquatic - 5m out	
Sample area: 25m2 (5x5)	Substrate: Bedrock	
Depth: 20 - 50 cm	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		5
Potamogeton pectinatus	70	5
Algae		95
Enteromorpha	15	95
Description: Enteromorpha dominant. P. pectinatus growing sparsely in fissures (grykes) of submerged limestone pavement.		

Site: Lough Muree	Transect code: B	
Location: Limestone pavement shore	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Bedrock and silt	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		5
Scirpus maritimus	80	5
Description: Open limestone pavement with Scirpus maritimus densely growing in silted fissures (grykes). 10m.		

Lough Murree

Site: Lough Muree	Transect code: B	
Location: Limestone pavement shore	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Bedrock	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		40
Agrostis stolonifera	30	35
Potentilla anserina	15	5
Juncus gerardii	25	< 1
Leontodon autumnalis	20	< 1
Description: Agrostis stolonifera dominant in species-poor community growing in fissures (grykes) of limestone pavement. 12m.		
Grading to more densely vegetated limestone pavement with Festuca rubra, Pteridium aquilinum, Prunus spinosa, Rubus fruticosus, Hedera helix frequent.		

Site: Lough Muree	Transect code: C	
Location: Marginal swamp	Sample point: 1 Aquatic - 20m out	
Sample area: 16m2 (4x4)	Substrate: Coarse sand, cobbles	
Depth: 70 cm	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		40
Potamogeton pectinatus	60	40
Ruppia sp.	60	< 1
Algae		70
Enteromorpha		70
Description: Patches of dense Potamogeton pectinatus locally dominant with Enteromorpha forming a free-floating algal mat. Ruppia in flower. Same species at more or less same cover from 10m to at least 25m out.		

Lough Murree

Site: Lough Muree	Transect code: C	
Location: Marginal swamp	Sample point: 2 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Sand, gravel, cobbles, boulders	
Depth: 30 cm	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		95
Higher Plant		< 1
Potamogeton pectinatus	30	< 1
Algae		95
Enteromorpha		75
Lamprothamnium papulosum	5	20
Chara canescens	6	< 1
Substrate		
Sand and gravel		50
Cobbles and boulders		50
Description: Patchy cover of Enteromorpha with open cover of low growing		
Lamprothamnium dominant below.		

Lough Murree

Site: Lough Muree	Transect code: C	
Location: Marginal swamp	Sample point: 3 Marginal	
Sample area: 16m2 (8x2)	Substrate: Sand, gravel, cobbles, boulders	
Depth: 0 - 20 cm	Salinity: 20 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Scirpus maritimus	50	40
Algae		80
Enteromorpha		80
Description: Open low growing Scirpus maritimus swamp with dense cover of Enteromorpha		
below. 3m wide strip along shore.		

Lough Murree

Site: Lough Muree	Transect code: C	
Location: Marginal swamp	Sample point: 4 Marginal	
Sample area: 16m2 (4x4)	Substrate: Coarse sand, cobbles	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		40
Scirpus maritimus	30	20
Glaux maritima	10	25
Substrate		
Cobbles		80
Sand		20
Description: Open Scirpus maritimus stand with Glaux the only associated species. 4m wide		
strip on stony shore.		

Site: Lough Muree	Transect code: C	
Location: Marginal swamp	Sample point: 5 Marginal	
Sample area: 16m2 (8x2)	Substrate: Coarse sand, cobbles	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		60
Glaux maritima	8	40
Juncus gerardii	25	20
Potentilla anserina	8	5
Agrostis stolonifera	15	< 1
Description: Glaux and Juncus gerardii dominant in fairly open species-poor community		
forming 3m wide strip.		
Backing 1.5m dry stone wall.		
Backing arable farmland.		

Lough Murree

Site: Lough Muree	Transect code: D	
Location: Marginal swamp	Sample point: 1 Aquatic - 20m out	
Sample area: 16m2 (4x4)	Substrate: Silt, cobbles	
Depth: 80 cm +	Salinity: 15 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		100
Ruppia sp.	85	60
Potamogeton pectinatus	90	40
Algae		10
Filamentous algae		5
Lamprothamnium papulosum	70	5
Chara canescens	60	< 1
Substrate		
Silt		90
Cobbles		10
Description: Ruppia and Potamogeton pectinatus co-dominant in dense bed with occasional patches of tall Lamprothamnium and very sparse Chara canescens. Filamentous algae free-floating, sparse. Some Ruppia plants in flower, some in fruit. Silty substrate of 10 - 20cm depth.		

Lough Murree

Site: Lough Muree	Transect code: D	
Location: Marginal swamp	Sample point: 2 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Silt, Boulders	
Depth: 30 cm	Salinity: 15 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		30
Potamogeton pectinatus	40	25
Ruppia sp.	35	5
Algae		90
Filamentous algae		90
Substrate		
Boulders		70
Silt		30
Description: Open cover of Potamogeton pectinatus dominant below free-floating algal mat.		
Both flowering and fruiting Ruppia plants present.		

Site: Lough Muree	Transect code: D	
Location: Marginal swamp	Sample point: 3 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Silt, coarse sand, boulders	
Depth: 0 - 15 cm	Salinity: 15 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		< 1
Potamogeton pectinatus	30	< 1
Algae		100
Filamentous algae		80
Enteromorpha		20
Substrate		
Silt and sand		80
Boulders		20
Description: Filamentous algae forming complete surface layer with Enteromorpha occurring		
on frequent submerged rocks. Potamogeton pectinatus very sparse.		

Lough Murree

Site: Lough Muree	Transect code: D	
Location: Marginal swamp	Sample point: 4 Marginal	
Sample area: 10m2 (10x1)	Substrate: Peat, cobbles, boulders	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		70
Scirpus maritimus	60	70
Bare substrate		50
Silt		30
Cobbles and boulders		20
Description: Fairly open Scirpus maritimus single species swamp forming 1m strip.		

Site: Lough Muree	Transect code: D	
Location: Marginal swamp	Sample point: 5 Marginal	
Sample area: 16m2 (8x2)	Substrate: Peat, cobbles, boulders	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		50
Scirpus maritimus	40	30
Glaux maritima	15	20
Agrostis stolonifera	10	< 1
Bare substrate		60
Peat		40
Cobbles and boulders		20
Description: Low growing open Scirpus maritimus cover with Glaux dominant below. 3m.		

Lough Murree

Site: Lough Muree	Transect code: D	
Location: Marginal swamp	Sample point: 6 Marginal	
Sample area: 10m2 (10x1)	Substrate: Peat, cobbles	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		90
Juncus gerardii	25	60
Glaux maritima	10	25
Agrostis stolonifera	10	5
Potentilla anserina	8	< 5
Bare substrate		
Peat		5
Cobbles		5
Description: Dominant Juncus gerardii in dense patches with abundant Glaux. 1m strip. Grading to Agrostis stolonifera - Potentilla anserina grassland on c. 45 degree slope to c. 1m height backing to public road.		

10.3.4 Evaluation

'Valuable'

The vegetation of Lough Muree is notable for its species composition and for the abundance of these typically brackish water plants.

Salinity levels varied across the site from 13-24 parts per thousand at time of survey. There is no freshwater inflow stream. No marine higher plant or algal species were found here. Neither were there any aquatic angiosperms associated with mildly brackish conditions.

Ruppia and Potamogeton pectinatus occur within 20 metres of all but the north eastern shores. P.pectinatus is dominant in dense beds along the eastern and western shores with more or less sparse Ruppia. Ruppia is locally dominant over P.pectinatus in mixed beds along the southern shore.

It is notable that both Ruppia cirrhosa and R.maritima occur at this site.

Lough Murree

Two rare charophytes were already known to occur here - Lamprothamnium papulosum and Chara canescens. Both were re-found during the course of this survey. Both are occasional along the western shore. Lamprothamnium is abundant along the southern half of the eastern shore and both species are frequent to locally abundant amongst Ruppia and P.pectinatus to at least 20 metres out from the southern shore. The presence of these rare charophytes is reason enough in itself to regard this site as valuable.

Marginal vegetation is fairly uniform. Scirpus maritimus fringes all shores, typically forming a more or less narrow strip interrupted by occasional open stands of Juncus gerardii dominated vegetation. Limestone pavement forms the north eastern shore and here Scirpus grows in the fissures between the bedrock slabs.

Lough Muree seems to present a good example of a brackish water community subject to a middling range of salinity. Its macrophytes are abundant and its charophyte species particularly notable.

Full aquatic survey is recommended.

10.4 ECOTONAL COLEOPTERA

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10.4.1 Site Description

Coastal brackish lagoon with shingle barrier and subterranean or subaquatic karst channel connections to, and possibly from, sea. Virtually no tidal response, but with seasonal water level fluctuation. Lake shore with organic-rich silty and sandy margins with extensive algal growth, and with some limestone outcrops, boulders and cobbles (Plates 1 and 2). Sparse *Scirpus maritimus* stands, but occasionally dense in patches.

Subsites (see Fig 10.4.1)

1. *Scirpus maritimus* (M 252118) Plate 1

Small (c.100 m^2) stand of *Scirpus maritimus* on silty sand shore at nearest point to sea barrier. Extensive algal growth both on cobbles, shore sediment and on water. Adjacent unvegetated shore with cobbles completely covered by bleached algal growth, with many amphipods and some *Ligia oceanica*. Salinity of near-shore water was 22‰ after spring tide (29 ix 96).

2. Grass bank (M 254117)

Bank several cm above unvegetated shore with *Agrostis* sp., *Potentilla anserina*, *Juncus* sp., etc. Likely to be flooded during winter. Salinity of near-shore water was 11‰ after spring tide (29 ix 96).

10.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

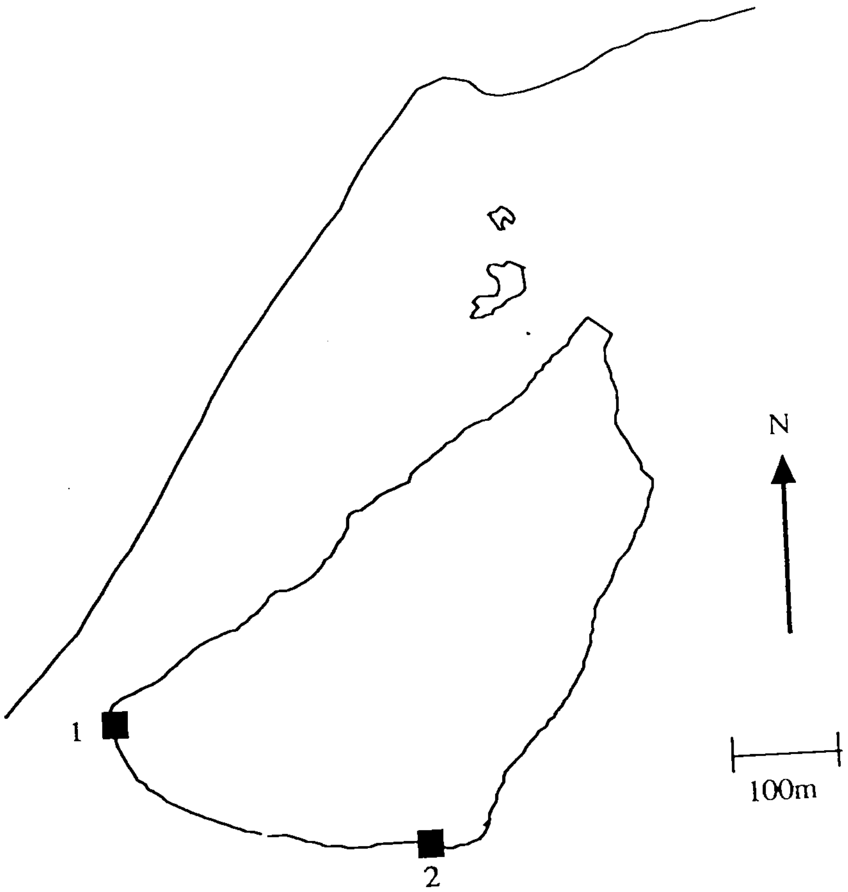

Fig. 10.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Lough Murree, Co. Clare

1 - Pitfall traps, Ground search, S-vac
2 - Pitfall traps

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 10.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample

were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

TABLE 10.4.1. Details of sampling methods.

Method	**Details**	**No. replicates per unit sample**	**Sampling period, etc.**
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is

not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References
Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.
Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Scirpus maritimus* area - S-vac suction sampler (4 viii 1996), c. 2 m^2;
(2) *Scirpus maritimus* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (4 viii - 29 ix 1996);
(3) Unvegetated shore near *Scirpus maritimus* area - cobble search (30 cobbles, 7 vii 1996);
(4) Grass bank - 6 plastic pitfall traps with funnels and ethylene glycol preservative (29 ix - 18 x 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

10.4.3 Survey Results

Eight species of carabid and twenty-two species of staphylinid were recorded, two species of which are regarded as indicator species (Table 10.4.2).

TABLE 10.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Lough Murree. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), and Booth (1988) for *Tachyporus dispar*.

	Species	No. individuals	
Carabidae			
	Bembidion assimile Gyll.	27	
	Bembidion lampros (Hbst)	1	
	Bembidion mannerheimi Sahlb.	3	
	Bembidion minimum (F.)	42	
	Bembidion varium (Ol.)	1	
	Harpalus rufipes (Geer)	1	
	Leistus fulvibarbis Dej.	1	
	Loricera pilicornis (F.)	1	
Staphylinidae			
	Aleochara lanuginosa Grav.	1	
	Anotylus rugosus (F.)	1	
	Atheta amplicollis (Muls. Rey)	5	
	Atheta fungi (Grav.)	1	
	Atheta graminicola (Grav.)	2	
	Atheta vestita (Grav.)	22	
	Atheta volans (Scriba)	2	
*	*Brundinia meridionalis* (Muls. Rey)	62	**Indicator species**
	Carpelimus corticinus (Grav.)	3	
	Cordalia obscura (Grav.)	26	
	Euaesthetus bipunctatus (Ljungh)	1	
	Gabrius pennatus Sharp	1	
	Geostiba circellaris (Grav.)	4	
	Ocypus olens (Müll.)	1	
	Omalium laeviusculum Gyll.	9	
	Stenus brunnipes Steph.	2	
	Stenus canaliculatus Gyll.	2	
	Stenus fulvicornis Steph.	1	
*	*Stenus nigritulus* Gyll.	3	**Indicator species**
	Tachinus signatus Grav.	4	
	Tachyporus dispar (Payk.)	1	
	Xantholinus longiventris Heer	3	

Brundinia meridionalis occurred in abundance in the *Scirpus maritimus* area (Table 2). It has not been previously recorded from Ireland. Although it is not listed in Hyman and Parsons (1994) as rare or notable in Great Britain, it appears to be rare or local in many parts of Europe (Porta 1926, Palm 1970, Benick & Lohse 1974, Mahler 1987, Koch 1989). *B. meridionalis* is a halophilous species, recorded from tidal refuse and silty soils on the coast and also on inland saline soils in Austria and other countries (Steel 1970, Koch 1989). Tidally undisturbed lagoons with stagnant water are favoured by this species - relatively large populations were recorded on organic-rich soils with dense algal growth at three lagoons in this survey (also at Bridge Lough and Cloonconeen), but not at other sites.

Stenus nigritulus is only known in Ireland from one record (1910) from Lough Neagh (Anderson 1984), although it was also found at Tacumshin Lake (Co. Wexford) during this survey. It is very local and declining in Britain according to Hyman & Parsons (1994), and scattered and rare in France (Horion 1963). However, it is not rare in Fennoscandia, and common in eastern Central Europe (Horion 1963). The species is restricted to marshy shores, including flooded meadows (Horion 1963), riverbanks and salt-marshes (Hyman & Parsons 1994), but also on sea shores (Koch 1989).

All but one of the dominant and intermediate staphylinid species recorded from the *Scirpus maritimus* stand were either halophilous or associated with riparian and marsh habitats (Table 10.4.3). Several of these species were stenotopic. Species occurring in disturbed nutrient-rich agricultural soils were only present as singletons. In contrast, these species were dominant in Bridge Lough, a similar lagoon on karst limestone.

TABLE 10.4.3. Staphylinid assemblage from *Scirpus maritimus* area, Lough Murree (S-vac suction sample and pitfall traps combined). Abund. Cat. refers to category of relative abundance (no. individuals: 1, 2-10, 11+).

Abund. Cat.	Species	No.	Main biotope
Dominant	*Atheta vestita*	17	Stenotopic halobiont, ripicolous
	Brundinia meridionalis	52	Halophilous, coastal
Intermediate	*Atheta graminicola*	2	Marshes, shores of water bodies
	Atheta volans	2	Marshes, shores of water bodies
	Carpelimus corticinus	3	Ripicolous
	Cordalia obscura	2	Eurytopic
	Omalium laeviusculum	9	Halobiont, decaying seaweed
	Stenus canaliculatus	2	Sandy & silty shores, incl. coastal
	Stenus nigritulus	3	Stenotopic, marshy shores
Present	*Aleochara lanuginosa*	1	Eurytopic, incl. nutrient-rich cultivated land
	Anotylus rugosus	1	Eurytopic, incl. nutrient-rich cultivated land
	Atheta amplicollis	1	Eurytopic, incl. nutrient-rich cultivated land
	Atheta fungi	1	Eurytopic, incl. nutrient-rich cultivated land
	Euaesthetus bipunctatus	1	Marshes, pool margins
	Ocypus olens	1	Grassland incl. dune grassland
	Tachinus signatus	1	Eurytopic, incl. nutrient-rich cultivated land
	Tachyporus dispar	1	Grassland
	Xantholinus longiventris	1	Eurytopic, incl. nutrient-rich cultivated land

10.4.4 Evaluation

Of average conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of two indicator species (Table 10.4.2), plus a group of dominant/intermediate abundance ripicolous and halophilous species (Table 10.4.3), indicates an ecologically well-developed system.

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Plate 1 Western shore Lough Murree, Co. Clare

Plate 2 Southern shore Lough Murree, Co. Clare

10.5 SUMMARY AND EVALUATION

Lough Murree is a medium-sized (15 ha) **rock lagoon** of a special morphological type occurring in karstic limestone. As a coastal lagoon it is of international importance based on the Habitats Directive.

The lake is part of the proposed Galway Bay NHA (Site Code No. 268)

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	Exceptional
Aquatic Fauna	Low/Moderate
Vegetation	Exceptional
Ecotonal Coleoptera	Average

Geomorphology.

Lough Murree is a coastal lagoon of a special morphological type occurring in karstic limestone. There is a typical cobble barrier on the shore but there is no visible connection with the sea. The lagoon appears to receive seawater through underground fissures in the limestone, and possibly occasional over-topping of the barrier during storms.

Based on geomorphology, Lough Murree is rated as of exceptional conservation value as a rare type of lagoon found in karstic limestone.

Aquatic Fauna

Among 25 taxa recorded, 20 are identified to species, including three which are listed as a lagoonal specialists in Britain. None of the species identified can be described as rare in Ireland.

The species assemblage typifies a medium salinity lagoon which has no direct contact with the sea. The medium salinity regime, good macrophyte growth and availability of both hard and soft substrates might be expected to provide conditions favouring a wide range of species, but the faunal richness was, in fact, low due probably to the limited opportunities for colonisation. In the absence of a sea inlet or frequent overwash, marine colonists presumably enter by way of rock fissures or some form of aerial transport. It is possible also that the eutrophic conditions which resulted in a severe algal bloom in July may have depleted the fauna. Blooms are not new to this lake, however, and were reported in the 1960s (Lansbury 1965).

Lough Murree

Previous studies indicate that conditions in the lake undergo wide fluctuations resulting in important variations in faunal composition. The salinity in 1974 was similar to that of 1996 but the fauna indicated a less saline regime with corixids (*Sigara stagnalis)*, a beetle (*Enochrus halophilus*) (both lagoonal specialists) and a variety of insect larvae coexisting with *Neomysis, Palaemonetes, Jaera* and *Potamopyrgus*, while empty shells of barnacles and *Pomatocerus* indicated that a more marine environment had existed in the past (Pybus and Pybus 1981).

Based on the relatively poor faunal assemblage and low numbers of lagoonal specialists recorded in the survey, Lough Murree is rated as of only low to moderate conservation value.

Vegetation

The vegetation of Lough Muree is notable for its species composition and for the abundance of these typically brackish water plants.

Salinity levels varied across the site from 13-24 ‰ at time of survey. There is no freshwater inflow stream. Neither were there any aquatic angiosperms associated with mildly brackish conditions.

Ruppia and *Potamogeton pectinatus* occur within 20 metres of all but the north eastern shores. *P.pectinatus* is dominant in dense beds along the eastern and western shores with more or less sparse *Ruppia*. *Ruppia* is locally dominant over *P.pectinatus* in mixed beds along the southern shore.

It is notable that both *Ruppia cirrhosa* and *R.maritima* occur at this site.

Two rare charophytes were already known to occur here - *Lamprothamnium papulosum* and *Chara canescens*. Both were re-found during the course of this survey. Both are occasional along the western shore. *Lamprothamnium* is abundant along the southern half of the eastern shore and both species are frequent to locally abundant amongst *Ruppia* and *P.pectinatus* to at least 20 metres out from the southern shore. The presence of these rare charophytes is reason enough in itself to regard this site as valuable.

Marginal vegetation is fairly uniform. *Scirpus maritimus* fringes all shores, typically forming a more or less narrow strip interrupted by occasional open stands of *Juncus gerardii* dominated vegetation. Limestone pavement forms the north eastern shore and here *Scirpus* grows in the fissures between the bedrock slabs.

Lough Muree seems to present a good example of a brackish water community subject to a middling range of salinity. Its macrophytes are abundant and its charophyte species particularly notable.

Based on vegetation Lough Murree is rated as of high conservation value

Full aquatic survey is recommended.

Lough Murree

Ecotonal Coleoptera

Eight species of carabid and twenty-two species of staphylinid were recorded, two species of which are regarded as indicator species.

Brundinia meridionalis occurred in abundance in the *Scirpus maritimus* area. It has not been previously recorded from Ireland. Although it is not listed in Hyman and Parsons (1994) as rare or notable in Great Britain, it appears to be rare or local in many parts of Europe. *B. meridionalis* is a halophilous species, recorded from tidal refuse and silty soils on the coast and also on inland saline soils in Austria and other countries. Tidally undisturbed lagoons with stagnant water are favoured by this species - relatively large populations were recorded on organic-rich soils with dense algal growth at three lagoons in this survey (also at Bridge Lough and Clooncooneen), but not at other sites.

Stenus nigritulus is only known in Ireland from one record (1910) from Lough Neagh (Anderson 1984), although it was also found at Tacumshin Lake (Co. Wexford) during this survey. It is very local and declining in Britain according to Hyman & Parsons (1994), and scattered and rare in France. However, it is not rare in Fennoscandia, and common in eastern Central Europe. The species is restricted to marshy shores, including flooded meadows, riverbanks and salt-marshes, but also on sea shores.

All but one of the dominant and intermediate staphylinid species recorded from the *Scirpus maritimus* stand were either halophilous or associated with riparian and marsh habitats. Several of these species were stenotopic. Species occurring in disturbed nutrient-rich agricultural soils were only present as singletons. In contrast, these species were dominant in Bridge Lough, a similar lagoon on karst limestone.

The presence of two indicator species, plus a group of dominant/intermediate abundance ripicolous and halophilous species, indicates an ecologically well-developed system.

Lough Murree is therefore rated as of average conservation value for terrestrial ecotonal community.

Summary

Lough Murree is a good example of a rare type of rock lagoon receiving seawater by way of underground rock crevices.

The lagoon is fairly well documented. There are published accounts of algae, Hemiptera, fauna and hydrology. The presence of a University Field Station encourages further research projects.

The lake obviously suffers from eutrophication and the invertebrate fauna recorded in this survey was poor. However, as a representative of an unusual morphological type **of coastal lagoon with a rich aquatic flora its conservation value is high.**

Based on geomorphology, vegetation and an interesting ecotonal fauna, Lough Murree is rated as of high conservation value.

Designation as a proposed SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

11. AUGHINISH LAGOON

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

11. AUGHINISH LAGOON

CONTENTS

11. AUGHINISH LAGOON, Co. Clare.

OS Grid Reference: M 286 134, 1:50,000 Sheet No. 51
Alternative names: ?

11.1 STUDY AREA

General Features
Aughinish Lagoon is situated on the south side of Galway Bay, 5 km west of Kinvarra, County Clare (Fig. 11.1.1). The lake is impounded by a cobble barrier with a meandering outlet through the barrier at the eastern end. A Martello tower was constructed on the barrier and the road leading to the tower originally had a bridge crossing this outlet. The bridge has now collapsed and the road is partly eroded due to changes in the course of the outlet stream. Aughinish is a good example of a shallow, sometimes hypersaline, lagoon with a cobble barrier, fed to an unknown extent by underground channels.

Very little is known about the lagoon: It appears to have no protective status other than the fact that it is included within a large proposed NHA referred to as the Galway Bay Complex (Site Code 268)

Climate and oceanographic influences
(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 5.5-6 °C in January and 15-15.5 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 9.5 and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1200 mm, and the number of rain days (1 mm or more) is 10 months. Prevailing winds are from the west and southwest. Mean annual hourly wind speeds are 5.0 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35(Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Galway is 4.5 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology The lagoon lies on Carboniferous limestone on the northwest side of the Burren area. Soils are described as lithosols or shallow organic soils and shallow brown earths. The area is karstic, with numerous underground channels and surface drainage is low. The low areas surrounding the lake are mostly improved grassland and cereals.

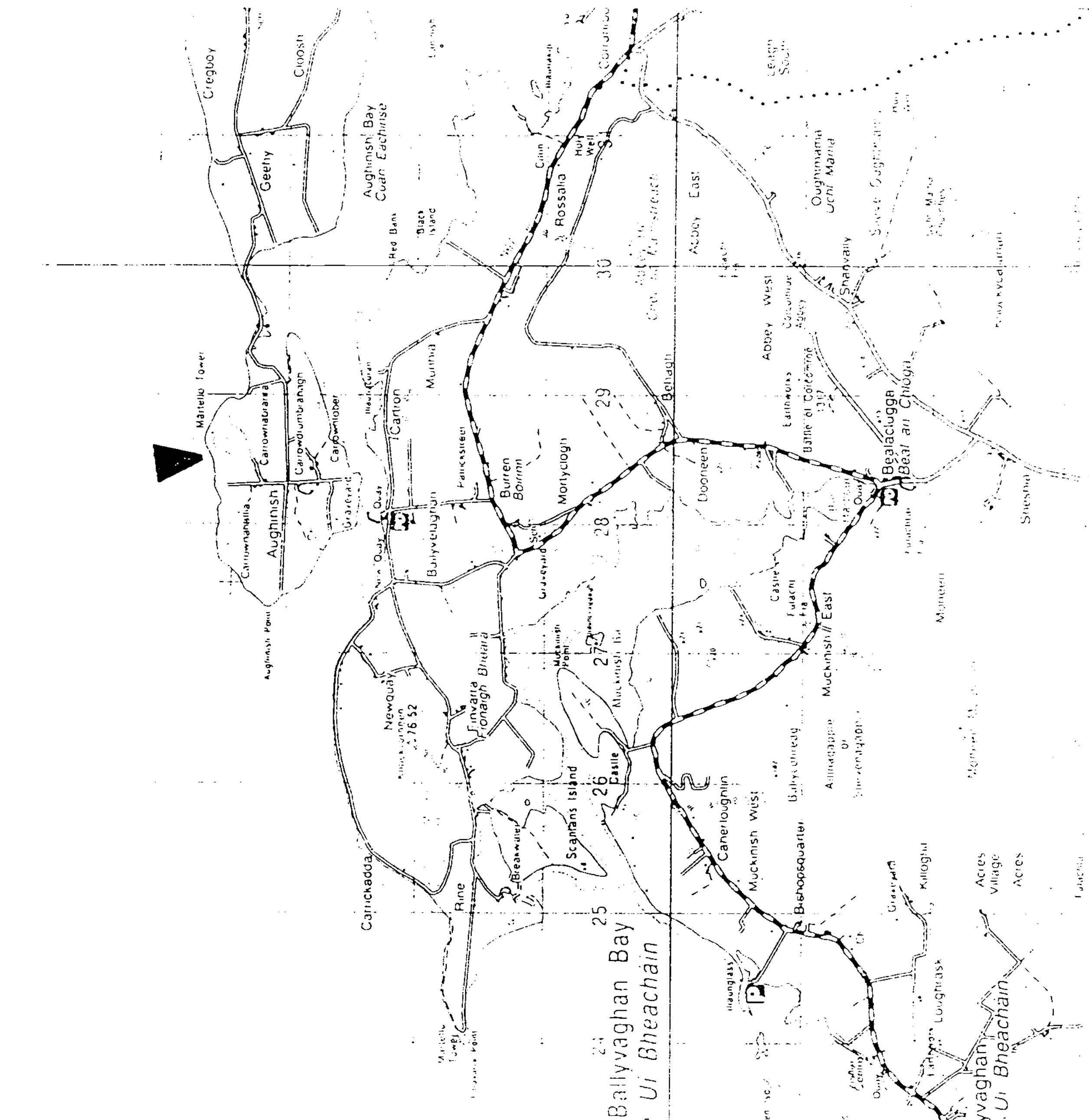

Fig. 11.1.1 Section of 1 50 000 map showing locality of Aughinish Lagoon

Lake Topography The lagoon is approximately 600 m from west to east, approximately 200 m across and total area is approximately 10 ha. Most of the lake is shallow (<2 m) and substrate includes limestone bedrock, with varying amounts of large rocks, cobbles, sand and softer organic sediments at the less disturbed western end.

Hydrology There is no obvious freshwater inlet, but the lagoon lies on limestone bedrock and may be fed by underground channels. Spring tides enter the lagoon through the outlet channel in the east and the barrier is overtopped at the lower western end during storms. It is also possible that seawater enters by percolation.

There is likely to be a daily tidal fluctuation in water level of the lake during spring tides only, but a seasonal pattern may occur whereby water levels rise in the winter with the increased rainfall, and gradually decline in the summer. Water levels appear to have increased in recent times, flooding neighbouring fields (Plate 11.2.2).

Salinity and water quality Salinity levels are likely to be close to that of seawater with hypersaline conditions occurring during summertime neap tides.

There are no obvious eutrophication problems partly due to the fact that the lagoon is regularly flushed by seawater. The lagoon is small and shallow, however, and therefore vulnerable to water quality problems (see Bridge Lough, section 12).

11.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

11.2.1 Methods

Environmental variables

A transverse profile of the barrier was drawn using heights measured with a builders level and staff. Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰. precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and E in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons

between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available.

11.2.2 Results

Aughinish Lagoon was sampled on the 23.vi.96 during the first part of the survey, and from the 5-6.viii.96 during the more intensive survey.

Five sampling stations were selected in the lake to reflect the influences of substrate, and tidal inflows. Fig. 11.2.1 shows the position of these sampling stations in the lagoon.

Environmental Variables

A transverse profiles at two places along the barrier were drawn using heights measured with a builders level and staff. (Fig. 11.2.2).

Station A (OS 2845 1345) was located at the western end of the lagoon, which is normally the most sheltered, except in storms when the barrier is overtopped (Plate 11.2.1). Water depth varied from 0 cm to 1 m, substrate was mostly soft organic mud, with numerous large stones, cobbles and gravel in places and salinity measured 40 ‰

Station B (OS 2867 1348) was located on the northern shoreline in the bay below the Martello Tower. Substrate was coarse sand, with occasional rocks, water depth was 50 cm - 1 m and salinity measured 34 ‰.

Station C (OS 2867 1329) was located on the southern shore of the lagoon (Plate 11.2.2). Substrate consisted of soft organic mud in the area where cattle were fed but was mostly large limestone rocks with varying amounts of sand and cobbles in most of the sample area. Water depth was 0-1.5 m and salinity measured 34 ‰.

Station D (OS 28981346) was located at the eastern end near the outlet from the lagoon and the remains of the old bridge (Plate 11.2..4). Substrate consisted of cobbles and occasional larger stones with patches of coarse sand and gravel. Depth varied from 0 cm - 1 m and salinity measured 34 ‰.

Station E (OS 2863 1334) was located in the central, narrow part of the lagoon. A deep channel runs through this constricted part of the shoreline. Depth varies from 0 - 3 m, substrate is sand with large rocks and cobbles and salinity measured 35 ‰

Fig. 11.2.1 Location Map of Sampling Stations in Aughinish Lagoon, Co. Clare.

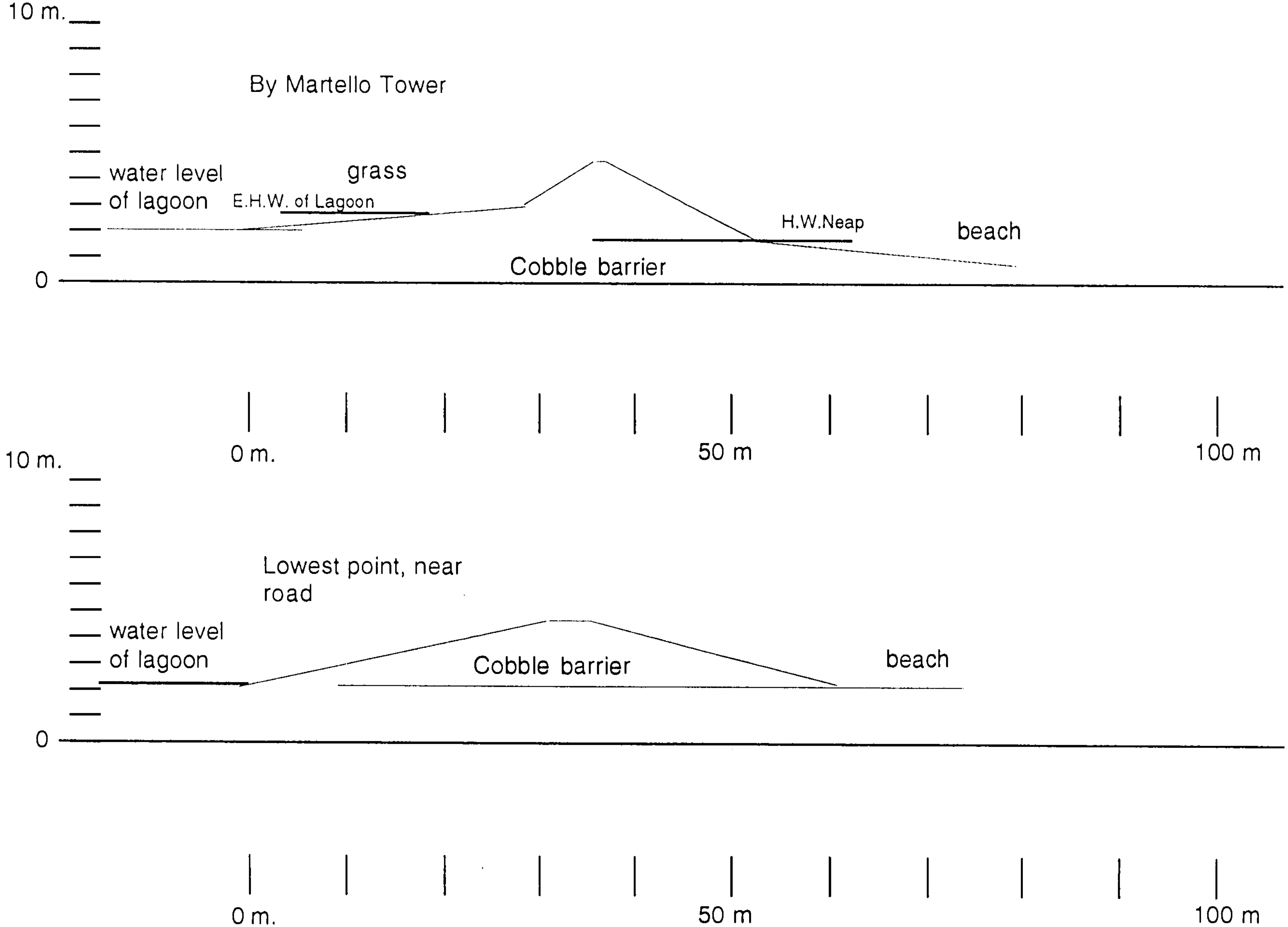

Fig. 11.2.2 Profile of Barrier at Aughinish Lagoon, Co. Clare.

Table 11.2.1. Fauna Recorded in Aughinish Lagoon, Co. Clare. July and August 1996.
( ) = records for July.

Fauna		Sampling Stations (L.T. = light-trap)								
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E
Porifera										
Cnidaria	*Anemonia viridis*	+				+				
	Chrysaora hysoscella							+		
	Dynamena pumila	+								
Turbellaria										
Nemertea										
Annelida	*Arenicola marina*			+						
	Capitella capitata			+				+		
	Hediste diversicolor					+				
	Lepidonotus squamatus	+								
	Pomatoceros triqueter	+						+		
	Polychaeta indet.							+		
	Spirorbis rupestris	+				+				
Crustacea										
Ostracoda										
Copepoda							+			
Cirripedia	*Balanus balanus*					+				
	Semibalanus balanoides	+				+				
Mysidacea	*Mysidopsis gibbosa*						10		22	22
	Praunus flexuosus	a	22	+	+	a	6	a	25	25
	P. neglectus								1	
Isopoda	*Idotea baltica*	+								
Amphipoda	*Dexamine spinosa*					+		+		
	Gammarus chevreuxi		+							
	G. duebeni	+								
	G. locusta	+	+			+		+		
	Melita palmata							+		
	Talitrus saltator							+		
Tanaidacea										
Decapoda	*Carcinus maenas*	+		+		+		+		
	Crangon crangon	c	6			a	2	+	2	2
	Hippolyte varians	1						o		
	Macropodium rostrata	+		+		+				
	Pagurus bernhardus			+						
	P. elegans					a	1	a		
	P. serratus	+				o				
	Thoralus cranchii							1		
Arachnida						+				
Insecta										
Hemiptera										
Coleoptera										
Odonata										
Plecoptera										
Trichoptera										

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Table 11.2.1. cont.. Fauna Recorded in Aughinish Lagoon, Co. Clare. July and August 1996.
( ) = records for July.

Fauna		Sampling Stations (L.T. = light-trap)								
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E
Ephemeroptera										
Diptera										
Mollusca										
Polyplacophora	*Lepidochitona cinerea*	+				+		+		
Prosobranchia	*Bittium reticulatum*	+						+		
	Gibbula umbilicalis							c		
	Littorina littorea	+								
	L. saxatilis							o		
	Patella aspera							+		
Opisthobranchia	*Aeolidia papillosa*	(+)								
	Elysia viridis					+		+		
Pulmonata										
Bivalvia	*Cerastoderma edule*			?				+		
	Modiolarca tumida					1				
	Mytilus edulis	+				+		+		
	Ostrea edulis	+				+				
	Venerupis sp.							2		
Bryozoa	*Alcyonidium gelatinosum*					+				
	Bowerbankia gracilis	+								
	Cryptosula pallasiana	+		+						
Echinodermata	*Amphipholis squamata*	+		+				+		
Tunicata	*Ascidiella aspersa*	+		+		+		+		
	A. scabra	+		+		+		+		
	Botryllus schlosseri	+				+				
	Clavelina lepadiformis	+								
	Diplosoma lysterianum	+				+		+		
Teleostei	*Anguilla anguilla*	F, 4								
	Ciliata mustela	F, 1								
	Pollachius pollachius	F, 6								
	Pomatoschistus microps	+				+				

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 11.2.1. Among 56 taxa listed, 54 are identified to species. Four species (*Balanus improvisus, Praunus flexuosus, Crangon crangon* and *Littorina saxatilis* are tolerant of lowered salinity and can be classed as polyhaline species; *Hediste diversicolor, Carcinus maenas, Anguilla anguilla* and *Pomatoschistus microps* are euryhaline species. The remainder are marine species. One species (*Gammarus chevreuxi*) is listed as a lagoonal specialist in Britain (Davidson *et al.* 1991), but the salinity range of this species is not known.

As the salinity was equivalent to that of seawater, or hypersaline, throughout the lake, and there were no point sources of freshwater, only physical habitat differences are assumed to affect species composition and abundance at the different stations. Both A and C were rocky with abundant algae and a number of sessile and cryptic species were present, while at B and D there were soft sediments and burrowing forms were well represented. No live burrowing bivalves were found, however, although shells of several species were plentiful.

11.2.3 Discussion

The faunal assemblage was almost entirely marine, all of the species classed as polyhaline or euryhaline being common intertidally on rocky shores. Geomorphologically, the site shows the characteristics of a typical lagoon with shallow water and a tidal inlet allowing only a small tidal range. The paucity of species typical of brackishwater lagoons may be attributed to the small freshwater input, with most surface water on the surrounding land disappearing underground through infiltration.

The only species of interest is *Gammarus chevreuxi* for which there are only two Irish records: a report by Spooner in the Plymouth Marine Fauna (1957) giving the position as "NE Ireland (rarely)", and a subsequent report by Pinkster (1978). The species is widespread in Europe in brackish habitats and is listed as a lagoonal specialist in Britain by Davidson *et al.* (1991) but Costello *et al.* (1989) list it as a species for which Irish records require confirmation. This was one of the few lagoons in which *Gasterosteus aculeatus* was absent

11.2.4 Threats

There are no obvious eutrophication problems, partly due to the fact that the lagoon is regularly flushed by seawater. The lagoon is small and shallow, however, and therefore vulnerable to water quality problems (see Bridge Lough, Section 12).

It appears that water levels have been rising and many of the small fields surrounding the lagoon are now partly flooded. There may be a threat of infilling by local farmers in order to regain lost land.

11.2.5 Evaluation

Aughinish is a **natural sedimentary lagoon**, having a cobble barrier and a natural inlet, and is therefore of international importance.based on geomorphology.

It is an unusual type as it is situated in karstic limestone and probably receives seawater through subterranean rock fissures as well as by way of the inlet, although the fact that it becomes hypersaline suggests that seawater in the lagoon is to some extent isolated.

The aquatic fauna is unusual for a lagoon in that it is almost entirely marine. The single lagoonal species, a rare amphipod, was present in low numbers only.

The aquatic fauna of the lagoon is a rich collection of marine species. The shallow water and virtual absence of tides, together with the close proximity to Galway, make it a potentially useful site for teaching purposes.

The lagoon lies within the boundary of the proposed Galway Bay NHA (site Code 0268).

In conclusion, although there was only one lagoonal specialist recorded, lboth faunistically and geomorphologically the conservation value of Aughinish Lagoon is high, and the site deserves protection and further study. Its designation as a proposed SAC is recommended.

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Plate 11.2. 1 View of the western area of Aughinish Lagoon with the Martello Tower, Station A (foreground).

Plate 11.2. 2 View of flooded fields in Aughinish Lagoon, near Station C.

Plate 11.2. 3 View of the barrier of Aughinish Lagoon from the Martello Tower.

Plate 11.2. 4 View of eastern area of Aughinish Lagoon, Station D.

11. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

11.3.1 Site Description (Fig. 11.3.1)

This small lagoon is situated on a low-lying peninsula and bordered by pasture to the south and west and a shingle barrier with the sea beyond to the north and east. Dry stone walls criss-cross the adjacent farmland and run along the lagoon's southern and western shores in places.

There is no major freshwater inflow stream. The outlet channel runs out to the sea through the barrier from the eastern end.

Shore slope is generally gradual to the north and associated with saltmarsh, except along the steeper, sparsely vegetated shingle barrier. To the south and south west narrow shores quickly give way to rising ground and adjacent pasture.

An area of saltmarsh subject to periodic flooding lies just to the west of the lagoon.

6.3.2 Methods

Two survey methods were employed in the course of fieldwork:
1. Transects
2. Shore-based survey

1. Transects:

The locality of these is shown in Fig. 11.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

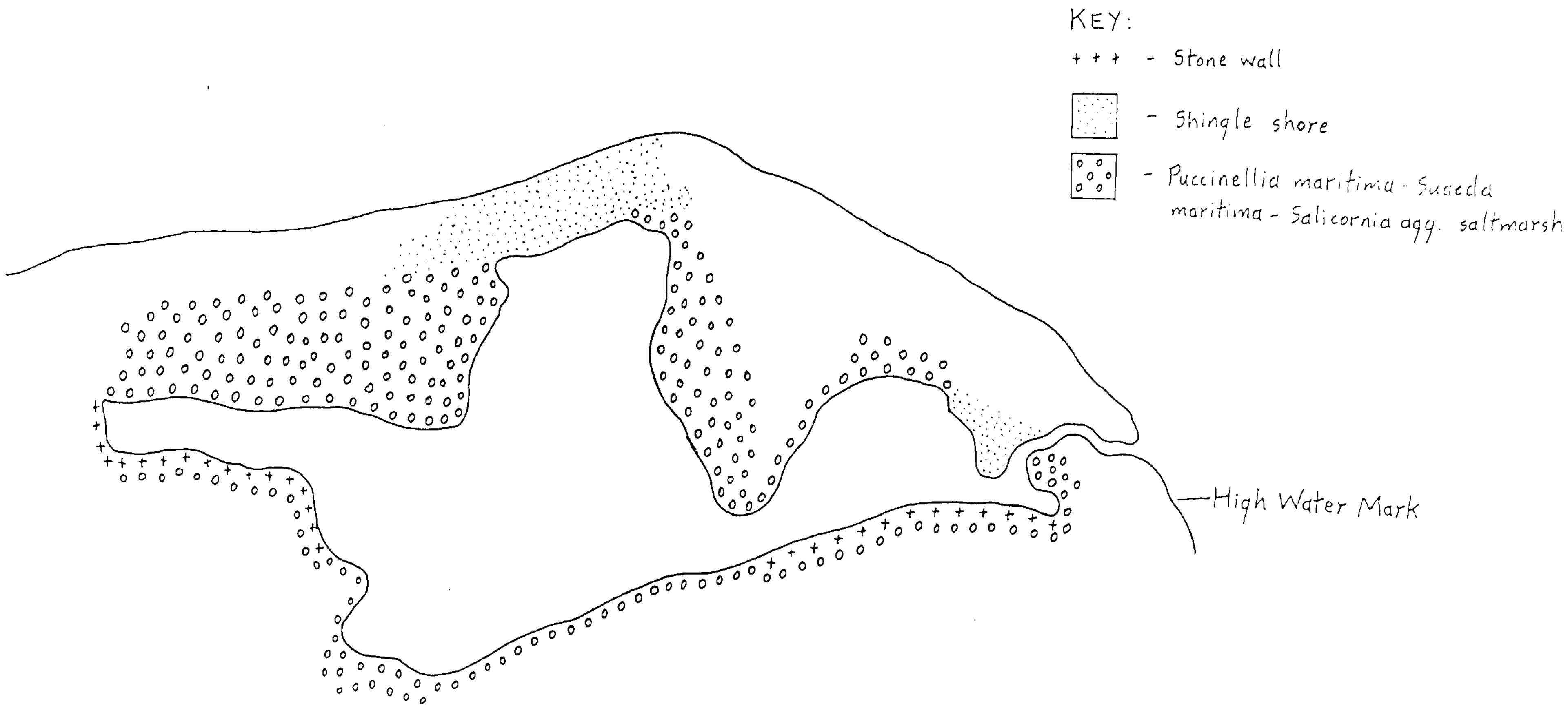

Fig. 11.3.1 Aughinish Lagoon, Co. Clare - Marginal Vegetation

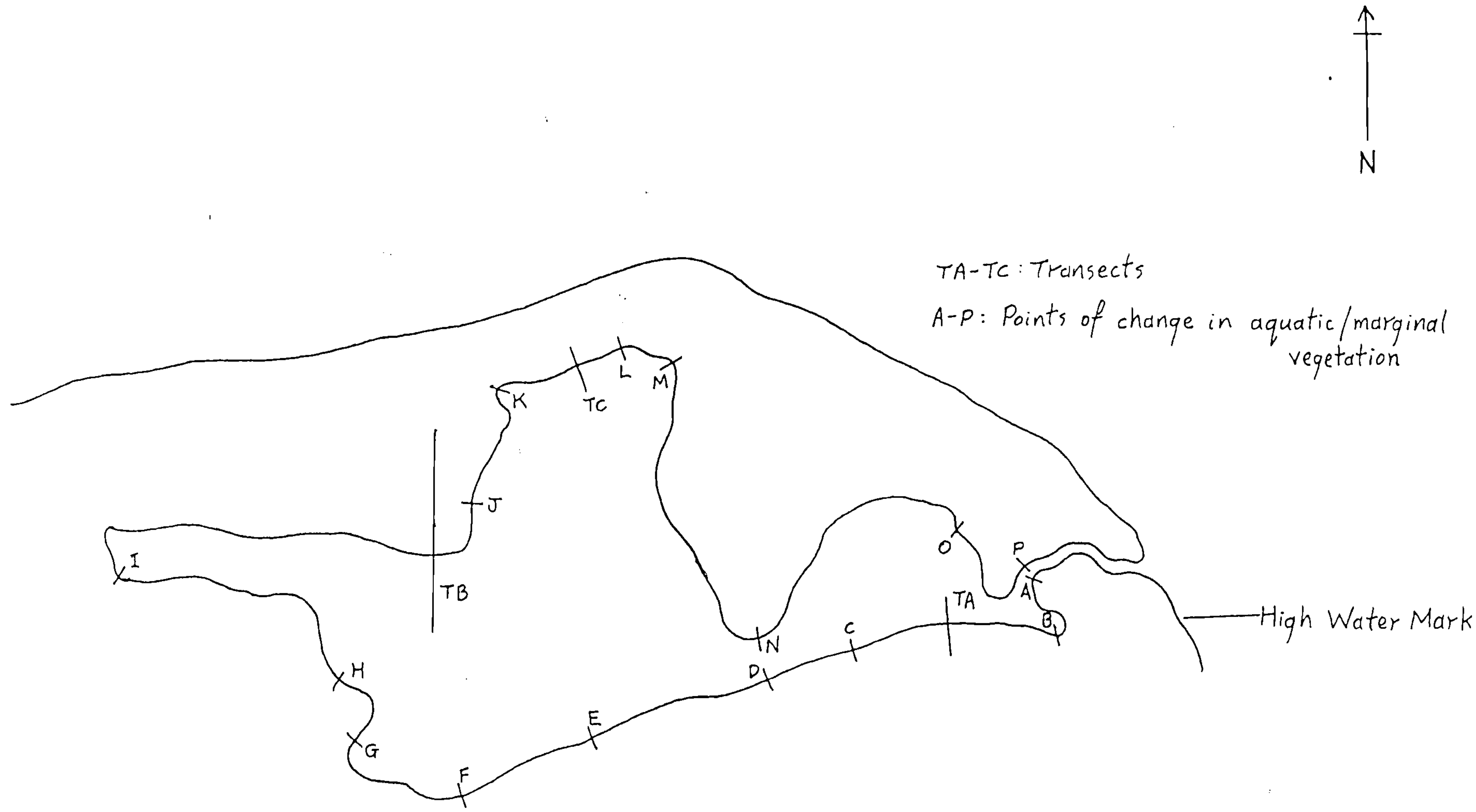

Fig. 11.3.2 Aughinish Lagoon, Co.Clare: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A '*Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A '*Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

11.3.3 Results

1. Shore-based survey

Section A-B

Aquatic: Enteromorpha - sparse
Filamentous algae - sparse
Silt substrate with scattered cobbles

Marginal: Puccinellia maritima - Suaeda maritima - Salicornia agg. saltmarsh as Transect B

Adjacent: Outlet channel
Shingle barrier

Section B-C (Transect A)

Aquatic: Filamentous algae - patchy
Codium tomentosum - patchy
Fucus serratus - patchy
Cystoseira foeniculata - patchy
Ulva lactuca - sparse
Polysiphonia elongata - sparse
Enteromorpha - sparse

Sand and gravel substrate with cobbles and boulders

Marginal: 1-1.5m dry stone wall
2-3m strip of unvegetated silt and gravel shore
Backing Puccinellia maritima - Suaeda maritima - Salicornia agg. saltmarsh. 3-5m

Adjacent: Lolium perenne - Dactylis glomerata - Trifolium repens pasture

Section C-D

Aquatic: Cystoseira foeniculata
Enteromorpha
Filamentous algae - covers unchanged

Silt substrate with cobbles

Marginal: Unchanged

Adjacent: Unchanged

Section D-E

Aquatic: Cystoseira foeniculata
Fucus serratus
Filamentous algae
Enteromorpha
Ulva lactuca - covers unchanged
Sand substrate with gravel and cobbles

Marginal: Cobble shore with sparse Puccinellia, Suaeda and Salicornia. 2-3m. Cover <1%

Adjacent: 2m dry stone wall
Backing Lolium pasture as before

Section E-F

Aquatic: Cystoseira foeniculata
Filamentous algae
Enteromorpha
Ulva lactuca - covers unchanged
Silt substrate with gravel and cobbles

Marginal: Unchanged

Adjacent: Unchanged

Section F-G

Aquatic: Filamentous algae - sparse

Marginal: Puccinellia - Suaeda - Salicornia saltmarsh as Transect A. c.10m. Poached

Adjacent: Lolium pasture as before with occasional Prunus spinosa and Crataegus monogyna

Section G-H

Aquatic: Cystoseira foeniculata
Enteromorpha
Filamentous algae - all sparse

Silt, sand and gravel substrate

Marginal: Puccinellia - Suaeda - Salicornia saltmarsh strip as Transect A. 0.5-1m

Adjacent: 1.5m dry stone wall
Lolium perenne - Holcus lanatus - Dactylis glomerata pasture

Section H-I

As G-H but with stone wall running along shoreline

Section I-J (Transect B)

Aquatic: Species unchanged

Silt substrate

Marginal: Puccinellia - Suaeda - Salicornia saltmarsh. c.80m

Adjacent: Shingle barrier with open vegetation dominated by Festuca rubra and Armeria maritima

Section J-K

Aquatic: Cystoseira foeniculata - sparse
Plocamium cartilagineum - sparse

Sand and gravel substrate with cobbles and boulders

Marginal: Unchanged

Adjacent: Unchanged

Section K-L (Transect C)

Aquatic: Cystoseira foeniculata
Plocamium cartilagineum
Osmundia hybrida
Filamentous algae - all sparse

Marginal: Unvegetated sand, gravel, cobbles and boulders of the shingle barrier. 2-12m

Adjacent: Unchanged

Section L-M

Aquatic: Unchanged

Marginal: Puccinellia - Suaeda - Salicornia saltmarsh strip as Transect A. 1-4m

Adjacent: Unchanged

Section M-N

Aquatic: Cystoseira foeniculata
Enteromorpha
Filamentous algae - all sparse

Marginal: Extensive Puccinellia - Suaeda - Salicornia saltmarsh as Transect B. c.80m

Adjacent: Agrostis stolonifera - Festuca rubra - Armeria maritima grassland
Backing shingle barrier

Section N-O

Aquatic: Cystoseira foeniculata
Osmundia hybrida
Enteromorpha
Filamentous algae - all sparse

Silt and gravel substrate with cobbles

Marginal: Unchanged. 4m

Adjacent: Unchanged

Section O-P

Aquatic: Cystoseira foeniculata
Osmundia hybrida
Fucus serratus
Enteromorpha
Filamentous algae - all sparse

Sand and gravel substrate with cobbles

Marginal: Unvegetated cobbles

Adjacent: Causeway
Shingle barrier

2. Transects

Site: Aughinish Lagoon	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - 2m out	
Sample area: 24m2 (6x4)	Substrate: Sand, gravel, cobbles, boulders	
Depth: 40 cm	Salinity: 33 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		70
Codium tomentosum	30	30
Fucus serratus	30	20
Filamentous algae		20
Cystoseira foeniculata	20	15
Enteromorpha	20	< 1
Ulva lactuca	15	< 1
Polysiphonia elongata	4	< 1
Bare substrate		30
Sand and gravel		30
Description: Patches of unvegetated sand and gravel amongst algae-covered cobbles and		
boulders. Codium, Fucus and Cystoseira patches covered in filamentous algae. Ulva and		
Enteromorpha restricted to landward edge of sample.		
Backing dry stone wall - 1.2m high.		
Backing 2.5m strip of unvegetated silt and gravel shore.		

Site: Aughinish Lagoon	Transect code: A	
Location: Outlet to sea	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Silt and gravel	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Puccinellia maritima	5	90
Suaeda maritima	15	15
Salicornia agg.	15	< 5
Glaux maritima	5	< 1
Description: Puccinellia dominant in species-poor saltmarsh community forming 4m wide strip along the shore.		
Backing c.30 degree bank to 3m height with Festuca rubra - Briza media - Trifolium pratense grassland.		
Backing Dactylis glomerata meadow.		

Site: Aughinish Lagoon	Transect code: B	
Location: Saltmarsh backing to barrier	Sample point: 1 Aquatic - 30m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 70 cm	Salinity: 31 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		50
Filamentous algae		40
Cystoseira foeniculata	25	20
Description: Open cover of Cystoseira with free-floating filamentous algae.		

Site: Aughinish Lagoon	Transect code: B	
Location: Saltmarsh backing to barrier	Sample point: 2 Aquatic - 20m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 10 cm	Salinity: 31 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		10
Filamentous alge		10
Description: Sparse cover of free-floating filamentous algae only. More or less same cover		
0 - 25m out.		

Site: Aughinish Lagoon	Transect code: B	
Location: Saltmarsh backing to barrier	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Puccinellia maritima	5	90
Suaeda maritima	10	30
Salicornia agg.	15	25
Spergularia marina	8	< 5
Aster tripolium	15	< 1
Armeria maritima	10	< 1
Description: Puccinellia dominant, forming dense low growing ground cover with Suaeda and		
Salicornia abundant. 80m.		
Backing shingle barrier. Festuca rubra dominant with Tripleurospermum		
maritimum, Armeria maritima, Silene maritima frequent. Average vegetation cover c.60%.		

Site: Aughinish Lagoon	Transect code: C	
Location: Open shingle shore - barrier	Sample point: 1 Aquatic - 5m out	
Sample area: 25m2 (5x5)	Substrate: Sand, gravel, cobbles	
Depth: 0 - 70 cm	Salinity: 32 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Cystoseira foeniculata	20	5
Osmundia hybrida	5	< 1
Filamentous algae		< 1
Substrate		
Sand and gravel		90
Cobbles		10
Description: Sparse, species-poor algal community confined to scattered submerged cobbles. Cystoseira dominant but restricted to larger rocks only.		
Backing shingle barrier.		
Unvegetated cobble and boulder shore 7m.		
Backing open Festuca rubra dominated vegetation on finer substrate with frequent Armeria maritima, Silene maritima, Tripleurospermum maritimum, Raphanus raphanistrum. Average vegetation cover c.50%.		

11.3.4 Evaluation

'Not Valuable'

This is a high salinity site (31-33 parts per thousand at time of survey) with no major freshwater inflow.

No aquatic higher plant species occur here.

Cystoseira foeniculata is frequent around most of the site and is typically the dominant species, with the exception of the southern shore.

Fucus serratus, Ulva lactuca and Codium tomentosum are frequent and locally abundant along the southern shore. Polysiphonia elongata is occasional here.

Plocamium cartilagineum is occasional up to 20m out from the northern barrier shore. Osmundia hybrida is rare here and near the northern shore of the eastern section of the site.

The dominant marginal community is saltmarsh dominated by Puccinellia maritima, Suaeda maritima and Salicornia. This forms a narrow strip along the southern shores and a more extensive cover on the lower-lying ground to the north of the site.

Further survey is not recommended.

11.4 ECOTONAL COLEOPTERA

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11.4.1 Site Description

Coastal saline lagoon with shingle/sand barrier with tidal incursion during spring high tides, and net water outflow during neap tides, resulting in monthly water level fluctuations of >1m. Little apparent freshwater inflow; lagoon on karst limestone. Outflow channel with cobble barrier exposed during neap part of cycle. Lagoon in two sections, with flooded field section to west (Plate 1), and with barrier inflow percolation to this area as well as overflow from eastern section. At neap part of cycle, much of shore exposed (Plate 2), grading through *Armeria maritima* and other halotolerant vegetation into dry coarse sand of barrier interior.

Subsites (Fig 11.4.1)

1. *Salicornia* salt meadow (M 286134)

Salicornia/Armeria on damp sand, with offshore water salinity >35‰. Limestone stone walls dividing area into fields, with cobble stones on sand. Area flooded at spring tides.

11.4.2 Methods

Site Rating using Indicator Species
Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was

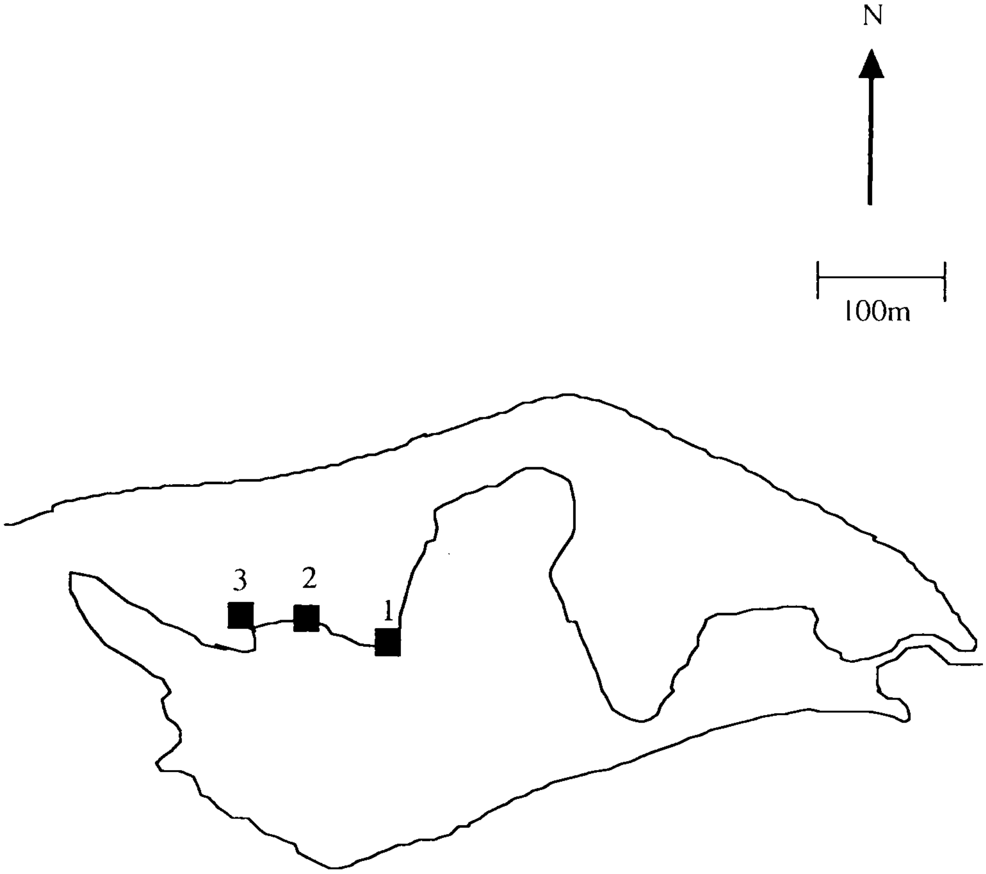

Fig. 11.4.1 Map of sampling sites (Carabidae and Staphylinidae) at eastern section of Aughinish Lagoon, Co. Clare.

1 - Pitfall traps
2 - Cobble search
3 - S-vac

likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 11.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 11.4.1 Details of sampling methods.

Method	**Details**	**No. replicates per unit sample**	**Sampling period, etc.**
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Plate 1 Flooded fields in west section of Aughinish Lagoon, Co. Clare

Plate 2 Exposed shore at Aughinish Lagoon , Co. Clare

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References
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Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Salicornia* salt meadow - S-vac suction sampler (4 viii 1996), c. 2 m^2;
(2) *Salicornia* salt meadow - 6 plastic pitfall traps with funnels and ethylene glycol preservative (4 viii - 8 ix 1996);
(3) *Salicornia* salt meadow - cobble search (n = 30 cobbles) (4 viii 1996)

A further set of pitfall traps placed on the west side (flooded fields) of the lagoon were completely flooded and did not provide sample.

11.4.3 Survey Results

Only three species of carabid and one species of staphylinid were recorded, none of which are sufficiently local to be regarded as indicator species (Table 11.4.2). However, with the exception of *Bembidion minimum* (which is halotolerant), all other species are stenotopic, halobiont and ripicolous, and clearly adapted to the high levels of flooding disturbance that occur at Aughinish. *Dicheirotrichus gustavi*, for instance was very abundant (Table 11.4.2), and did not occur at any of the other lagoons surveyed.

TABLE 11.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Aughinish Lagoon. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

Species	No. individuals
Carabidae	
Bembidion minimum (F.)	10
Dicheirotrichus gustavi Crotch	47
Pogonus chalceus (Marsh.)	6
Staphylinidae	
Halobrecta flavipes Thoms.	2

11.4.4 Evaluation

Of no recorded conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

Indicator species were absent. The low number of specialist species is probably a result of a monthly cycle of a period of tidal flooding followed by period of dry conditions when the sandy substrate dries out.

11.4.5 References

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11.5 SUMMARY AND EVALUATION

Aughinish is a relatively small (10 ha) **natural sedimentary lagoon**, and is therefore of international importance based on the Habitats Directive.

Very little is known about the lagoon except that it lies within the boundary of the proposed Galway Bay NHA (site Code 0268).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	High
Aquatic Fauna	High
Vegetation	None
Ecotonal Coleoptera	None

Geomorphology.

Aughinish is a relatively small (c10 ha) lagoon with a typical cobble barrier with an inlet but is of an unusual type as it is situated in karstic limestone and probably receives seawater through subterranean rock fissures as well as by way of the inlet.

The inlet was modified in the past by construction of a bridge to carry a road. However, the bridge has collapsed and the inlet can again be regarded as natural.

Based on geomorphology, the lagoon is regarded as of high conservation value.

Aquatic Fauna

Among 56 taxa recorded, 54 are identified to species. Four species (*Balanus improvisus, Praunus flexuosus, Crangon crangon* and *Littorina saxatilis* are tolerant of lowered salinity but only species (*Gammarus chevreuxi*) is listed as a lagoonal specialist in Britain

As the salinity was equivalent to that of seawater, or hypersaline, throughout the lake, and there were no point sources of freshwater, only physical habitat differences are assumed to affect species composition and abundance at the different stations.

The aquatic fauna is unusual for a lagoon in that it is almost entirely marine. The single lagoonal species, a rare amphipod, was present in low numbers only.

In conclusion, although there was only one lagoonal specialist recorded, faunistically Aughinish Lagoon is rated as of high conservation value

Vegetation

This is a high salinity site (31-33 ‰ at time of survey) with no major freshwater inflow. No aquatic higher plant species occur here.

Cystoseira foeniculata is frequent around most of the site and is typically the dominant species, with the exception of the southern shore. *Fucus serratus*, *Ulva lactuca* and *Codium tomentosum* are frequent and locally abundant along the southern shore. *Polysiphonia elongata* is occasional here. *Plocamium cartilagineum* is occasional up to 20m out from the northern barrier shore. *Osmundia hybrida* is rare here and near the northern shore of the eastern section of the site.

The dominant marginal community is saltmarsh dominated by *Puccinellia maritima*, *Sueda maritima* and *Salicornia*. This forms a narrow strip along the southern shores and a more extensive cover on the lower-lying ground to the north of the site.

The lagoon is rated as of no conservation value and further survey is not recommended

Ecotonal Coleoptera

Only three species of carabid and one species of staphylinid were recorded, none of which are sufficiently local to be regarded as indicator species. However, with the exception of *Bembidion minimum* (which is halotolerant), all other species are stenotopic, halobiont and ripicolous, and clearly adapted to the high levels of flooding disturbance that occur at Aughinish. *Dicheirotrichus gustavi*, for instance was very abundant, and did not occur at any of the other lagoons surveyed.

Indicator species were absent. The low number of specialist species is probably a result of a monthly cycle of a period of tidal flooding followed by period of dry conditions when the sandy substrate dries out.

Aughinish Lagoon is rated as of no recorded conservation value for terrestrial ecotonal community.

Summary

Aughinish lagoon is a good example of a true coastal lagoon of an unusual type with rich collection of marine fauna. Salinity is always high but the fact that it becomes hypersaline indicates at least temporary isolation from the sea and restricted tidal exchange.

The aquatic fauna and vegetation are unusual for a lagoon in being almost entirely marine

The shallow water and virtual absence of tides, together with the close proximity to Galway, make it a potentially useful site for teaching purposes.

Based on geomorphology and aquatic fauna, Aughinish Lagoon is rated as of high conservation value.

Proposal as an SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

12. BRIDGE LOUGH

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Geoff Oliver
Pat Hatch
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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

12. BRIDGE LOUGH

CONTENTS

12.1 BRIDGE LOUGH

OS Grid Reference: M 342 128, 1:50,000 Sheet No. 52 (unpublished to date)

Alternative names: ?

12.1 STUDY AREA

General Features

Bridge Lough is situated on the south side of Galway Bay, 10 km west of Kinvarra, County Clare (Fig. 12.1.1). The lake is impounded by a causeway which allows a limited tidal exchange through a small outlet running through a channel under the road at the southern end of the causeway. Bedrock is limestone and no visible streams enter the lagoon, but it may be fed by both fresh- and seawater through underground channels.

The lagoon is small and shallow and appears to be highly eutrophic. Sediments consist of bare limestone rocks and a thick layer of organic mud. Open water areas are largely choked with growths of filamentous algae. Very little is known about the lagoon. Originally it was probably similar to Aughinish lagoon (see Section 11), but restriction of tidal flushing through construction of the causeway with such a small outlet appears to have resulted in colmatisation and a concentration of nutrients.

The lagoon is privately owned and it was not possible to carry out the more intensive survey of aquatic fauna due to objections from a landowner. It appears to have no protective status other than the fact that it is included within a large proposed NHA referred to as the Galway Bay Complex (Site code 0268)

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 5-5.6 °C in January and 15-15.5 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 9.5 and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1200 mm, and the number of rain days (1 mm or more) is 10 months. Winds are mainly from the south-southwest. Mean annual hourly wind speeds are between 5 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Galway is 4.5 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Fig. 12.1.1 Section of 1:126 720 map, enlarged to approximately 1:50 000, showing locality of Bridge Lough

Landscape and Geology The lagoon lies on Carboniferous limestone on the northwest side of the Burren area. Soils are described as lithosols, shallow organic soils and shallow brown earths. The area is karstic, with numerous underground channels and surface drainage is low. The low areas surrounding the lake are mostly improved grassland and cereals.

Lake Topography The main area of the lagoon lies between the causeway and another road further to the west which runs parallel to it (Fig 12.2.1). The approximate dimensions of this part of the lagoon are 300 m from west to east, 200 m from north to south and total area is approximately 5 ha. An additional area extends beyond the road to the west giving the lagoon a total area of approx. 7-8 ha. Most of the lake is shallow (<1 m) and substrate includes limestone bedrock, with detached rock and cobbles, and a thick layer of organic mud extending over most of the bed of the lagoon.

Hydrology There is no obvious freshwater inlet, but the lagoon lies on limestone bedrock and may be fed by underground channels. Spring tides presumably enter the lagoon through the outlet channel in the east and it is possible that both freshwater and seawater enters through underground channels..

There is likely to be a daily tidal fluctuation in water level of the lake during spring tides only, but a seasonal pattern may occur whereby water levels rise in the winter with the increased rainfall and storm surges, and gradually decline in the summer.

Salinity and water quality Salinity levels are likely to be close to that of seawater with hypersaline conditions occurring during summertime neap tides.

There are obvious eutrophication problems partly due to the fact that the lagoon is not regularly flushed by seawater. The lagoon is small and shallow and therefore vulnerable to water quality problems.

12.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin.

12.2.1 Methods

Environmental variables

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ppt. precision). A photographic record was made of the site and local information sought concerning background and recent history.

Faunal Sampling.

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

No light-traps or fyke nets were used in this lagoon.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. *Jaera spp.*, hydrobiids).

All Diptera are identified to family level.

12.2.2 Results

It was intended to select stations within the lagoon to reflect the influences of fresh and saline water and differences in vegetation and substrate but objections by the landowner made this impossible.

Bridge Lough was sampled only on the 23.vi.96 during the first part of the survey but some faunal species were recorded in the field near the outlet during the second visit in August.

Environmental Variables

Station A (OS 3405 1306) was located at the northeastern corner of the lagoon below the ruins of a stone tower. Water depth varied from 0 cm to 50 cm, substrate was mostly soft organic mud, with numerous large stones and salinity measured 37‰.

Station B was located at the southeastern corner where the outlet runs under the causeway. Substrate was mostly rocks with soft organic mud, water depth was 0 cm - 1 m and salinity measured 37 ‰ flowing from the lagoon.

Station C (OS 3379 1285) was located at the western end of the main body of the lagoon. Substrate consisted of soft organic mud with limestone rocks of various sizes. Water depth was 0-50 cm and salinity measured 37‰.

Salinity in the western section of the lagoon varied from 31 - 38‰.

Fauna.

The following assessment is based on a single collection made at two stations.

The species recorded are listed in Table 12.2.1 Among 20 taxa listed, 18 are identified to species. The list comprises 4 marine species, 5 poly-mesohaline species and 8 euryhaline species. (Table 12.2.2). Six of the species are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Most of the recorded species occurred on the thick masses of *Enteromorpha* or *Chaetomorpha,* or on stones on the soft substratum. *Idotea chelipes* and *Cerastoderma glaucum* were particularly abundant. A feature of the site was the presence of a dark variety of the common beadlet anemone *Actinia equina*, a species not found at any other lagoon site although it is known to be tolerant of brackish conditions. The entire animal, including the beadlets was nearly black.

Table 12.2.2 Ecological categories of the recorded taxa in Bridge Lough. L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Actinia equina*	
	Dexamine spinosa	
	Littorina littorea	
	Mytilus edulis	
Poly-mesohaline	*Arenicola marina*	
	Praunus flexuosus	
	Cerastoderma glaucum	L
	Hydrobia ventrosa	L
	Limapontia depressa	

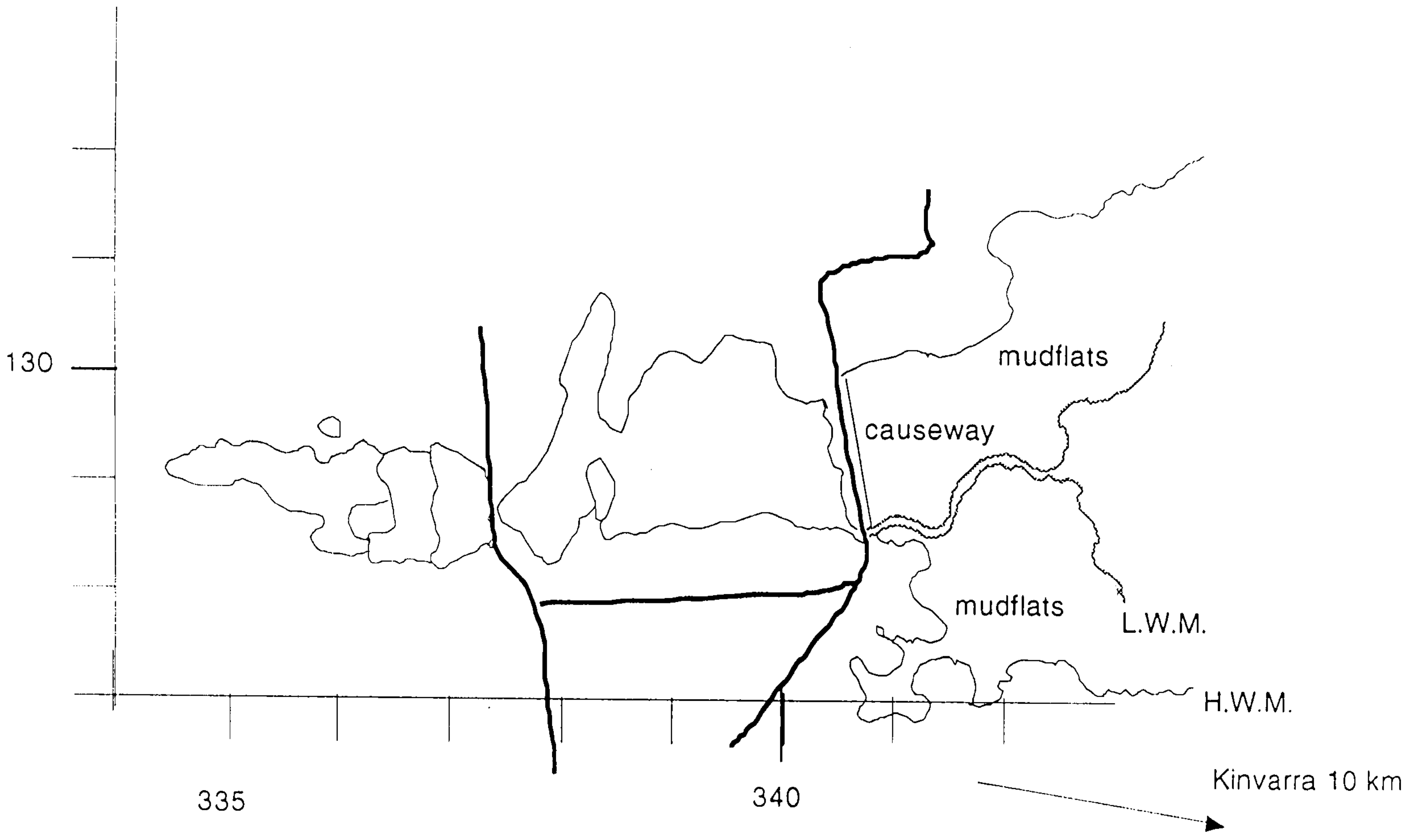

Fig. 12.2.1 Location Map of Sampling Stations in Bridge Lough, Knockakilleen, Co. Galway

Table 12.2.1. Fauna Recorded in Bridge Lough, Co. Galway. June and September, 1996.
( ) = records from June.

		Sampling Stations			
		A	B	C	D
Porifera					
Cnidaria	*Actinia equina*	(c)	c		
Turbellaria					
Nemertea					
Annelida	*Arenicola marina*	(c)			
Crustacea					
Ostracoda					
Copepoda					
Cirripedia					
Mysidacea	*Praunus flexuosus*	(+)			
Isopoda	*Idotea chelipes*	(a)			
	Jaera sp.	(+)			
Amphipoda	*Dexamine spinosa*	(+)	(+)		
	Orchestia gammarella	(+)			
Tanaidacea					
Decapoda	*Carcinus maenas*	(+)	+		
	Palaemonetes varians	(c)			
Arachnida					
Insecta					
Thysanura					
Ephemeroptera					
Odonata					
Plecoptera					
Trichoptera					
Hemiptera					
Coleoptera	*Enochrus bicolor*	+			
	Cercyon littoralis	+			
Diptera	Chironomidae	(c)			
	Culicidae				
	Ephidridae				
Mollusca					
Prosobranchia	*Hydrobia ventrosa*	(c)			
	Littorina littorea	(o)	c		
Opisthobranchia	*Limopontia depressa*	(+)			
Pulmonata					
Bivalvia	*Cerastoderma glaucum*	a			
	Mytilus edulis		c		
Bryozoa	*Conopeum seurati*	+			
Echinodermata					
Tunicata					
Teleostei	*Pomatoschistus microps*	l			
	Gasterosteus aculeatus	+			

+ = present; o = occasional; c = common; a = abundant

Bridge Lough

Euryhaline	*Idotea chelipes* L
	Palaemonetes varians L
	Carcinus maenas
	Enochrus bicolor L
	Cercyon littoralis
	Conopeum seurati
	Pomatoschistus microps
	Gasterosteus aculeatus

12.2.3 Discussion

The short list of species indicates an assemblage characteristic of a lagoon in which medium to high salinities are maintained by frequent tidal incursions. The relatively high proportion of lagoonal specialists makes it particularly interesting. The lake is very shallow and the species present are assumed to be capable of withstanding high temperatures in summer.

The fauna displayed some interesting features e.g. the abundance of the lagoonal specialist Idotea chelipes and the melanic anemone. It would repay further study, especially sampling at inland sites where the salinity may be lower.

12.2.4 Threats

The lagoon appears to be highly eutrophic, partly due to the limited flow of water through the system.

It appears that at least one landowner has attempted to "reclaim" part of the lagoon. The owner of one area of the lake prevented any further surveying

12.2.5 Evaluation

Bridge Lough is an **artificial saline lake** formed by construction of a causeway across a sea inlet. Geomorphologically, therefore, it is not of international importance.

It is situated in a limestone area and may be fed by subterranean fissures, which would make it interesting at least from a geomorphological point of view. However, it is largely artificial due to the construction of the causeway.

The lake appears to be highly eutrophic and seems unlikely to improve in the immediate future.

Despite the fact that only one area was sampled, and very briefly, some interesting species were recorded and there was a relatively high proportion of lagoonal species..

The lake is part of the proposed Galway Bay NHA (Site Code No. 0268)

An evaluation of the fauna cannot be made based on the limited amount of information collected. Further investigations should be carried out if possible.

12.2.6 References and Additional Sources of Information

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Plate 12.2.1 View of the causeway and eastern area of Bridge Lough, Station A

Plate 12.2.2 View of the western area of Bridge Lough.

12. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

12.3.1 Site Description (Fig. 12.3.1)

This is a small silty lagoon on a low-lying promontory with pasture to the north and south and wetland to the west. A causeway forms the eastern shore and seperates the site from the sea.

A stand of blackthorn woodland occurs close to the western shore, where a dry stone wall runs along the edge of the lagoon.

Shores are generally shallow of slope. Emergent vegetation is restricted to a small stand of Schoenoplectus in a sheltered bay in the south west corner of the lagoon. Small areas of saltmarsh adjoin the lagoon along the north shore.

The pool which lies to the west is also a brackish water site. There is no major freshwater inflow stream.

12.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

1. <u>Transects:</u>

The locality of these is shown in Fig. 12.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

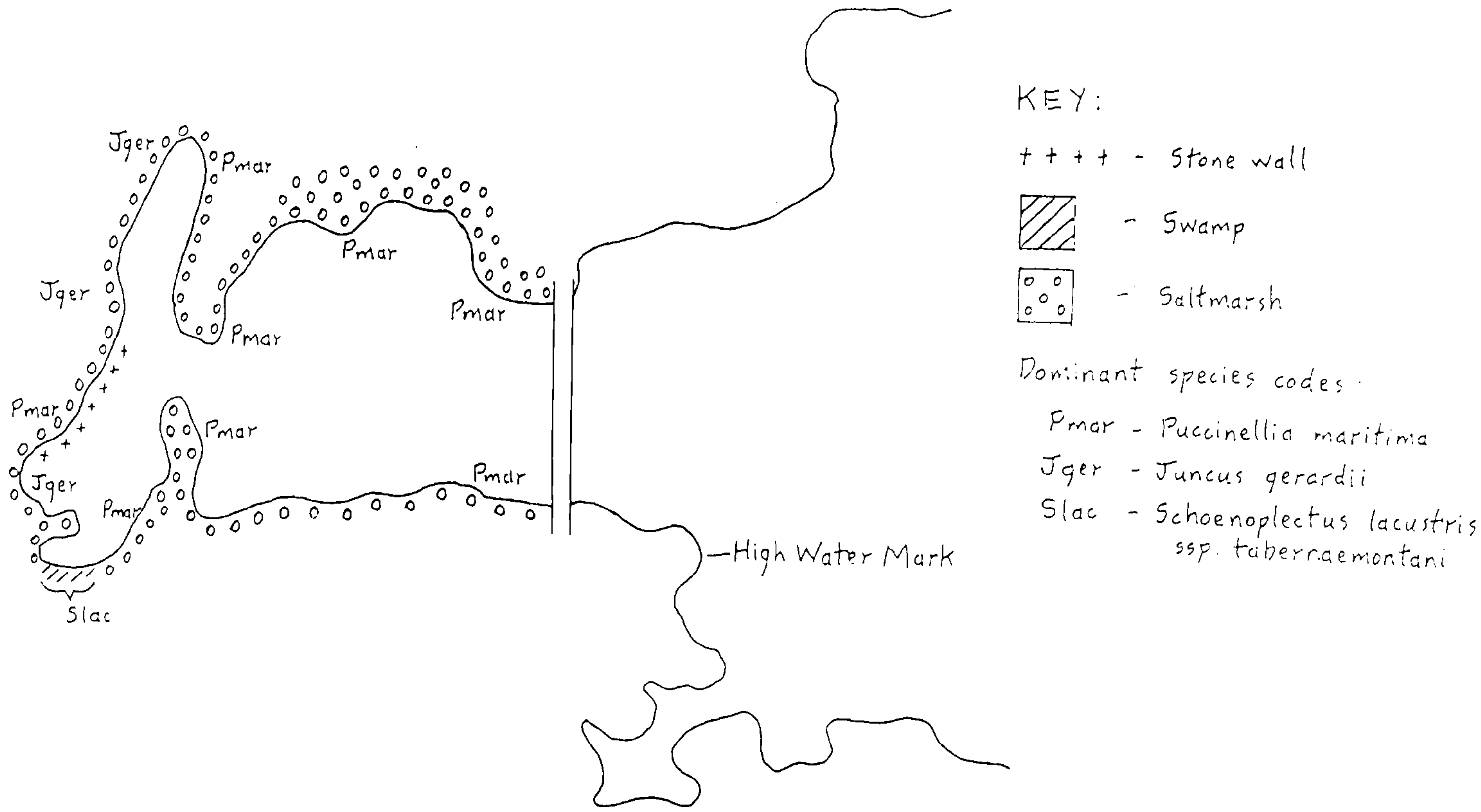

Fig. 12.3.1 Bridge Lough, Co. Galway - Marginal Vegetation

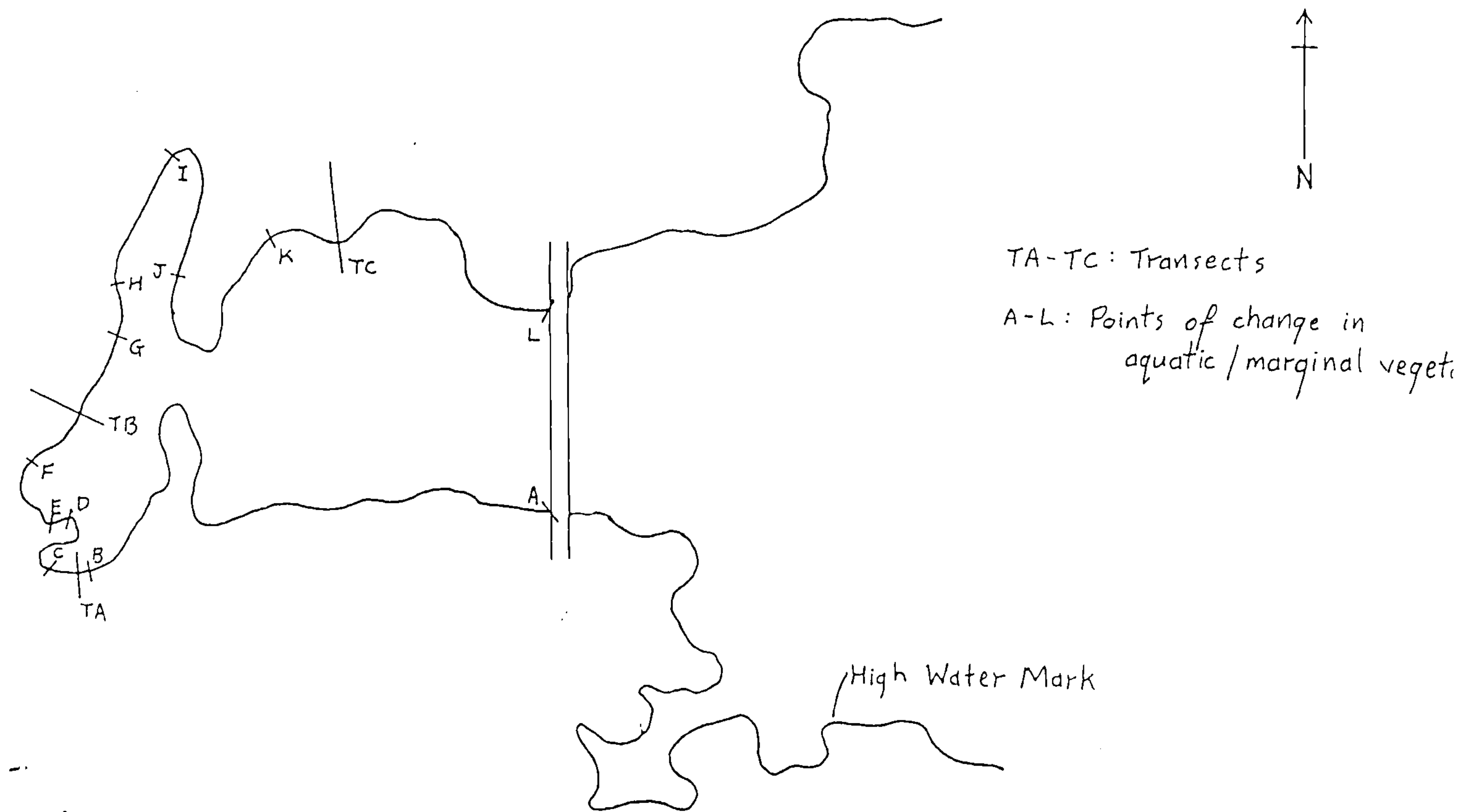

Fig. 12.3.2 Bridge Lough, Co.Galway: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

12.3.3 Results

1. Shore-based survey

Section A-B

Aquatic: Enteromorpha
Filamentous algae
Silt substrate with cobbles

Marginal: Unvegetated cobble and boulder substrate. c.2m
Puccinellia maritima dominated saltmarsh vegetation with frequent
Agrostis
stolonifera and Juncus gerardii as Transect C. 1-2m strip on heavily
poached substrate

Adjacent: Lolium perenne improved pasture

Section B-C (Transect A)

Aquatic: Filamentous algae
Silt substrate

Marginal: Schoenoplectus lacustris ssp tabernaemontani dominant with Epilobium
hirsutum
locally co-dominant, Agrostis stolonifera and Ranunculus sceleratus
frequent.
20x8m

Adjacent: Agrostis stolonifera grassland with frequent Rorippa nasturtium-aquaticum. 10m
Backing public road

Section C-D

Aquatic: Unchanged

Marginal: Festuca rubra - Juncus gerardii dominated salt tolerant vegetation as Transect B. 0.5-3m strip

Adjacent: Crataegus monogyna scrub on promontory

Section D-E

Aquatic: Ruppia maritima - sparse
Filamentous algae

Marginal: Vegetation unchanged
Scattered boulders along shore

Adjacent: Unchanged

Section E-F

Aquatic: Unchanged

Marginal: Unchanged

Adjacent: Low stone wall and public road

Section F-G (Transect B)

Aquatic: Ruppia maritima
Enteromorpha
Filamentous algae

1m dry stone wall runs more or less parallel to shore c.5m out
100% cover of filamentous algae and Enteromorpha loughward of wall
Patchy cover of Ruppia and filamentous algae landward of wall

Marginal: Species-poor Puccinellia dominated salt tolerant vegetation. 2-3m
Juncus gerardii - Festuca rubra dominated salt tolerant community. 4-6m
Both communities with scattered cobbles and boulders

Adjacent: Prunus spinosa scrub with occasional Crataegus monogyna

Bridge Lough

Section G-H

Aquatic: Filamentous algae - extensive

Marginal: Juncus gerardii - Festuca rubra dominated community as Transect B. 0.3-1m

Adjacent: 1.5m dry stone wall with occasional Crataegus monogyna
Lolium perenne pasture

Section H-I

Aquatic: Filamentous algae - sparse

Marginal: Unchanged

Adjacent: Unchanged

Section I-J

Aquatic: Unchanged

Marginal: Puccinellia dominant with Spergularia marina and Glaux maritima. 0.5-5m. Poached

Adjacent: Agrostis stolonifera - Trifolium pretense pasture

Section J-K

Aquatic: Filamentous algae - extensive

Marginal: Unchanged

Adjacent: Unchanged

Section K-L (Transect C)

Aquatic: Unchanged

Marginal: Puccinellia dominated salt tolerant vegetation with frequent Agrostis stolonifera
and Juncus gerardii. 4-20m

Adjacent: Dactylis glomerata - Agrostis stolonifera - Trifolium repens - T. pratense grassland

2. Transects

Site: Bridge Lough	Transect code: A	
Location: Marginal swamp	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 5 cm	Salinity: 32 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Filamentous algae		5
Description: Occasional small patches of free-floating filamentous algae only. Deep silt substrate.		

Site: Bridge Lough	Transect code: A	
Location: Marginal swamp	Sample point: 2 Marginal	
Sample area: 80m2 (10x8)	Substrate: Silt	
Depth: 0 cm	Salinity: -----	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		70
Schoenoplectus lacustris ssp tabernaemontani	90	30
Epilobium hirsutum	80	20
Agrostis stolonifera	20	10
Ranunculus sceleratus	40	5
Triglochin palustris	15	< 5
Nasturtium officinale	15	< 5
Rumex obtusifolius	50	< 1
Chenopodium rubrum	8	< 1
Juncus bufonius	8	< 1
Carex otrubae	40	< 1
Description: Schoenoplectus lacustris dominant with Epilobium hirsutum locally co-dominant among freshwater associates. 8m.		
Backing Agrostis stolonifera damp grassland with frequent Nasturtium officinale.		

Site: Bridge Lough	Transect code: B	
Location: Open shore	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 30 cm	Salinity: 32 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Filamentous algae		100
Description: Complete cover of filamentous algae only, extending back to dry stone wall at		
3m out from shore.		

Site: Bridge Lough	Transect code: B	
Location: Open shore	Sample point: 2 Aquatic - 3m out	
Sample area: 15m2 (5x3)	Substrate: Silt, cobbles	
Depth: 10 cm	Salinity: 28 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		25
Higher Plant		20
Ruppia maritima	20	20
Algae		5
Filamentous algae		5
Enteromorpha		< 1
Description: Open cover of dominant Ruppia. Older parts of Ruppia plants coated with		
algae, newer shoots more sparsely so. About 30 - 40% of plants showing signs of recent		
growth, with some in bud, some flowering and some coming into fruit. The remaining		
60 - 70% shorter and completely coated by algae.		
Backing low peat cliff - 50 cm.		

Site: Bridge Lough	Transect code: B	
Location: Open shore	Sample point: 3 Marginal	
Sample area: 20m2 (10x2)	Substrate: Peat, cobbles, boulders	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Puccinellia maritima	15	90
Glaux maritima	15	< 5
Chenopodium rubrum	20	< 5
Juncus gerardii	25	< 1
Bare substrate		5
Cobbles and boulders		5
Description: Dense cover of dominant Puccinellia with tall associates in species-poor saltmarsh strip. 3m.		

Site: Bridge Lough	Transect code: B	
Location: Open shore	Sample point: 4 Marginal	
Sample area: 20m2 (10x2)	Substrate: Peat, bedrock, boulders	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Juncus gerardii	40	50
Festuca rubra	20	50
Agrostis stolonifera	20	30
Chenopodium rubrum	15	< 5
Glaux maritima	15	< 5
Leontodon autumnalis	25	< 1
Spergularia marina	10	< 1
Triglochin maritima	20	< 1
Carex otrubae	40	< 1
Bare substrate		5
Bedrock and boulders		5
Description: Juncus gerardii and Festuca rubra co-dominant with Agrostis stolonifera frequent and all other species sparse. Exposed bedrock and scattered boulders with epiphytic lichens and bryophytes. 5m.		
Backing Prunus spinosa woodland with occasional Crataegus monogyna.		

Site: Bridge Lough	Transect code: C	
Location: Open shore	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Silt, cobbles	
Depth: 20 cm	Salinity: 32 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Filamentous algae		100
Enteromorpha		< 1
Description: Complete surface layer of filamentous algal mat with sparse Enteromorpha		
restricted to submerged rocks. Same species at more or less same cover to shore.		

Bridge Lough

Site: Bridge Lough	Transect code: C	
Location: Open shore	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Puccinellia maritima	6	80
Spergularia marina	8	10
Agrostis stolonifera	6	10
Juncus gerardii	20	5
Juncus bufonius	6	5
Salicornia agg	10	< 1
Triglochin maritima	15	< 1
Glaux maritima	8	< 1
Chenopodium rubrum	15	< 1
Leontodon autumnalis	15	< 1
Cochlearia anglica	6	< 1
Samolus valerandi	6	< 1
Description: Salt tolerant community dominated by extensive Puccinellia with frequent		
Spergularia and Agrostis. Associated species sparse. 25m.		
Backing dry stone wall.		
Backing Agrostis stolonifera - Trifolium repens pasture.		

12.3.4 Evaluation

'Not Valuable'

This is a shallow silty lagoon. Salinity was high (32 parts per thousand) at time of survey.

Ruppia maritima is the only higher plant species here and is restricted to a small area landward of a dry stone wall that runs parallel to the south western shore.

Elsewhere, filamentous algae has an almost complete cover over the entire site.

Marginal vegetation shows no notable variation. Puccinellia maritima dominated saltmarsh forms a more or less narrow strip around most of the site with Schoenoplectus lacustris ssp tabernaemontani locally dominant in a small bay in the south west corner of the site.

This is a very species-poor site of no botanical interest.

Further survey is not recommended.

12.4 ECOTONAL COLEOPTERA

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12.4.1 Site Description

Small, possibly hypertrophic, coastal brackish lake with causeway barrier and possible blocked causeway seepages and/or subterranean or subaquatic karst channel connections to sea. Lake shore with peaty and organic-rich silty margins with extensive filamentous algal growth, and with some limestone outcrops. Organic soil margins with *Juncus gerardi* dominated swards where ungrazed. Bare mineral soil margins mostly saturated.

Subsites (see Fig. 12.4.1)

1. *Juncus gerardi* (M 339129)
Shallow peaty organic soil on limestone rock with bare shore margin (c. 40 cm) and landward gradient of plants: laminar and fibrous algae without vascular vegetation; *Puccinellia marina*; *Juncus gerardi, Glaux maritima* and *Trigolichin maritima*. Algal growth on water near shore. Amphipods very abundant. Calcareous pasture behind shore, near base of derelict windmill. Water near shore with salinity > 30 ‰.

2. Limestone grass margin (M 336128)
Rough grass on shallow soils with limestone pavement outcrops. Near road-bridge outflow from marshy area on west side of lough.

12.4.2 Methods

Site Rating using Indicator Species
Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

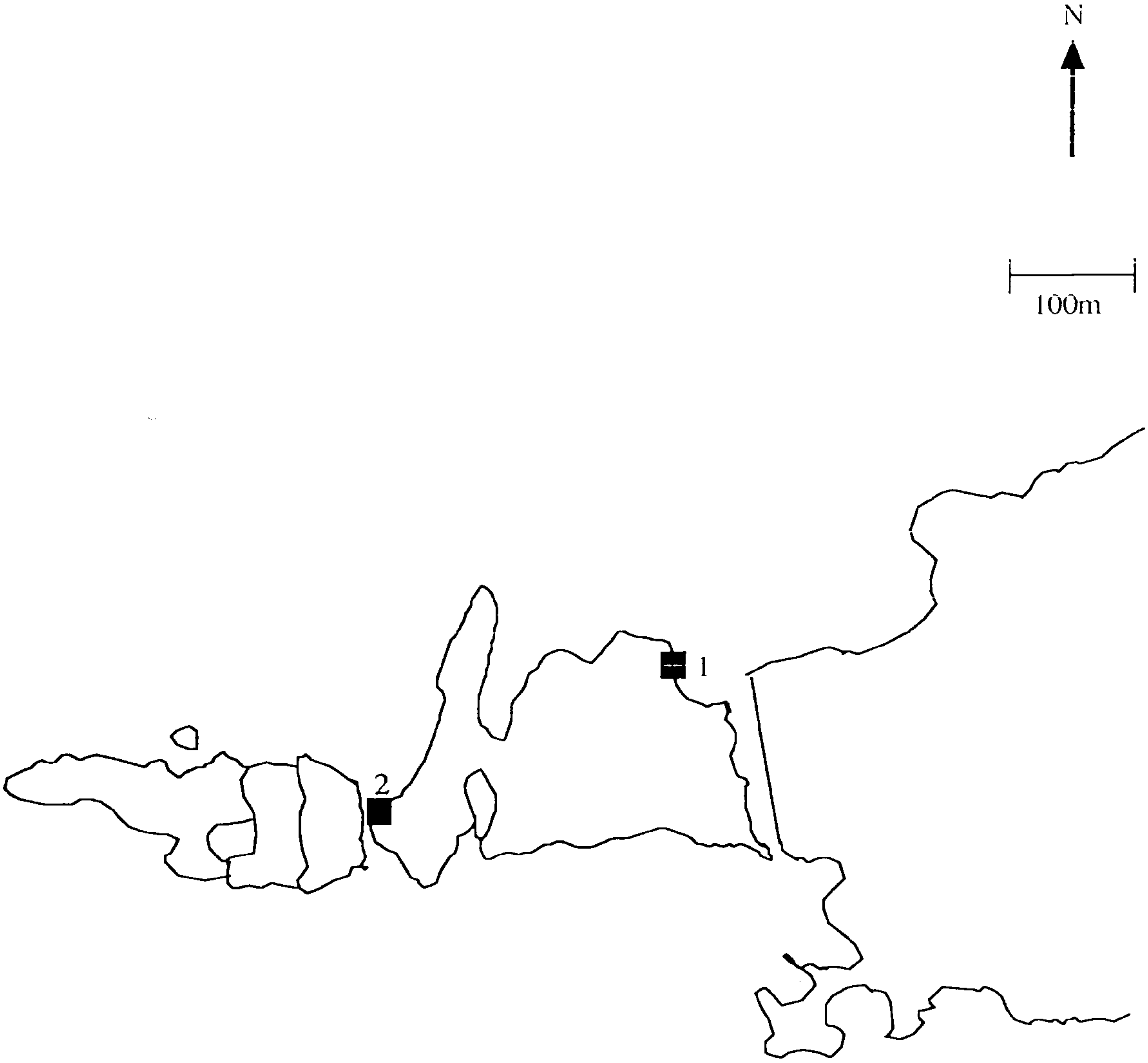

Fig. 12.4.1

Map of sampling sites (Carabidae and Staphylinidae) at Bridge Lough, Knockakilleen, Co. Galway

1 - Pitfall traps, S-vac
2 - Pitfall traps

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 12.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter

(0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 12.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques
Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is

regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References

Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Juncus gerardi* area - S-vac suction sampler (3 viii 1996), c. 2 m^2;
(2) *Juncus gerardi* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (23 vi - 3 viii 1996);
(3) Limestone grass margin - 6 pitfall traps (8 - 28 ix 1996);

Areas suitable for flotation or cobble search were not found.

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

12.4.3 Survey Results

Eleven species of carabid and thirty-one species of staphylinid were recorded, one of which is regarded as an indicator species (Table 12.4.2).

Brundinia meridionalis occurred in all samples, but especially in the *Juncus gerardi* area (Table 12.4.3). It has not been previously recorded from Ireland. Although it is not listed in Hyman and Parsons (1994) as rare or notable in Great Britain, it appears to be rare or local in many parts of Europe (Porta 1926, Palm 1970, Benick & Lohse 1974, Mahler 1987, Koch 1989). *B. meridionalis* is a halophilous species, recorded from tidal refuse and silty soils on the coast and also on inland saline soils in Austria and other countries (Steel 1970, Koch 1989). Tidally-undisturbed lagoons with stagnant water are favoured by this species - relatively large populations were recorded on organic-rich soils with dense algal growth at three lagoons in this survey (also at Cloonconeen Pool and Lough Murree), but not at other sites.

The staphylinid assemblage recorded from the *Juncus gerardi* area were predominantly species which can occur in nutrient-rich agricultural soils (cf. Good and Giller 1990) (Table 12.4.3).

TABLE 12.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Bridge Lough. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), and also Booth (1988) and Muona (1990) for two genera.

Species	No. individuals
Carabidae	
Agonum marginatum (L.)	2
Bembidion guttula (F.)	1
Bembidion lampros (Hbst)	2
Bembidion mannerheimi Sahlb.	4
Bembidion obtusum Serv.	1
Bembidion varium (Ol.)	2
Calathus melanocephalus (L.)	1
Dyschirius globosus (Hbst)	3
Nebria brevicollis (F.)	1
Pterostichus madidus (F.)	1
Pterostichus nigrita (Payk.)	1

TABLE 12.4.2 (cont.)

Staphylinidae

	Aleochara bipustulata (L.)	1	
	Amischa analis (Grav.)	28	
	Amischa nigrofusca (Steph.)	168	
	Anotylus rugosus (F.)	1	
	Atheta amplicollis (Muls. Rey)	11	
	Atheta elongatula (Grav.)	1	
*	*Brundinia meridionalis* (Muls. Rey)	37	**Indicator species**
	Carpelimus corticinus (Grav.)	1	
	Drusilla canaliculata (F.)	1	
	Gyrohypnus angustatus (Steph.)	5	
	Ischnopoda atra (Grav.)	1	
	Lesteva sicula Er.	3	
	Mycetoporus splendidus (Grav.)	1	
	Omalium laeviusculum Gyll.	2	
	Philonthus carbonarius (Grav.)	2	
	Philonthus laminatus (Creutz.)	5	
	Sepedophilus nigripennis (Steph.)	4	
	Stenus clavicornis (Scop.)	1	
	Stenus fuscipes Grav.	3	
	Stenus ossium Steph.	8	
	Tachinus signatus Grav.	1	
	Tachyporus chrysomelinus (L.)	3	
	Tachyporus dispar (Payk.)	25	
	Tachyporus hypnorum (F.)	1	
	Tachyporus nitidulus (F.)	7	
	Tachyporus obtusus (L.)	1	
	Tachyporus pusillus Grav.	1	
	Tachyporus tersus Er.	1	
	Tinotus morion (Grav.)	1	
	Xantholinus glabratus (Grav.)	1	
	Xantholinus longiventris Heer	1	

TABLE 12.4.3 Staphylinid assemblage from *Juncus gerardi* area, Bridge Lough (S-vac suction sample and pitfall traps combined). Abund. Cat. refers to category of relative abundance (no. individuals: 1, 2-10, 11+).

Abund. Cat.	Species	No.	Main biotope
Dominant	*Amischa analis*	28	Eurytopic, incl. nutrient-rich cultivated land
	Amischa nigrofusca	168	Eurytopic, incl. nutrient-rich cultivated land
	Brundinia meridionalis	34	Halophilous, coastal
	Tachyporus dispar	20	Grassland

TABLE 12.4.3 (cont.)

Intermediate	*Atheta amplicollis*	9	Eurytopic, incl. nutrient-rich cultivated land
	Gyrohypnus angustatus	5	Eurytopic, incl. nutrient-rich cultivated land
	Philonthus carbonarius	2	Eurytopic, incl. nutrient-rich cultivated land
	Philonthus laminatus	5	Eurytopic, incl. nutrient-rich cultivated land
	Sepedophilus nigripennis	3	Grassland
	Stenus clavicornis	2	Eurytopic, incl. nutrient-rich cultivated land
	Stenus fuscipes	3	Mesotrophic/eutrophic marshes, riparian
	Stenus ossium	6	Eurytopic, incl. nutrient-rich grassland
	Tachyporus chrysomelinus	3	Eurytopic, incl. nutrient-rich cultivated land
	Tachyporus nitidulus	5	Eurytopic, incl. nutrient-rich cultivated land
Present	*Aleochara bipustulata*	1	Eurytopic, incl. nutrient-rich cultivated land
	Atheta elongatula	1	Eurytopic, incl. nutrient-rich cultivated land
	Carpelimus corticinus	1	Riparian
	Ischnopoda atra	1	Riparian, freshwater
	Mycetoporus splendidus	1	Eurytopic, incl. nutrient-rich grassland
	Omalium laeviusculum	1	Halobiont, decaying seaweed
	Tachinus signatus	1	Eurytopic, incl. nutrient-rich cultivated land
	Tachyporus hypnorum	1	Eurytopic, incl. nutrient-rich cultivated land
	Tachyporus obtusus	1	Eurytopic, incl. nutrient-rich cultivated land
	Tachyporus pusillus	1	Eurytopic, incl. nutrient-rich grassland
	Tachyporus tersus	1	Grassland
	Tinotus morion	1	Eurytopic, incl. nutrient-rich cultivated land
	Xantholinus glabratus	1	Eurytopic, incl. nutrient-rich grassland
	Xantholinus longiventris	1	Eurytopic, incl. nutrient-rich cultivated land

12.4.4 Evaluation

Of no conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The single indicator species recorded is tolerant of eutrophic conditions. The possible hypertrophic state of the lake, and the nutrient-rich shore soil, is also indicated by the majority of staphylinid species which occur frequently in fertilized and manured agricultural land (Table 12.4.3). A single indicator species, without an associated assemblage of more typical riparian or halophilous species, is insufficient to give the site conservation status (Good and Speight 1991).

12.5 SUMMARY AND EVALUATION

Bridge Lough is not a coastal lagoon in the strict sense, but an **artificial saline lake** formed by construction of a causeway across a sea inlet.

The lake is part of the proposed Galway Bay NHA (Site Code No. 0268).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	Low
Aquatic Fauna	Moderate/High
Vegetation	None
Ecotonal Coleoptera	None

Geomorphology.

Bridge Lough is a small (5 ha.) lake situated in a limestone area and may be fed by subterranean fissures, which would make it interesting at least from a geomorphological point of view. However, it is largely artificial due to the construction of the causeway and the presence of a sluiced outlet..

Based on geomorphology, Bridge Lough is regarded as of <u>low</u> conservation value.

Aquatic Fauna

The following assessment is based on small collections made at two stations only.

Among 20 taxa recorded, 18 are identified to species, of which six are listed as a lagoonal specialists in Britain.

Most of the recorded species occurred on the thick masses of *Enteromorpha* or *Chaetomorpha,* or on stones on the soft substratum. *Idotea chelipes* and *Cerastoderma glaucum* were particularly abundant. A feature of the site was the presence of a dark variety of the common beadlet anemone *Actinia equina*, a species not found at any other lagoon site although it is known to be tolerant of brackish conditions.

The short list of species indicates an assemblage characteristic of a lagoon in which medium to high salinities are maintained by frequent tidal incursions. The relatively high proportion of lagoonal specialists makes it particularly interesting.

Despite the small number of samples analysed, the fauna appears moderately rich with two interesting species. Bridge Lough is therefore rated as of moderate to high conservation value.

Further investigations should be carried out if possible as a more detailed survey may indicate a higher rating.

Vegetation

This is a shallow silty lagoon. Salinity was high (32 ‰) at time of survey.

Ruppia maritima is the only higher plant species here and is restricted to a small area landward of a dry stone wall that runs parallel to the south western shore. Elsewhere, filamentous algae has an almost complete cover over the entire site.

Marginal vegetation shows no notable variation. *Puccinellia maritima* dominated saltmarsh forms a more or less narrow strip around most of the site with *Schoenoplectus lacustris* ssp *tabernaemontani* locally dominant in a small bay in the south west corner of the site.

This is a very species-poor site of no botanical interest for higher plants.

Further survey is not recommended.

Ecotonal Coleoptera

Eleven species of carabid and thirty-one species of staphylinid were recorded, one of which is regarded as an indicator species.

Brundinia meridionalis occurred in all samples, but especially in the *Juncus gerardii* area. It has not been previously recorded from Ireland. Although it is not listed as rare or notable in Great Britain, it appears to be rare or local in many parts of Europe. It is an halophilous species, recorded from tidal refuse and silty soils on the coast and also on inland saline soils in Austria and other countries. Tidally-undisturbed lagoons with stagnant water are favoured by this species - relatively large populations were recorded on organic-rich soils with dense algal growth at three lagoons in this survey (also at Cloonconeen Pool and Lough Murree), but not at other sites.

The single indicator species recorded is tolerant of eutrophic conditions. The possible hypertrophic state of the lake, and the nutrient-rich shore soil, is also indicated by the majority of staphylinid species which occur frequently in fertilized and manured agricultural land.

A single indicator species, without an associated assemblage of more typical riparian or halophilous species, is insufficient to give the site conservation status.

Therefore, Bridge Lough is rated as of no conservation value for terrestrial ecotonal community.

Summary

Based on geomorphology, vegetation and ecotonal coleoptera, Bridge Lough is of very little interest. However, despite the fact that only one area was sampled, and very briefly, some interesting species were recorded and there was a relatively high proportion of lagoonal species.

Based on aquatic invertebrates the lake is of moderate conservation value as an artificial lagoonal environment.

The lake appears to be highly eutrophic and seems unlikely to improve in the immediate future. There has also been at least one attempt recently to infill parts of it.

Overall, Bridge Lough is small and rated as of <u>low</u> conservation value, but further investigations are encouraged.

Proposal as an SAC is not recommended

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

13. LETTERMULLEN POOL

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

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13 LETTERMULLEN POOL, Co. Galway.

OS Grid Reference: L 827 213, 1:50,000 Sheet No. 44
Alternative names:

13.1 STUDY AREA

Lettermullen Pool is situated on the western shore of Lettermullen Island in western Connemara (Fig. 13.1.1). Six islands have to be crossed by bridges and causeways to reach Lettermullen. Golam Head is the final island in this group which lies 500 metres west of Lettermullen. The pool is usually regarded as a large rock pool into which a freshwater spring runs and seawater enters on spring tides and during storms. It can just as easily be regarded as a small coastal lagoon with a rock barrier.

Very little is known about the lagoon. It appears to have no protective status.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 5.5 °C in January and 14.4 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1200 mm, and the number of rain days (1 mm or more) is 175-200. Winds are mainly from the southwest and west. Mean annual hourly wind speeds are between 5 and 6 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1984). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Galway is 4.5 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology The Connemara region of Galway is a glaciated plain of rolling lowland with granite outcrops and Atlantic type blanket bog. The granite bedrock is impervious and drainage density is high. Soils other than peat are shallow podzols with very limited land-use capability (R.I.A., 1979). The area was described by Haughton (1957) as a "wilderness of bare rock, glacial erratics, water and peat".

Land surrounding the pool consists of small irregular fields of semi-improved pasture, bare rock, small peatbogs and wet heathland.

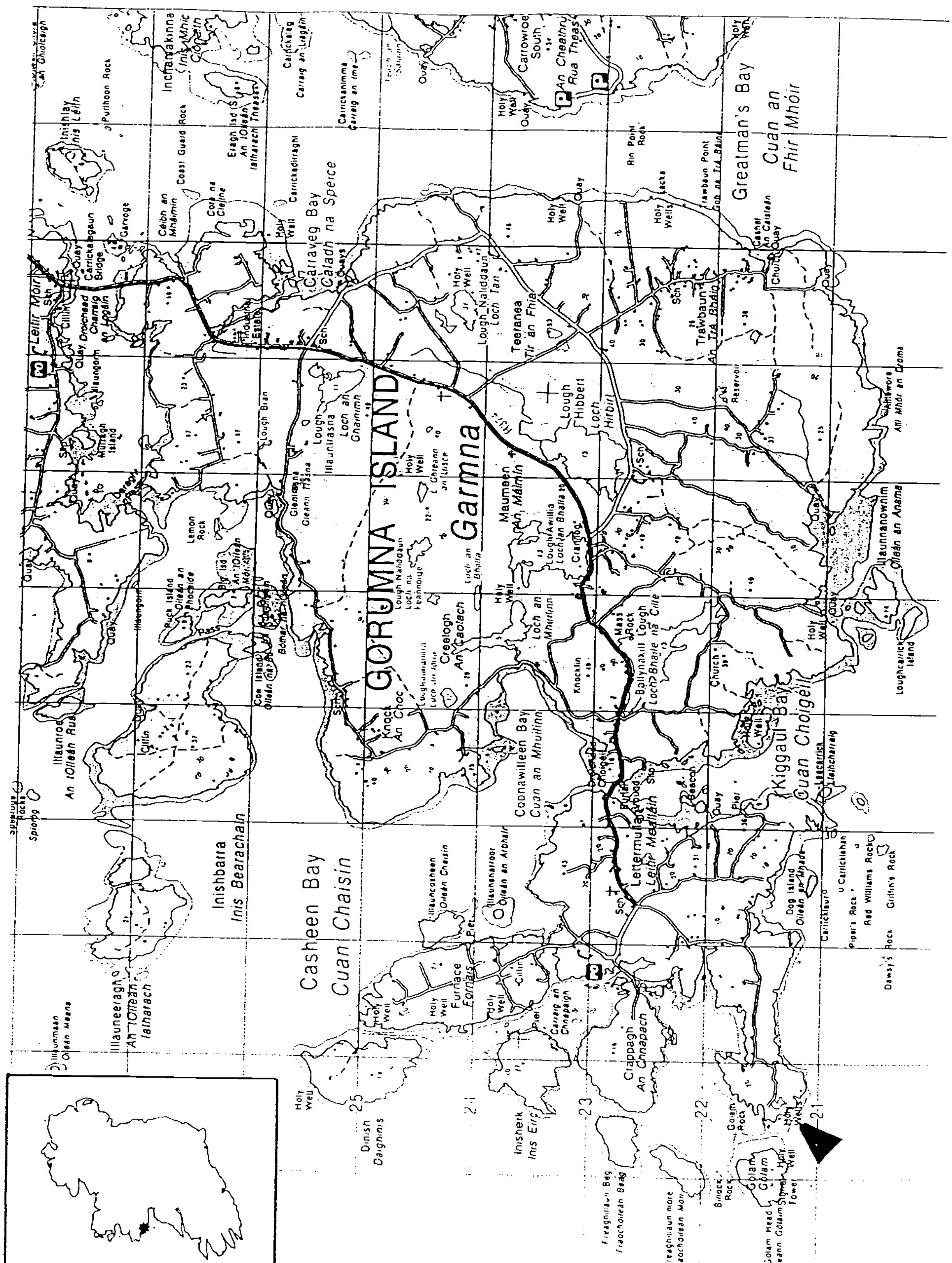

Fig. 13.1.1 Section of 1:50 000 map showing locality of Lettermullen Pool

Lake Topography The lagoon is approximately one hectare in size, is up to 4 m in depth and substrate consists mostly of rocks of various sizes, some patches of bare bedrock, gravel and patches of organic silty sand.

Hydrology Fresh water enters the pool through a small stream in the east, through small groundwater springs at the edges of the pool and in direct rainfall. Seawater enters during spring tides and storms through two overwash areas in the west (Fig. 13.2.1) and from spray.

There is no apparent daily tidal fluctuation in water level of the lake even during spring tides , but a seasonal pattern is likely, whereby water levels rise in the winter with the increased rainfall and storm frequency, and gradually decline in the summer. The peaty soils of the surrounding land would, however, through absorption and slow release of water, affect the delivery time of both surface- and ground-water flows to the pool.

Salinity and water quality Salinity is likely to remain close to that of seawater in summer, with hypersaline conditions occurring during neap tides but to fall below 30‰ in winter. The peaty soils of the surrounding land would, however, through absorption and slow release of water, affect the delivery time of both surface- and ground-water flows to the pool. The prolonged flow of freshwater to the pool during the "dry" months may result in lower salinities than might be expected.

The surrounding land is relatively natural and even grazing land is likely to receive only limited fertilizer applications. Water quality appears to be high although quite a deep layer of organic silt has accumulated in the central area of the pool.

13.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

13.2.1 Methods

Environmental variables
Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰. precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling
Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used near stations A and B in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination
All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (eg *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (Nemertea).

All Diptera are identified to family level.

13.2.2 Results

Lettermullen Pool was sampled on 22.vi.96 during the first part of the survey, and from 25-26.viii.96 during the more intensive survey. Positions of the sampling stations are shown in Fig 13.2.1

Environmental Variables

. As the pool is only 1 ha in area it was not considered useful to record grid references of sampling stations, other than that at Station A

Station A (OS 8261 2142) was located at the northern end of the pool nearest to the road (Plates 13.2.1 & 4). A freshwater spring discharges into the pool at this point and the area is slightly poached by cattle. Water depth varied from 0 cm to 1 m, substrate was mostly soft organic mud, with large stones, cobbles and gravel in varying proportions, and salinity measured 37 ‰.

Station B was located on the western shoreline in an flattened area of rock, cobbles, gravel and coarse sand which appears to be regularly inundated through overwash (Plate 13.2.2). Water depth varied from 0 - 1 m and salinity measured 35 ‰.

Station C was located on the southern shore of the pool, where a deep gully runs between the bedrock towards the coast (Plate 13.2.2). There is a series of deep pools in this area between the pool and the high water mark on the coastline, and it seems likely that seawater enters the pool through the gully, but perhaps only on the highest of spring tides or during strong southwesterly gales. Substrate consisted of bedrock and detached rocks of various sizes, cobbles and small pockets of coarse sand. Water depth was 0-4 m and salinity measured 35‰

Station D was located in the central area of the pool in a *Zostera* bed. Depth varied from 0 cm - 1 m, substrate was a deep layer of organic mud and fine silt/sand and salinity measured 35‰.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 13.2.1. Among 52 taxa listed, 48 are identified to species; identification of remaining groups (Nemertea and larvae) will not be attempted. Four species (*Arenicola marina, Praunus flexuosus, Melita palmata* and *Rissoa membranacea)* are marine species with some tolerance of lowered salinity, three species (*Littorina "tenebrosa"*, *Balanus improvisus,* and *Cerastoderma glaucum)* are poly-mesohaline, five are euryhaline (*Hediste diversicolor, Idotea chelipes, Carcinus maenas,*

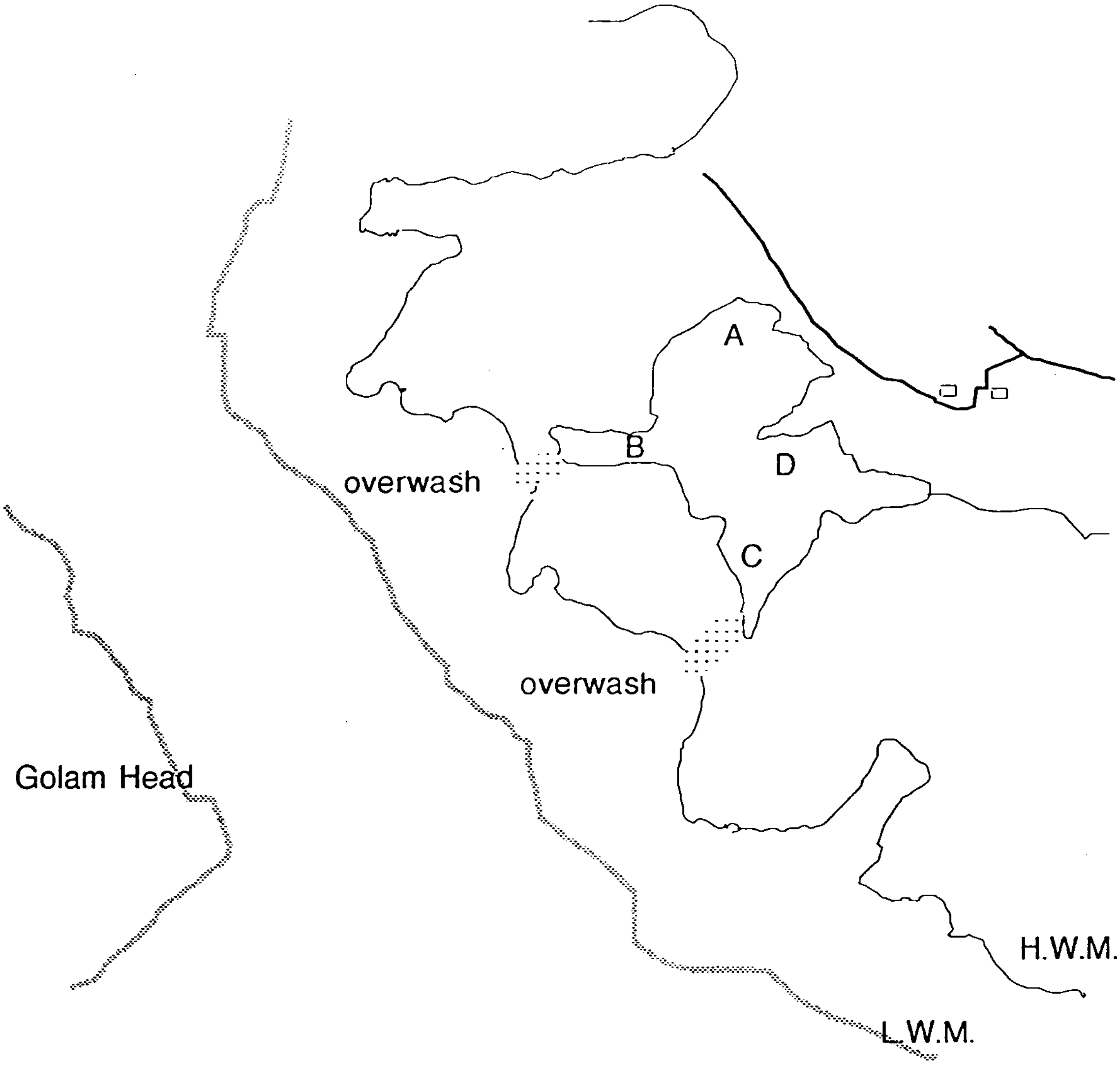

Fig. 13.2.1 Location Map of Sampling Stations in Lettermullen Pool, Co. Galway

100 m aprox !!!

Table 13.2.1. Fauna Recorded at Lettermullen Pool, Co. Galway. June and September, 1996.
( ) = records from June.

Fauna		Sampling Stations (L.T. = light-trap)							
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D
Porifera									
Cnidaria	*Aurelia aurita*	(+)							
	Laomedea angulata	+		+		+		+	
Turbellaria									
Nemertea	Nemertea sp. 1	+							
	Nemertea sp. 2			+					
Annelida	*Arenicola marina*	+		+					
	Hediste diversicolor			?					
	Janua pagenstecheri			+					
	Spirorbidae indet.	+		+		+		+	
	Tubificoides benedii			+					
Crustacea									
Ostracoda									
Copepoda							+		
Cirripedia	*Balanus improvisus*	+							
Cumacean									1
Mysidacea	*Praunus flexuosus*	c	75	c	11	c	2	c	50
	Siriella jaltensis						1		
Isopoda	*Idotea baltica*	+	+						
	I. chelipes	a	11	a				o	
Amphipoda	*Dexamine spinosa*	+	+	+					
	Melita palmata	+	+						
	Orchestia gamarella	+							
Tanaidacea	*Tanais dulongi*							+	
Decapoda	*Carcinus maenas*	+		+		+		+	
	Palaemon elegans	o							
Arachnida									
Insecta									
Thysanura									
Ephemeroptera									
Odonata									
Plecoptera									
Trichoptera									
Hemiptera									
Coleoptera	*Enochrus bicolor*	+							
Diptera	Chironomidae	+		+					
Mollusca									
Polyplacophora	*Lepidochitona cinerea*					+		+	
Prosobranchia	*Bittium reticulatum*	+							
	Gibbula umbilicalis			+					
	Hinia incrassata			+					
	Littorina littorea			+					
	L. "tenebrosa"	a		+				c	+
	Nucella lapillus					+		1	
	Patella vulgata			+		+			
	Rissoa membranacea	c		a				c	
	Skeneopsis planorbis	o		c					

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Table 13.2.1. cont.. Fauna Recorded at Lettermullen Pool, Co. Galway. June and September, 1996.
( ) = records from June.

Fauna		Sampling Stations (L.T. = light-trap)							
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D
Opisthobranchia	*Elysia viridis*							+	
Pulmonata									
Bivalvia	*Cerastoderma glaucum*	c		o		o		c	
	Mytilus edulis	o							
Bryozoa	*Alcyonidium mamillatum*	+							
	Conopeum seurati			+		+			
	Bowerbankia gracilis	+							
	Walkeria uva	+							
Echinodermata	*Amphipholis squamata*					+			
	Luidia ciliaris					c			
	Paracentrotus lividus					1			
Tunicata	*Ascidiella aspersa*	+							
	A. scabra	+				+			
	A. virginiata	+							
	Botryllus schlosseri	+				+			
	Clavelina lepadiformis	+		+		+		+	
Teleostei	*Conger conger*	F, 1							
	Ctenolabrus rupestris			F, 1					
	Gasterosteus aculeatus	+	1	+	4	+		o	
	Molva molva			F, 1					
	Pollachius pollachius	F, 1		F, 2					

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Conopeum seurati, Gasterosteus aculeatus) and one (*Enochrus bicolor*) is considered as oligohaline in this report.. Five species (*Idotea chelipes, Enochrus bicolor, Littorina "tenebrosa", Cerastoderma glaucum* and *Conopeum seurati*) are listed as lagoonal specialists in Britain (Davidson *et al.* 1991).

Most species were distributed throughout the pool but some which are common intertidally in the area (*Patella vulgata, Littorina littorea, Nucella lapillus, Paracentrotus lividus, Luidia ciliata*) were restricted to the seaward stations, and some herbivores and euryhaline species (*Balanus improvisus, Idotea chelipes, Elysia viridis, Enochrus bicolor)* were found only at the landward stations (A and D) which may receive more freshwater, or in *Zostera* beds.

13.2.3 Discussion

The fauna was distinctly marine and most of the recorded species probably occur in nearby shallow coastal water. There was, however, a significant brackish element which included five lagoonal specialists, three of which have been recorded in previous years and their populations are therefore well established. The salinity on both sampling occasions in 1996 was at least 34‰ but 28‰ was recorded in July 1990 when the lagoonal specialists *Hydrobia ventrosa* and *Palaemonetes varians* were present (not recorded in 1996). The salinity almost certainly falls to lower levels in winter and the high summer levels in 1996 may have been exceptional. The presence of marine fish not normally associated with isolated saline waters (ling and conger) suggests that large influxes of seawater occur occasionally.

The hydroid *Laomedea angulata,* which is associated with *Zostera,* is considered to be a rare species in Britain and there appears to be only one record of it in Ireland, but a recent coastal survey has shown that it actually occurs on many of the *Zostera* beds investigated. This site, and the North Slob, are the only known localities in Ireland of the controversial "species" *Littorina tenebrosa*..

13.2.4 Threats

Small numbers of cattle graze the surrounding land but have little impact on the pool.

The local landowner is attempting to provide a campsite in the vicinity of the pool but no special facilities have been provided so far.

13.2.5 Evaluation

Lettermullen Pool is a **natural rock lagoon** and is therefore of international importance on the basis of geomorphology alone..

Geomorphologically, this is a large, supralittoral rock pool which can also be classified as a lagoon with a rock barrier, receiving seawater by occasional overwash.

The pool contains a mixed flora of marine algae, *Zostera* and charophytes, and both hard and soft substrates, providing a wide range of habitats for fauna in a small area.

The aquatic fauna is distinctly marine, most species probably occurring on nearby shores, but there is also a significant element of brackish species, including five lagoonal specialists one of which, *Littorina "tenebrosa"*, is currently being investigated. The pool and its fauna are known to local marine biologists but no proper survey of the fauna has been carried out previously.

A interesting hydroid was recorded.

In conclusion, Lettermullen Pool has high conservation value as a unique type of lagoon but the area is remote and unlikely to need special conservation measures in the immediate future. Its designation as a proposed SAC is recommended.

13.2.6 References and Additional Sources of Information

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Plate 13.2.1 View of Lettermullen Pool looking west, Station A

Plate 13.2.2 View of Lettermullen Pool looking east, Station B (foreground) D (middle distance) and C (on the left)

Plate 13.2.3 View of Lettermullen Pool looking south

Plate 13.2.4 View of Lettermullen Pool looking southeast from Station A

13. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

13.3.1 Site Description (Fig 13.3.1)

Lettermullen Pool is a small isolated lagoon situated on a rocky headland and immediately bordered by high ground on all sides but the north east.

This high ground is predominantly covered with maritime grassland and cliff communities and drops more or less steeply to the lagoon's shores. These are low peat cliffs with occasional stretches of exposed bedrock.

The rocky substrate drops away fairly steeply from all shores but the northern, except where where a narrow bedrock shelf straddles the mouth of the southern bay.

A small area of wet grassland lies beyond the low cliff and outcrops of the north eastern shore and is associated with the pool's only inflow channel, which enters here. According to local knowledge this narrow channel is a third access point for seawater during winter storms, in addition to the two overwash points. Scirpus maritimus occurs in this channel up to approximately 250 meteres back from the lagoon.

There is no emergent vegetation.

13.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

1. <u>Transects:</u>

The locality of these is shown in Fig. 13.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A

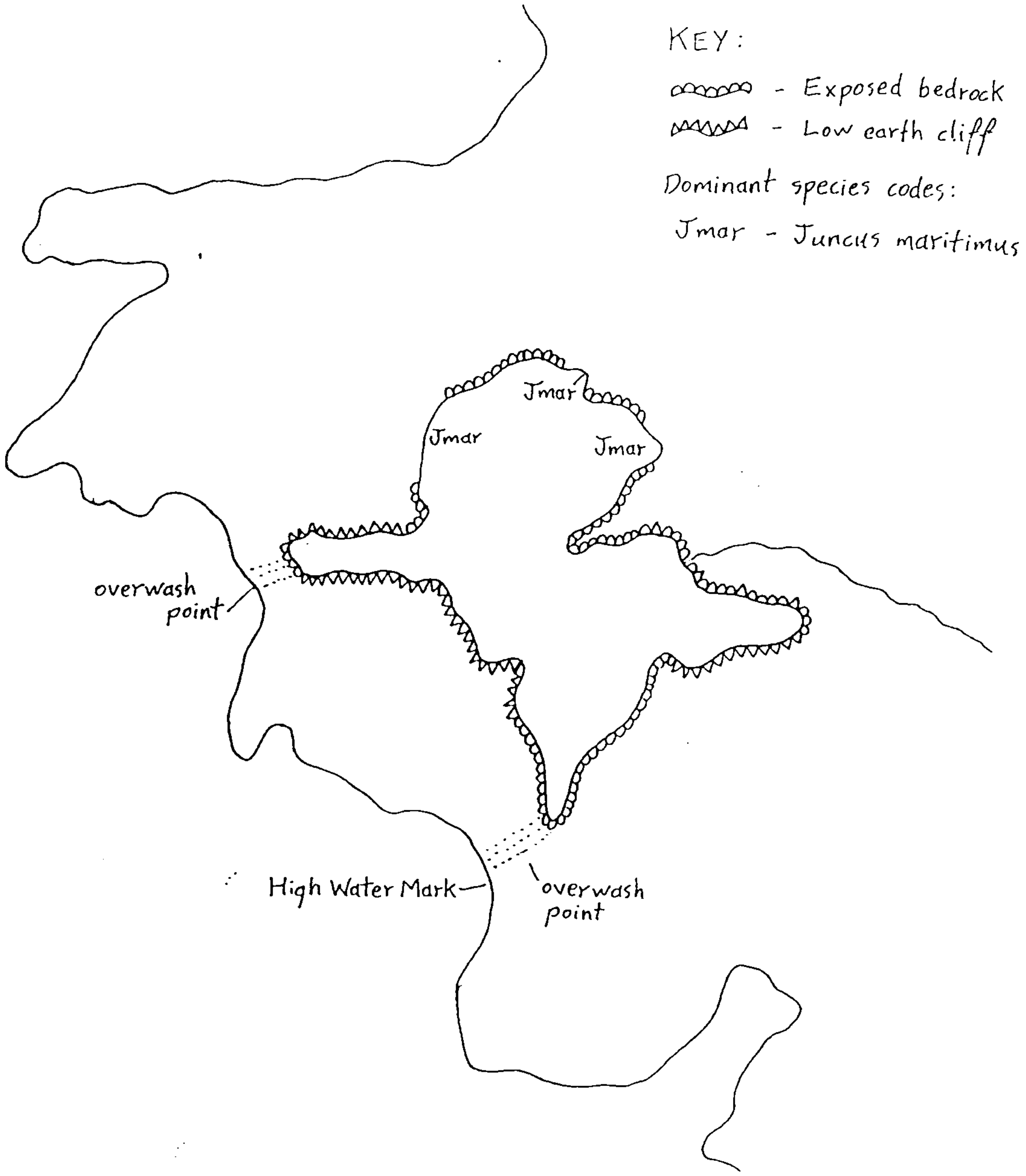

Fig. 13.3.1 Lettermullen Pool, Co. Galway - Marginal Vegetation

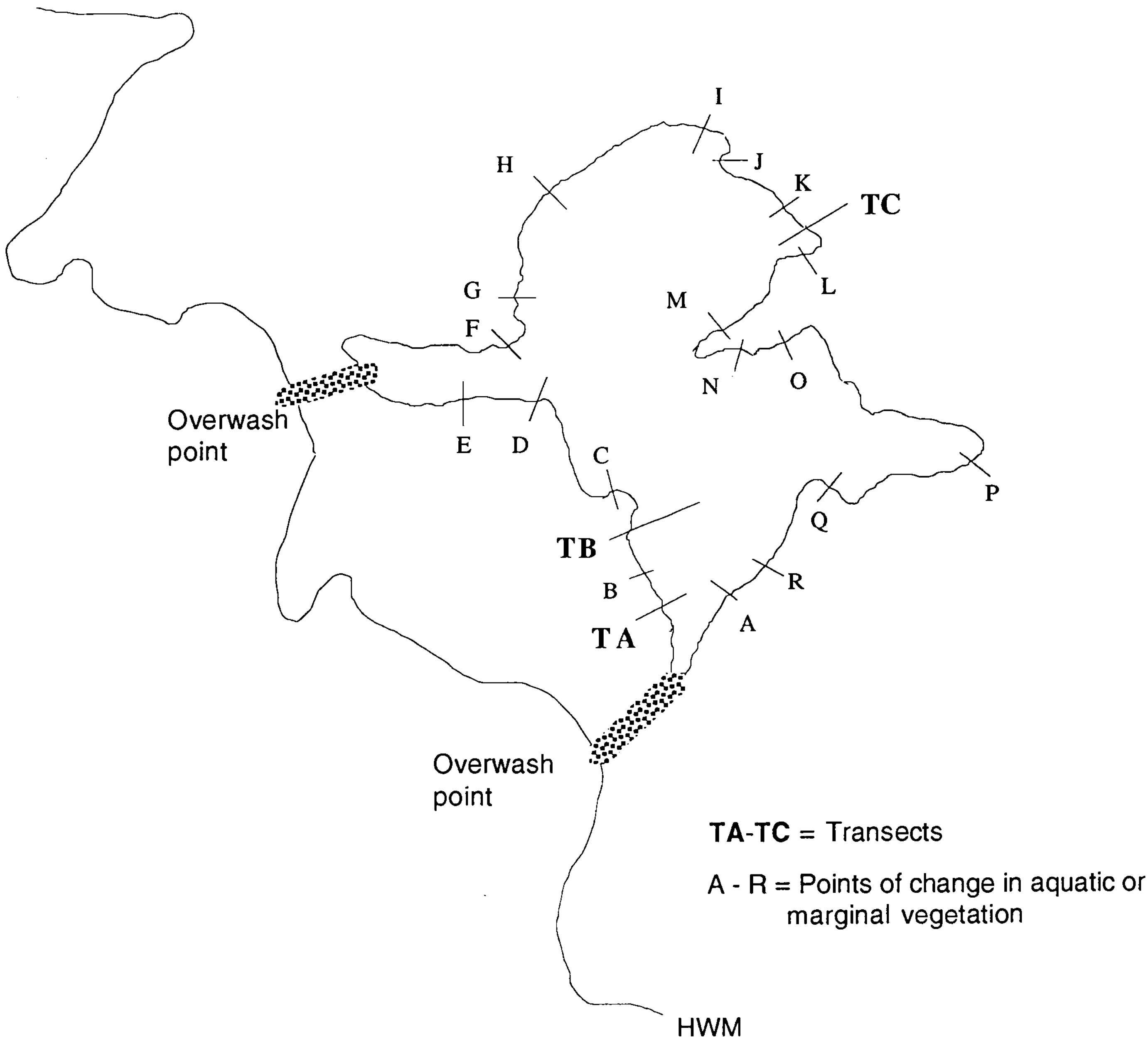

Figure 13.3.2 Location of Transects and Shore-based Survey Sections, Lettermullen Pool, Co. Galway

transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded.
The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values
Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin .	10	91-100 %
	9	76-90 %
	8	51-75 %
	7	34-50 %

6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.
Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

13.3.3 Results

1. Shore-based survey

Section A-B (Transect A)

Aquatic: Filamentous algae - extensive
Corallina officinalis - patchy
Chondrus crispus - sparse

Bedrock substrate

Marginal: Exposed bedrock shore - slope c.35-90 degrees

Adjacent: Maritime cliff community dominated by Festuca rubra with frequent Armeria maritima, Crithmum maritimum, Plantago maritima, Plantago coronopus, Spergularia rupicola, Silene maritima and crustose and fruticose lichens

Section B-C (Transect B)

Aquatic: Ruppia cirrhosa - patchy
Zostera marina - patchy
Filamentous algae - patchy
Enteromorpha - sparse
Polysiphonia elongata - sparse
Codium tomentosum - sparse
Lomentaria clavellosa - sparse

Bedrock substrate forming shallow shelf with sand, gravel, cobbles and boulders

Marginal: Low rock and earth cliff to 20cm

Adjacent: As A-B plus occasional Limonium humile and Raphanus maritimus

Section C-D

Aquatic: Ruppia cirrhosa - dense bed beyond algae
Zostera marina - patchy cover amongst Ruppia
Filamentous algae - dense cover up to 1m out
Enteromorpha - sparse amongst filamentous algae
Chondrus crispus - sparse amongst filamentous algae
Lamprothamnium papulosum

Bedrock substrate

Marginal: Unchanged

Adjacent: Unchanged

Section D-E

Aquatic: Ruppia cirrhosa - patchy
Zostera marina - sparse
Filamentous algae - as above
Enteromorpha - as above
Chondrus crispus - as above

Marginal: Unchanged

Adjacent: Unchanged

Section E-F

Aquatic: Ruppia cirrhosa - patchy
Zostera marina - very sparse
Filamentous algae - as above
Enteromorpha - as above
Chondrus crispus - as above

Bedrock substrate with cobbles and boulders in shallow sheltered bay

Marginal: Unchanged

Adjacent: Unchanged

Section F-G

Aquatic: Ruppia cirrhosa - dense bed beyond algae
Zostera marina - patchy cover amongst Ruppia
Filamentous algae - patchy cover up to 1m out
Corallina officinalis - patchy cover up to 1m out
Chondrus crispus - sparse up to 1m out

Marginal: Bedrock shore with lichens

Adjacent: Festuca rubra - Potentilla anserina grassland. Grazed

Section G-H

Aquatic: Unchanged

Marginal: Juncus maritimus dominated salt tolerant community as Transect C forming 1-2m strip along shore. Juncus gerardii and Glaux maritima frequent with few sparse associates.

Adjacent: Unchanged

Section H-I

Aquatic: Species and cover as before plus Lamprothamnium papulosum

Marginal: Bedrock shore - average slope c.45 degrees - with occasional emergent Juncus maritimus tussocks

Adjacent: Unchanged

Section I-J

Aquatic: Unchanged

Marginal: As G-H

Adjacent: Unchanged

Section J-K

Aquatic: As F-G

Marginal: Bedrock shore with lichens

Adjacent: Public road
Backing to Ulex gallii - Erica cinerea heath

Section K-L (Transect C)

Aquatic: Ruppia cirrhosa - dense bed c.10m out, increasingly sparse to landward
Zostera marina - patchy cover amongst Ruppia, increasingly sparse to landward
Filamentous algae - increasing cover to landward
Lamprothamnium papulosum - patchy cover up to 5m out

Silt substrate

Marginal: Dense Juncus maritimus cover with patchy Juncus gerardii and sparse salt tolerant associates. 1m

Adjacent: Festuca rubra - Potentilla anserina grassland

Section L-M

Aquatic: Ruppia cirrhosa - dense bed beyond algal belt
Zostera marina - patchy cover amongst Ruppia
Filamentous algae - dense cover up to 1m out
Lamprothamnium papulosum - beyond Ruppia belt

Bedrock substrate with silt and cobbles

Marginal: Bedrock shore with lichens

Adjacent: Bedrock outcrop with lichens

Section M-N

Aquatic: Ruppia cirrhosa - dense bed beyond algal belt
Zostera marina - patchy cover amongst Ruppia
Algae as A-B in narrow strip to 2m out

Bedrock substrate

Marginal: Unchanged

Adjacent: Unchanged

Section N-O

Aquatic: Ruppia cirrhosa - open bed beyond algal belt
Zostera marina - patchy cover amongst Ruppia
Lamprothamnium papulosum - patchy cover amongst Ruppia
Filamentous algae - dense cover up to 1m out
Chondrus crispus - sparse amongst filamentous algae

Marginal: Unchanged

Adjacent: Unchanged

Section O-P

Aquatic: Species unchanged
Lamprothamnium restricted to shallow bays
Chondrus restricted to steeply sloping bedrock shores

Bedrock substrate with silty patches

Marginal: Bedrock shore with occasional stretches of c.50cm peat cliff
Peat cliff areas backing to Juncus maritimus dominated community as
Transect C.
1-2m

Adjacent: Festuca rubra - Potentilla erecta grassland

Section P-Q

Aquatic: Ruppia cirrhosa - dense bed beyond algal belt
Zostera marina - patchy cover amongst Ruppia
Filamentous algae - dense cover to 2-5m out

Marginal: 30-50cm peat cliff

Adjacent: Unchanged

Section Q-R

As A-B plus sparse Codium

Section R-A

Aquatic: As B-C

Marginal: Steep bedrock shore with crustose, foliose and fruticose lichens - slope c.80 degrees

Adjacent: Maritime cliff community as A-B

2. Transects

Site: Lettermullen Pool	Transect code: A	
Location: Seawater access point	Sample point: 1 Aquatic - 2m out	
Sample area: 20m2 (10x2)	Substrate: Bedrock	
Depth: 10 - 40 cm	Salinity: 34 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Corallina officinalis	4	65
Filamentous algae	6	30
Chondrus crispus	5	> 1
Description: Open cover of Corallina with patchy filamentous algae on steeply sloping		
substrate.		

Site: Lettermullen Pool	Transect code: A	
Location: Seawater access point	Sample point: 2 Aquatic - 50cm out	
Sample area: 10m2 (10x1)	Substrate: Bedrock	
Depth: 0 - 10 cm	Salinity: 34 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Filamentous algae		100
Description: Dense cover of filamentous algae only.		
Backing rocky shore (slope c.75 degrees) dominated by Festuca rubra with		
Armeria maritima, Crithmum maritimum, Plantago maritima, Plantago coronopus, Spergularia		
rupicola, Silene maritima and rupicolous crustose and fruticose lichens.		

Lettermullen Pool

Site: Lettermullen Pool	Transect code: B	
Location: Shallow rock shelf	Sample point: 1 Aquatic - 25m out	
Sample area: c.300m2 (whole stand)	Substrate: Bedrock, sand	
Depth: 30 cm (average)	Salinity: 34 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		20
Ruppia cirrhosa	40	15
Zostera marina	40	5
Algae		40
Filamentous algae	10	40
Codium tomentosum	3	< 1
Polysiphonia elongata	4	< 1
Lomentaria clavellosa	4	< 1
Enteromorpha	10	< 1
Description: Open filamentous algae cover with Ruppia and Zostera occurring in occasional small dense beds (average area c.5m2) and in more open cover. Other algal species sparse. Within Ruppia - Zostera beds average cover c.80% Ruppia - 20% Zostera. This is a raised area of bedrock running across the northern end of the bay at the southern seawater overwash point. The substrate drops away sharply to north and south. Backing to 50cm peat cliff. Plantago coronopus, Plantago maritima, Armeria maritima, Silene maritima frequent.		

Site: Lettermullen Pool	Transect code: C	
Location: Sheltered bay	Sample point: 1 Aquatic - 10m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 30 cm	Salinity: 35 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		100
Ruppia cirrhosa	50	90
Zostera marina	60	10
Algae		10
Filamentous algae		10
Description: Dense Ruppia bed with occasional patches of Zostera and filamentous algae.		

Lettermullen Pool

Site: Lettermullen Pool	Transect code: C	
Location: Sheltered bay	Sample point: 2 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt, cobbles	
Depth: 20 cm	Salinity: 35 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		5
Ruppia cirrhosa	30	< 5
Zostera marina	30	< 5
Algae		90
Filamentous algae		70
Lamprothamnium papulosum	10	20
Description: Filamentous algae dominant with sparse Ruppia and Zostera. Lamprothamnium		
in fairly dense patches, locally dominant within 2m of shore.		

Site: Lettermullen Pool	Transect code: C	
Location: Sheltered bay	Sample point: 3 Marginal	
Sample area: 10m2 (10x1)	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Juncus maritimus	50	80
Juncus gerardii	25	10
Glaux maritima	10	5
Cochlearia anglica	4	5
Aster tripolium	25	< 1
Plantago maritima	10	< 1
Limonium humile	25	< 1
Description: Dense Juncus maritimus cover with patchy Juncus gerardii and sparse salt		
tolerant associates. 2m.		
Grading to Festuca rubra - Potentilla anserina grassland. 10m.		
Backing public road.		

13.3.4 Evaluation

'Valuable'

Lettermullen is a small rocky site of high salinity (34-35 parts per thousand at time of survey) and interesting species composition.

The presence of marine algae could be expected at such a site and several species are found here. Corallina officinalis is abundant. Chondrus crispus, Lomentaria clavellosa, Codium tomentosum and Polysiphonia elongata all occur at varying degrees of frequency.

Zostera marina could also be expected and is abundant here. Particularly interesting is the occurrence of these marine species with abundant Ruppia cirrhosa and with Lamprothamnium papulosum, a rare charophyte for which this is a new site.

Lamprothamnium was known from only three Irish sites before this survey took place. Its presence at Lettermullen is alone reason enough to regard the site as valuable. Lamprothamnium is very locally abundant in shallow areas close to the northern shore and was also found in deeper water (>1m) by grapnel survey from the southern and western shores.

The distribution of species is also interesting in that a distinct zonation occurs along the steeper, rocky shores with algal species forming a 1-2m wide belt below the shore with a dense mixed Ruppia and Zostera bed beyond.

Marginal vegetation is restricted due to the rocky, steep-sided nature of the site. No emergent species occur here. Juncus maritimus over species-poor salt tolerant vegetation is the dominant community.

Lettermullen Pool is a good representative of an isolated (i.e. having no permanent connection to the sea) highly saline lagoon. Species composition and shore zonation are interesting, species diversity and abundance are high and a rare charophyte occurs here.

A full aquatic survey is recommended.

13.4 ECOTONAL COLEOPTERA

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13.4.1 Site Description

A < 0.5 ha rock-pool lagoon, with mostly rocky shore, and small rock pools occurring above lagoon water level at date of visit. Eroded peat and coarse shell-sand cliff-banks and coarse sand / pebble shingle and some *Juncus maritimus* occurred. However, none of these areas were represented by more than a few metres of shore-line.

Subsites (see Fig 13.4.1)

1. Barrier shingle (L 827213)

Cobbles on coarse sand, bank creating barrier to sea to north-west of site. *Ligia oceanica* abundant.

13.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the

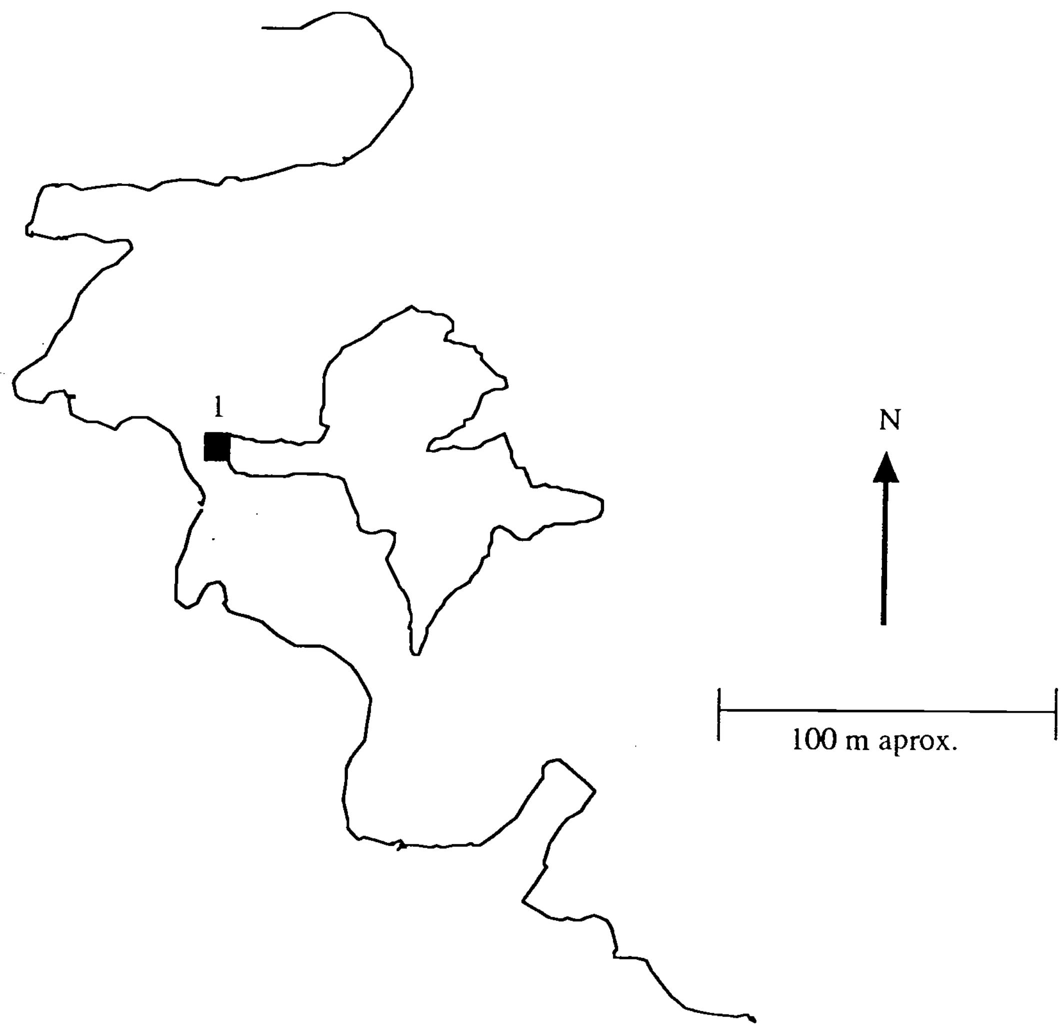

Fig. 13.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Lettermullen Pool, Co. Galway

1 - Cobble search

non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 13.4.1 For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.
Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water.

Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

TABLE 13.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps

Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References
Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

(1) Barrier shingle - cobble search (50 cobbles, 6 vii 1996).

No carabids or staphylinids were recorded.

13.4.3 Survey Results

There is insufficient habitat at this site to allow comparative sampling, so a full survey was not undertaken.

13.4.4 Evaluation

Of <u>no</u> conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

There is insufficient habitat to allow comparative sampling, and probably to support a viable assemblage of ecotonal Coleoptera. Furthermore, the nature of the substrate and abundance of *Ligia* indicate that the margins of the site are regularly disturbed by sea flooding.

13.5 SUMMARY AND EVALUATION

Lettermullen Pool is a small (1 ha) **natural rock lagoon** and is therefore of international importance based on the Habitats Directive.

The pool and its fauna are known to local marine biologists but no proper survey of the fauna has been carried out previously.

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	High
Aquatic Fauna	High/Exceptional
Vegetation	Exceptional
Ecotonal Coleoptera	(No appropriate habitats)

Geomorphology

Geomorphologically, this is a large, supralittoral rock pool (c.1 ha.) which can also be classified as a lagoon with a rock barrier, receiving seawater by occasional overwash.

As a coastal lagoon of unusual type Lettermullen is rated as of high conservation value.

Aquatic Fauna

Among 52 taxa listed, 48 are identified to species; including five species (*Idotea chelipes, Enochrus bicolor, Littorina "tenebrosa", Cerastoderma glaucum* and *Conopeum seurati*) which are listed as lagoonal specialists.

Most species were distributed throughout the pool but some which are common intertidally in the area (*Patella vulgata, Littorina littorea, Nucella lapillus, Paracentrotus lividus, Luidia ciliata*) were restricted to the seaward stations, and some herbivores and euryhaline species (*Balanus improvisus, Idotea chelipes, Elysia viridis, Enochrus bicolor)* were found only at the landward stations which may receive more freshwater, or in *Zostera* beds.

The pool contains a mixed flora of marine algae, *Ruppia, Zostera* and charophytes, and both hard and soft substrates, providing a wide range of habitats for fauna in a small area.

This one of only two known localities *forLittorina "tenebrosa". An* interesting hydroid (*Laomedia angulata*) was recorded.

Based on the high number of species including lagoonal specialists. Lettermullen is rated as of high to exceptional conservation value.

Vegetation

Lettermullen is a small rocky site of high salinity (34-35 ‰ at time of survey) and interesting species composition.

The presence of marine algae could be expected at such a site and several species are found here. *Corallina officinalis* is abundant. *Chondrus crispus, Lomentaria clavellosa, Codium tomentosum* and *Polysiphonia elongata* all occur at varying degrees of frequency.

Zostera marina could also be expected and is abundant here. Particularly interesting is the occurrence of these marine species with abundant *Ruppia cirrhosa* and with *Lamprothamnium papulosum*, a rare charophyte for which this is a new site.

Lamprothamnium was known from only three Irish sites before this survey took place. Its presence at Lettermullen is alone reason enough to regard the site as valuable. *Lamprothamnium* is very locally abundant in shallow areas close to the northern shore and was also found in deeper water (>1m) by grapnel survey from the southern and western shores.

The distribution of species is also interesting in that a distinct zonation occurs along the steeper, rocky shores with algal species forming a 1-2m wide belt below the shore with a dense mixed *Ruppia* and *Zostera* bed beyond.

Marginal vegetation is restricted due to the rocky, steep-sided nature of the site. No emergent species occur here. *Juncus maritimus* over species-poor salt tolerant vegetation is the dominant community.

Lettermullen Pool is a good representative of an isolated (i.e. having no permanent connection to the sea) highly saline lagoon. Species composition and shore zonation are interesting, species diversity and abundance are high and a rare charophyte occurs here. The site is therefore rated as of exceptional conservation value

A full aquatic survey is recommended.

Ecotonal Coleoptera

No carabids or staphylinids were recorded.

There is insufficient habitat to allow comparative sampling, and probably to support a viable assemblage of ecotonal Coleoptera. Furthermore, the nature of the substrate and abundance of *Ligia* indicate that the margins of the site are regularly disturbed by sea flooding.

Lettermullen Pool is therefore rated as of no conservation value for terrestrial ecotonal community.

Summary

In conclusion, Lettermullen Pool has high conservation value as a unique type of lagoon.

The aquatic fauna was distinctly marine, most species probably occurring on nearby shores, but there is also a significant element of brackish species, including five lagoonal specialists one of which, *Littorina "tenebrosa"*, is currently being investigated. The pool and its fauna are known to local marine biologists but no proper survey of the fauna has been carried out previously.

Species composition and shore zonation of the vegetation are interesting, species diversity and abundance are high and a rare charophyte was recorded.

Based on geomorphology, aquatic fauna and flora Lettermullen Pool is rated as of high conservation value.

Designation as a proposed SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

14. LOCH TANAÍ

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

14. LOCH TANAÍ, Co. Galway

CONTENTS

14. LOCH TANAÍ, Co. Galway.

OS Grid Reference: L 950 305, 1:50,000 Sheet No. 45
Alternative names: Lough Nacrimina

14.1 STUDY AREA

General features
Loch Tanaí is situated in western Connemara, 5 km north of Costelloe and 6 km south of Camus. The lake is shallow and lies in an area of lowland peat, which receives seawater through a channel in the peat which connects it to Loughaunavneen, a small bay of the larger Camus Bay (Fig. 14.1.1). The description of this lake as a lagoon may be contentious but it is included as a good example of a type of lagoon, rare in a European context, but characteristic of parts of the west coast of Ireland, especially in Connemara, which are permanent, shallow, brackish, with restricted tidal influence due to the presence of a "barrier" of peat. These "peat" lagoons are of particular interest as very little appears to be known about any aspect of the functioning of brackish lagoons situated in acid peatbogs.

Very little is known about the lake. It appears to have no protective status but lies close to the proposed Kinvarra Saltmarsh NHA (Site code 2075)

Climate and oceanographic influences
(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6°C in January and 15°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8.5 and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1300 mm, and the number of rain days (1 mm or more) is 175-200. Winds are mainly from the southwest. Mean annual hourly wind speeds are 5-6.0 m/s and a maximum wind speed of 30-35 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Kilkieran is 4.2 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology The Connemara region of Galway is a glaciated plain of rolling lowland with granite outcrops and Atlantic type blanket bog. The granite bedrock is impervious and drainage density is high. Soils other than peat are shallow

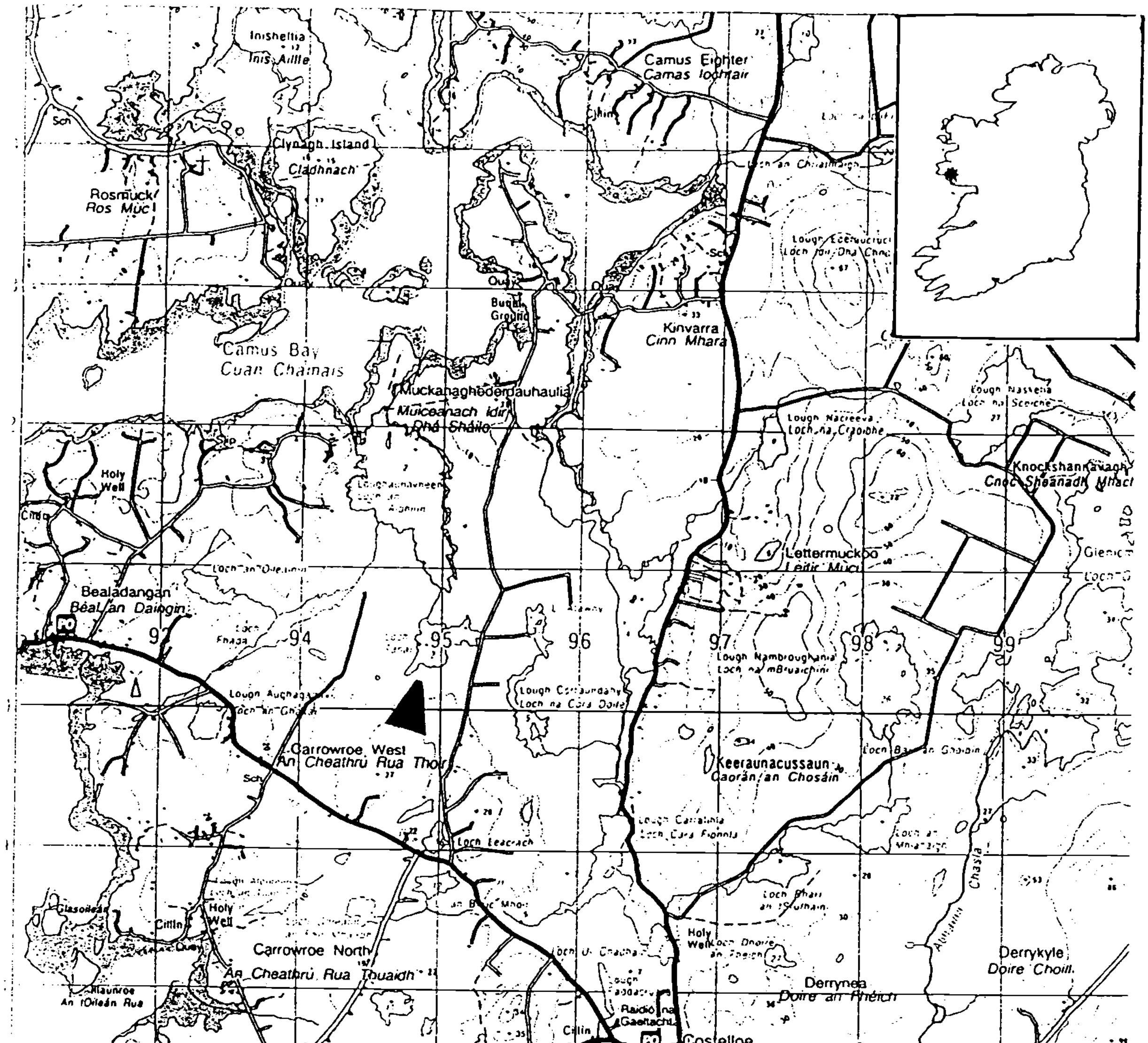

Fig. 14.1.1 Section of 1:50 000 map showing locality of Loch Tanai

podzols with very limited land-use capability (R.I.A. 1979). The area was described by Haughton (1957) as a "wilderness of bare rock, glacial erratics, water and peat".

Land surrounding the loch consists of small irregular fields of semi-improved pasture, bare rock, small peatbogs and wet heathland.

Lake Topography The lagoon is an 'L' shape, rotated 90 degrees, measuring approximately 300 m from north to south, 500 m from west to east and covers about 12 ha. Water depth is fairly uniform 50 - 120 cm over most of the lake with shallower margins, substrate consists mostly of unconsolidated peat with patches of rocks of various sizes, associated especially with scattered rocky islands.

It seems likely that the lake is not as natural as it appears, but that it may have been at least partly created through an earlier phase of peat cutting. The channel connecting the lake to the tidal area of Loughaunavneen appears to have been cut deliberately but it is not known at what date or whether it was cut recently in an attempt to drain the lake and surrounding land or at an earlier date in order to cut peat.

Hydrology Freshwater enters the lake through a stream in the southwest, through the slow release of groundwater from the saturated peat and in direct rainfall. Seawater appears to enter during spring tides and perhaps on the higher neap tides.

No tidal fluctuation in water level of the lake was recorded during the survey, but a seasonal pattern is likely (Plate 2.14.4), whereby water levels rise in the winter with the increased rainfall and storm frequency, and gradually decline in the summer. The peaty soils of the surrounding land would, however, through absorption and slow release of water, affect the delivery time of both surface- and ground-water flows to the pool.

Salinity and water quality Salinity levels are likely to be in the upper range through most of the year, with a rise during the summer and decline in the winter. The peaty soils of the surrounding land would, however, affect the variation. The prolonged flow of freshwater to the pool during the "dry" months may result in lower salinities than might be expected. On the other hand, winter storms may result in a higher volume of seawater entering the lake and raising salinity levels at a time when they might be expected to fall.

The surrounding land is relatively natural and even grazing land is likely to receive only limited fertilizer applications. Water quality appears to be high although quite a deep layer of organic silt has accumulated in some areas of the lake and there is a dense growth of pond weed and filamentous algae in the southwest where the freshwater stream enters. A certain amount of pollution of the lake has occurred through the dumping of cars and refuse in the part of the lake closest to the road.

14.2. AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

14.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰ precision). A photographic record was made of the site and local information sought concerning background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and D in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of

the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved.

All Diptera are identified to family level.

14.2. 2 Results

Loch Tanaí was sampled on the 22.vi.96. during the first part of the survey, and from 22-24.viii.96 during the more intensive survey.

Five sampling stations were selected in the lake to reflect the influences of substrate, and freshwater/seawater inflows. Fig. 14.2.1 shows the position of these sampling stations in the lagoon.

Environmental Variables

Station A (OS 9521 3057) was located at the eastern end of the lake nearest to the road (Plate 14.2.1). There are freshwater seepage zones on the shoreline in this area, and this part of the lake has been used as a dumping area for cars and refuse. Water depth varied from 0 cm to 60 cm, substrate was fine silts and peat, with occasional stones and gravel. Salinity measured 32-34‰

Station B (OS 9515 3057) was located in the small bay slightly to the northwest of Station A (Plate 14.2.1). A small spring enters at this point, water depth was very shallow (0 - 15 cm) substrate consisted of soft unconsolidated peat and salinity measured 11 ‰

Station C (OS 9492 3061) was located in the northwest corner where the channel which leads to Camus Bay enters the lake. Water depth was 0 - 1 m, substrate was mostly unconsolidated peat and salinity measured 28 - 32 ‰.

Station D (OS 9488 3036) was located at the bay at the southwestern end of the lake where a stream enters. Depth varied from 0 cm - 1 m, substrate was unconsolidated peat with a dense growth of pond weed and filamentous algae and salinity measured 14 - 27 ‰..

Station E (OS 9498 3052) was located on the shoreline of the largest rocky island in the lake. substrate consisted of granite rocks and boulders with pockets of coarse granite sand and organic silt, water depth varied from 0 - 1 m. and salinity measured 34 ‰

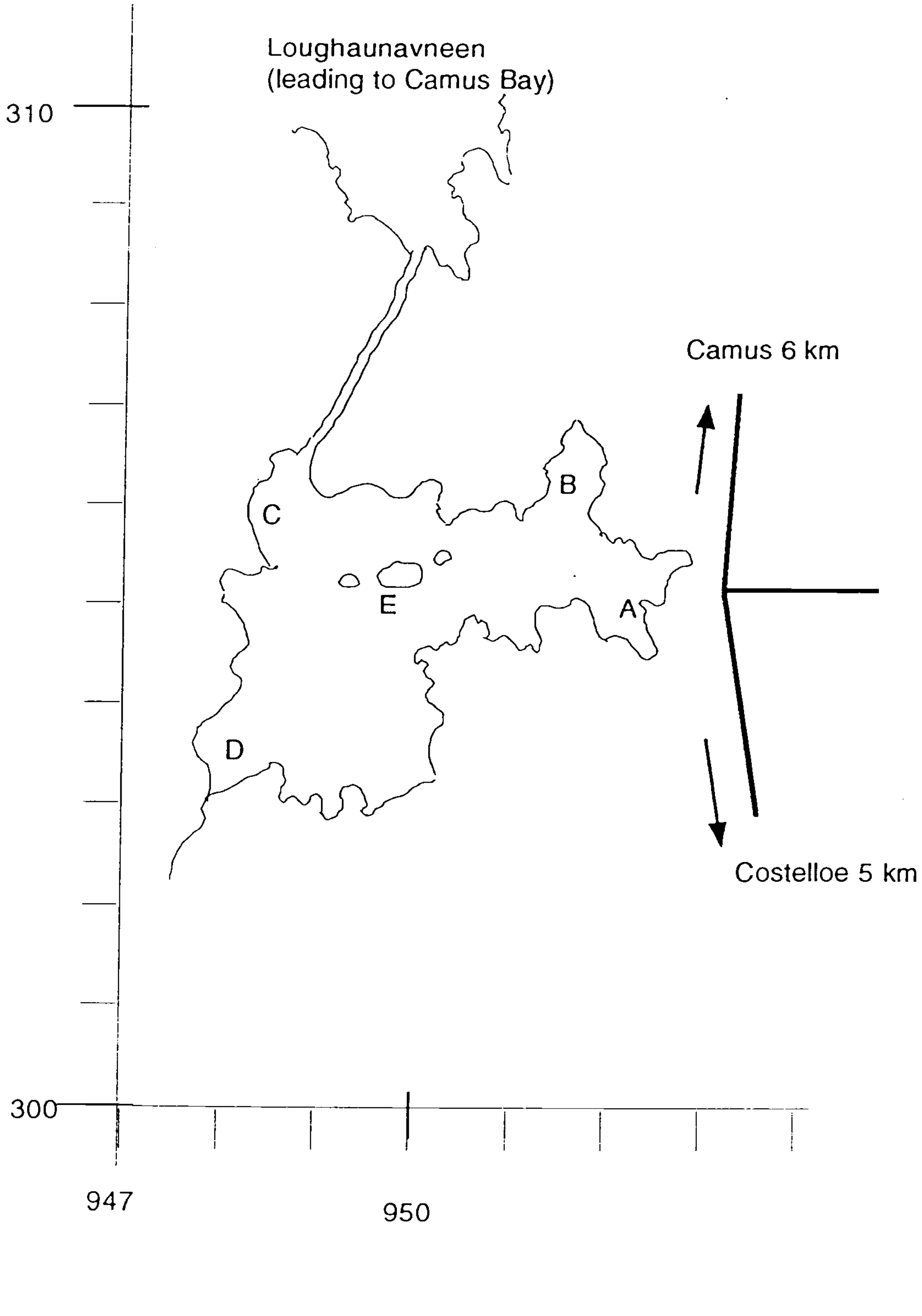

Fig. 14.2.1 Location Map of Sampling Stations in Loch Tanaí, Co. Galway.

Table 14.2.1. Fauna Recorded at Loch Tanai. June and August 1996.

		Sampling Stations (L.T. = light-trap)									
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	L.T.E
Porifera											
Cnidaria	*Aurelia aurita*	+								+	
Turbellaria											
Nemertea	Nemertea	+									
Annelida	*Arenicola marina*	o		a							
	Hediste diversicolor			+		+	1			+	
	Polychaeta indet.	+									
	Tubificidae indet.	+									
Crustacea											
Cirripedia											
Mysidacea	*Praunus flexuosus*	a	>100	a		a	100	a	>100	a	c100
Isopoda	*Lekanesphaera hookeri*	+	4	+				+	+	3	
	Idotea chelipes	+		+		+		+		+	1
	Ligia oceanica									+	
Amphipoda	*Caprella acanthifera*					+					
	Corophium volutator			+				+			
	Dexamine spinosa										+
	Melita palmata	+						+		+	
	Orchestia gammarella					+				+	
Tanaidacea											
Decapoda	*Carcinus maenas*	+						F, 1			
	Palaemonetes varians	o	3								
Arachnida	Hydracarina						1				
Insecta											
Ephemeroptera											
Odonata											
Plecoptera											
Trichoptera											
Hemiptera											
Coleoptera	*Enochrus bicolor*			+							
Diptera	Chironomidae	+						+			
Mollusca											
Prosobranchia	*Hydrobia ulvae*	+						+			
	Hydrobia ventrosa	+		+				+			
	Littorina saxatilis	+				+		+	12	+	1
	Rissoa membranacea	+				c		+		+	
Opisthobranchia	*Akera bullata*	c	6			+		+		+	
Pulmonata											
Bivalvia	*Cerastoderma glaucum*	a				o		+		+	
	Musculus discors	+				+				+	
	Mytilus edulis	+				+		+		+	
Bryozoa	*Conopeum seurati*	+				+				+	
Echinodermata											
Tunicata	*Ascidiella scabra*	+				+				+	
	Clavelina lepadiformis	+				+		+		+	
Teleostei	*Anguilla anguilla*							F,			
	Gasterosteus aculeatus	o	2			o	2	o	3		
	Mugilidae	a	1								
	Platichthys flesus	F,									
	Syngnathus typhle					1					

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 14.2.1. Among 36 taxa listed, 30 are identified to species. The list (excluding marginal species) comprises 10 marine species, 9 poly-mesohaline, 9 euryhaline and one oligohaline species. Hydracarina are assumed to be limnic. (Table 14.2.2). Six species are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Differences in salinity between stations, which varied from 11‰ at B to 32-34‰ at A and E, did not have a noticeable affect on faunal distribution. *Enochrus bicolor*, for example, were taken in both the lowest and highest salinities. Equally, habitats with different substrates and vegetation were not characterised by differences in faunal composition or diversity. In spite of the soft substrate, much of which was unconsolidated peat, burrowing forms were relatively well represented throughout the lake and were not more abundant or diverse at stations with more sand or silt (e.g. A). The most abundant species at all stations was *Praunus flexuosus*. *Cerastoderma glaucum* was represented by both adults and juveniles.

Table 14.2.2 Ecological categories of the recorded taxa in Loch Tanaí (excluding marginal species). L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Aurelia aurita*	
	Dexamine spinosa	
	Caprella acanthifera	
	Hydrobia ulvae	
	Akera bullata	
	Musculus discors	
	Mytilus edulis	
	Ascidiella scabra	
	Clavelina lepadiformis	
	Syngnathus typhle	
Poly-mesohaline	*Arenicola marina*	
	Praunus flexuosus	
	Melita palmata	
	Corophium volutator	
	Hydrobia ventrosa	L
	Littorina saxatilis	
	Rissoa membranacea	
	Cerastoderma glaucum	L
	Mugilidae	
Euryhaline	*Hediste diversicolor*	
	Lekanesphaera hookeri	L
	Idotea chelipes	L
	Palaemonetes varians	L
	Carcinus maenas	
	Conopeum seurati	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Platichthys flesus	
Oligo-mesohaline	*Enochrus bicolor*	L
Limnic	Hydracarina	

14.2.3 Discussion

The fauna is moderately rich and the species predominantly brackish with a high proportion of lagoonal specialists. The assemblage typifies an open system receiving regular influxes of seawater but also considerable amounts of freshwater. The fauna is characteristic of lagoons with sea inlets and water in the upper to middle salinity range which allows persistence of lagoonal specialists such as *Cerastoderma glaucum* and *Hydrobia ventrosa* together with marine species such as tunicates, *Akera bullata* and *Syngnathus typhle.*

Akera bullata and *Syngnathus typhle* were not found at any other site. None of the recorded species can be described as rare in Ireland.

14.2.4 Threats

There appear to be no threats to the lake other than the fact that the shore is used as a refuse dump and there is possible eutrophication in the southwest of the lake.

14.2.5 Evaluation

Loch Tanaí is a **natural saline lake** in peat. Although not a lagoon in the strict sense because the barrier is neither sedimentary or of rock, it presents many of the characteristics of lagoons e.g. it is shallow and brackish, and contains a high proportion of lagoonal specialist species. It could be described as a lagoon with a peat barrier.

It is an unusual type of saline lake formed in peat, with a long, possibly artificial, tidal inlet. It is one of several similar lakes in the peatland area south of Camus Bay all of which have long inlets and may have similar origins. Their history and hydrology are worth further investigation.

Loch Tanaí, and the other similar lakes in the area, appear to be unknown to marine biologists and their communities have not, therefore, been investigated.

Faunistically, the lake is a good example of a lagoon with salinity in the middle to upper range. A high proportion of the species recorded are lagoonal specialists. There were some unusual species present, e.g. *Akera bullata* and *Syngnathus typhle,* but no rare species were recorded.

As very little appears to be known about any aspect of brackish lagoons in acid peatlands, it is recommended that the other similar lakes in the vicinity be investigated and consideration be given to a proposed SAC designation for the total area in which they lie.

14.2.6 References and Additional Sources of Information

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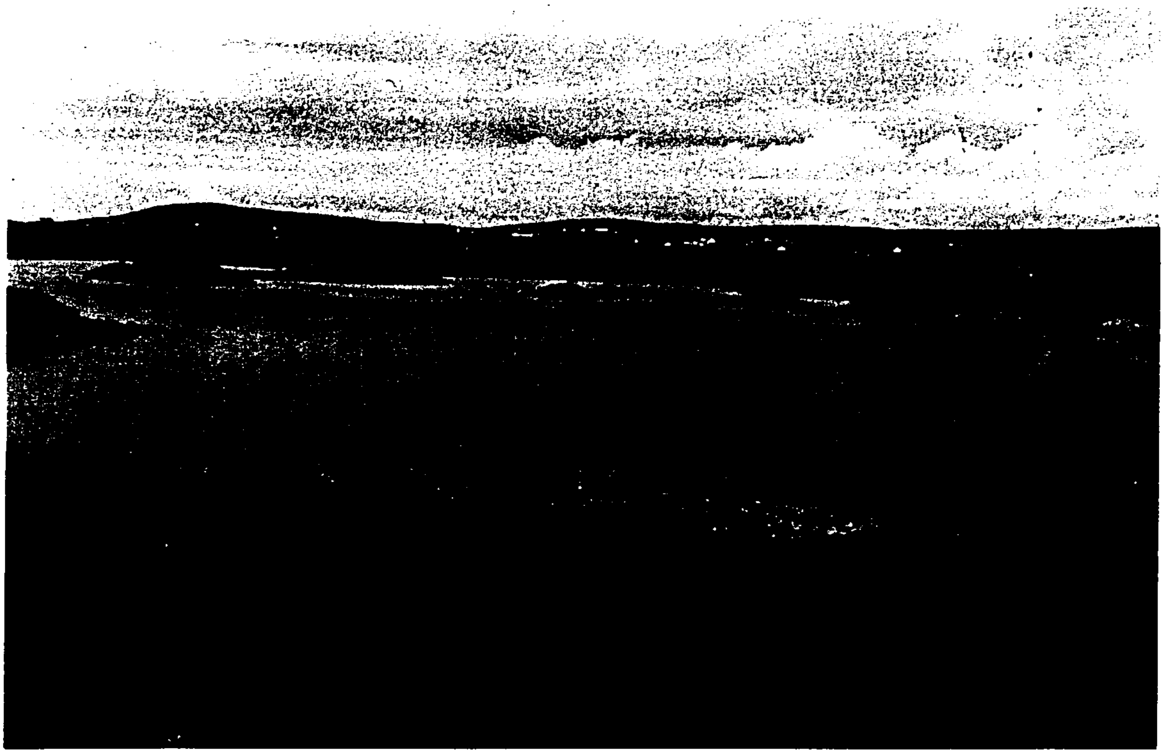

Plate 14.2.1 View of Loch Tanaí looking west from Station A.

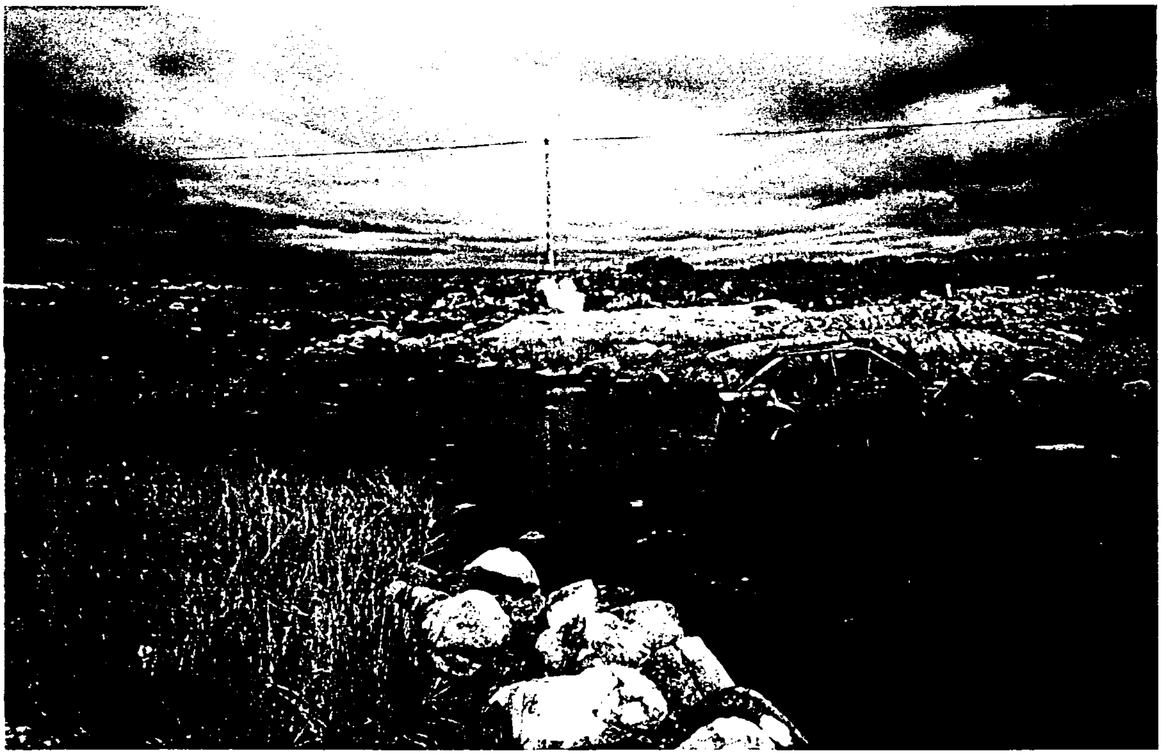

Plate 14.2.2 Area of Loch Tanaí close to the road used as a rubbish dump.

Plate 14.2.3 View across Loch Tanaí from Station B, looking southwest..

Plate 14.2.4 Large granite rock in Loch Tanaí showing evidence of variation in water level.

14. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

14.3.1 Site Description (Fig. 14.3.1)

This is a low-lying area of heath and bog with frequent rock outcrops.

Exposed bedrock forms much of the shoreline, particularly on small promontories, with long stretches of peat shore between forming low cliffs in places. Marginal areas are typically narrow with more extensive Juncus maritimus wetland around bayheads and associated inflows.

The only stands of tall emergents are narrow Phragmites beds fringing the two largest islands.

The main freshwater inflow joins the lagoon from the south west. There are several smaller streams and flushes, mostly to the south.

The outlet channel runs from the north west corner of the lagoon.

A public road runs along part of the north eastern shore.

14.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey.

1. <u>Transects:</u>

The locality of these is shown in Fig. 14.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A

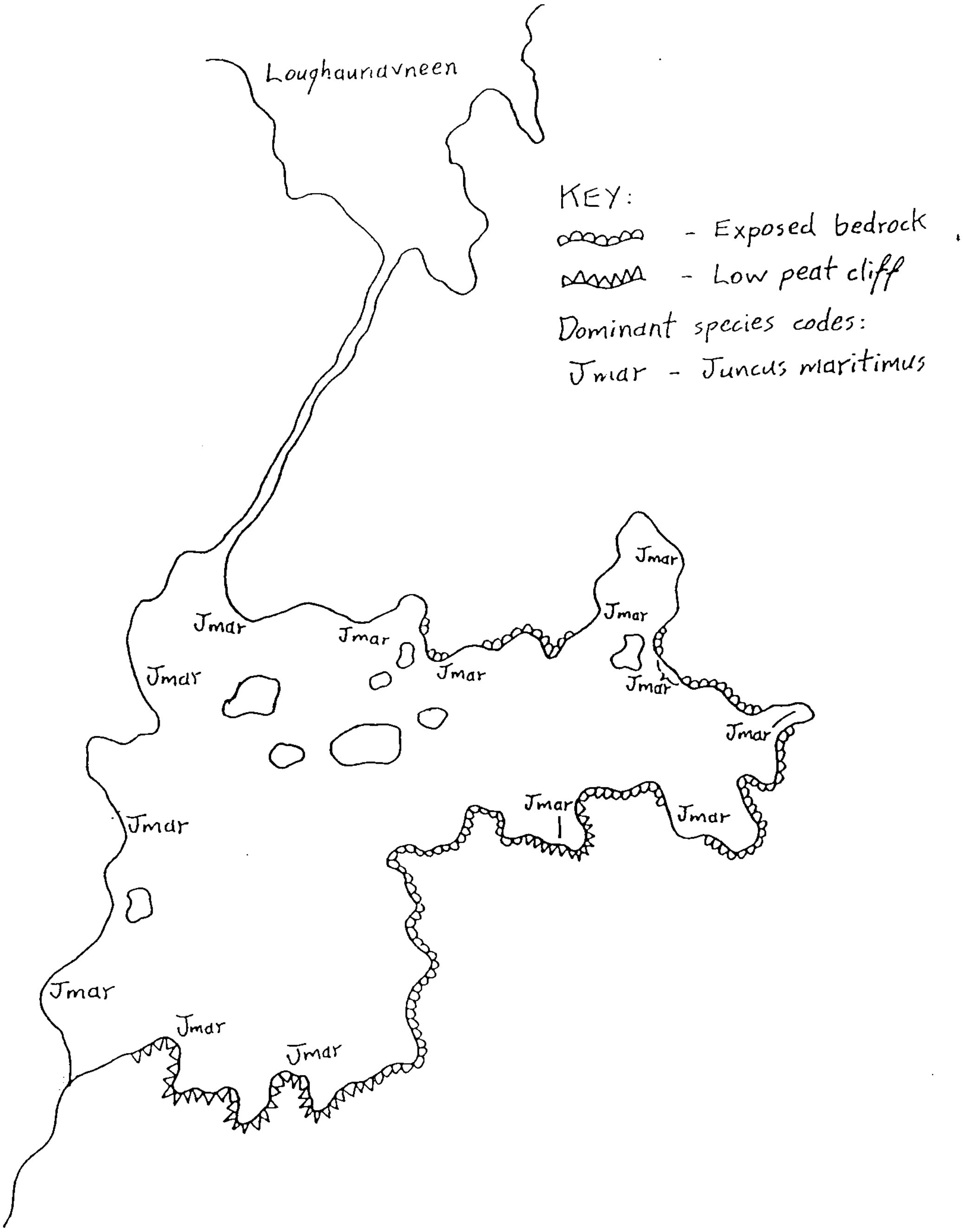

Fig. 14.3.1 Loch Tanai, Co. Galway - Marginal Vegetation

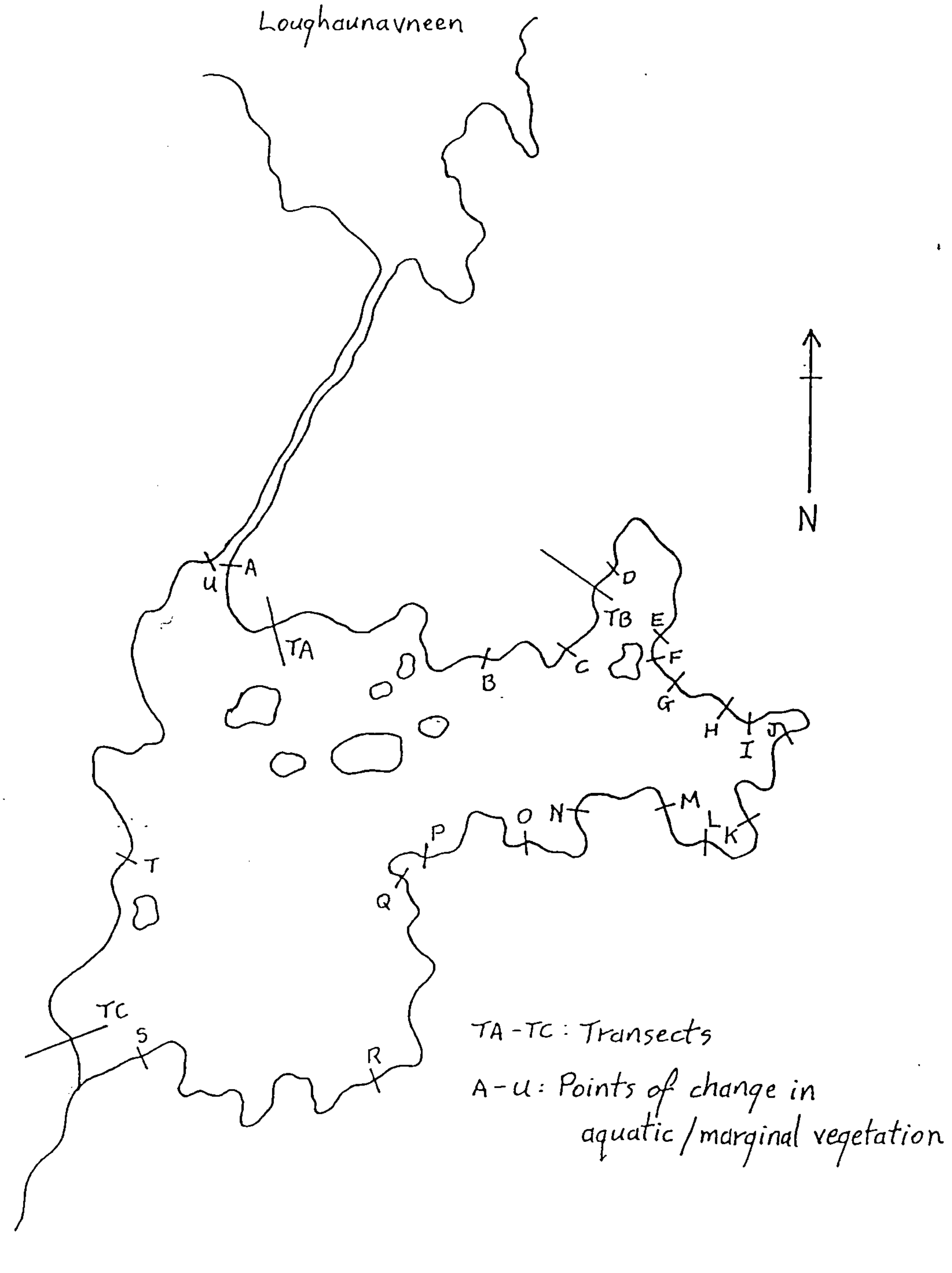

Fig. 14.3.2 Loch Tanai, Co.Galway: Location of Transects and Shore-based Survey Sections

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin .	10	91-100 %
	9	76-90 %
	8	51-75 %
	7	34-50 %
	6	26-33 %
	5	11-25 %
	4	4-10 %

3	<4	%	-	many individuals
2	<4	%	-	several individuals
1	<4	%	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency V	81-100 %
IV	61-80 %
III	41-60 %
II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon..

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

14.3.3 Results

1. Shore-based survey

Section A-B (Transect A)

Aquatic: Ruppia sp. - dense beds
Zostera marina - patchy cover amongst Ruppia
Filamentous algae - extensive
Enteromorpha - patchy
Fucus c.f. vesiculosus - patchy, to 1-2m out only
Fucus sp. - patchy, to 1-2m out only
Phyllophora psuedo ceranoides - sparse
Lamprothamnium papulosum - patchy cover amongst Ruppia

Peat and silt substrate with frequent cobbles

Marginal: Juncus maritimus tussocks with species-poor understorey of patchy
Agrostis stolonifera and sparse salt tolerant associates. 1-10m
Vegetated strip interrupted by occasional bedrock outcrops

Adjacent: Ulex gallii - Molinia caerulea - Erica cinerea heath with frequent Daboecia cantabrica

Section B-C

Aquatic: Unchanged

Marginal: Bedrock and boulder shore with lichens

Adjacent: Ulex gallii - Molinia caerulea - Calluna vulgaris heath

Section C-D (Transect B)

Aquatic: Ruppia sp. - patchy
Zostera marina - patchy
Filamentous algae - extensive
Lamprothamnium papulosum - sparse

Silt substrate

Marginal: Juncus maritimus tussocks with patchy Agrostis stolonifera and sparse salt tolerant associates. 25-30m

Adjacent: Bog vegetation dominated by Molinia caerulea, Calluna vulgaris, Sphagnum spp.

Section D-E

Aquatic: Ruppia sp. - sparse, low growing
Filamentous algae - extensive

Marginal: As C-D. 8-10m

Adjacent: Heath as B-C and bog vegetation as C-D

Section E-F

Aquatic: Ruppia sp. - sparse, low growing
Filamentous algae - extensive
Lamprothamnium papulosum - sparse

Peat and silt substrate with cobbles

Marginal: Bedrock shore with lichens

Adjacent: Heath as B-C

Section F-G

Aquatic: Ruppia sp. - sparse
Filamentous algae - extensive
Fucus c.f. vesiculosus - patchy
Fucus sp. - patchy

Marginal: Juncus maritimus salt tolerant community. 1m

Adjacent: Unchanged

Loch Tanaí

Section G-H

Aquatic: Ruppia sp. - very sparse
Zostera marina - sparse
Filamentous algae - extensive
Fucus c.f. vesiculosus - dense cover to 1-2m out
Fucus sp. - dense cover to 1-2m out

Marginal: Bedrock shore with lichens

Adjacent: Unchanged

Section H-I

Aquatic: Ruppia sp. - fairly dense patches beyond fucoid belt
Zostera marina - sparse
Filamentous algae - extensive
Fucus c.f. vesiculosus - sparse
Fucus sp. - sparse
Lamprothamnium papulosum - sparse

Marginal: Unchanged

Adjacent: Unchanged

Section I-J

Aquatic: Ruppia sp. - dense patches
Zostera marina - sparse
Filamentous algae - extensive
Fucus c.f. vesiculosus - dense cover to 1-2m out
Fucus sp. - dense cover to 1-2m out
Lamprothamnium papulosum - sparse

Marginal: Juncus maritimus salt tolerant community. 1-2m

Adjacent: Unchanged

Section J-K

Aquatic: Unchanged

Marginal: Lichenous bedrock shore with occasional patches of Juncus maritimus salt tolerant community

Adjacent: Unchanged

Section K-L

Aquatic: Ruppia sp. - dense patches
Zostera marina - very sparse
Filamentous algae - extensive
Lamprothamnium papulosum - dense patches

Marginal: Unchanged

Adjacent: Unchanged

Section L-M

Aquatic: Ruppia sp. - sparse, low growing
Filamentous algae - extensive

Silt substrate

Marginal: Juncus maritimus salt tolerant community. Up to c.50m at bayhead, 1-2m strip elsewhere

Adjacent: Unchanged

Section M-N

Aquatic: Ruppia sp. - dense beds beyond fucoid belt
Zostera marina - sparse amongst Ruppia
Filamentous algae - extensive
Fucus c.f. vesiculosus - dense cover to 1-2m out
Fucus sp. - dense cover to 1-2m out
Lamprothamnium papulosum

Bedrock substrate with gravel and cobbles

Marginal: Lichenous bedrock shore with occasional patches of Juncus maritimus salt tolerant community

Adjacent: Unchanged

Section N-O

Aquatic: Ruppia sp. - dense beds
Filamentous algae - extensive
Lamprothamnium papulosum

Coarse gravel substrate with cobbles

Marginal: Juncus maritimus salt tolerant community forming 1-2m strip along shore
Backing to 1.5m peat cliff

Adjacent: Unchanged

Section O-P

Aquatic: Ruppia sp. - fairly dense cover beyond fucoid belt
Zostera marina - sparse amongst Ruppia
Filamentous algae - extensive
Fucus c.f. vesiculosus - dense cover to 1-2m out
Fucus sp. - dense cover to 1-2m out
Lamprothamnium papulosum - patchy cover amongst Ruppia

Marginal: Rocky shore as M-N

Adjacent: Unchanged

Section P-Q

Aquatic: Zostera marina - patchy cover
Filamentous algae - extensive
Fucus c.f. vesiculosus - cover unchanged
Fucus sp. - cover unchanged

Marginal: Unchanged

Adjacent: Unchanged

Section Q-R

Aquatic: As O-P
Zostera now fairly dense

Marginal: Unchanged

Adjacent: Unchanged

Section R-S

Aquatic: Ruppia sp. - fairly dense
Filamentous algae - extensive
Lamprothamnium papulosum

Peat, silt and gravel substrate with cobbles and boulders

Marginal: Juncus maritimus salt tolerant community forming 2-8m strip along shore
Backing to 1.5m peat cliff

Adjacent: Heath as B-C and bog vegetation as C-D

Section S-T (Transect C)

Aquatic: Ruppia sp. - patchy, low growing
Filamentous algae - extensive

Silt substrate

Marginal: Juncus maritimus community with patchy Agrostis stolonifera and sparse associates to c.20m with occasional small patches of Puccinellia maritima dominated vegetation

Adjacent: Ulex gallii - Calluna vulgaris - Erica cinerea dominated heath

Section T-U

Aquatic: Ruppia sp. - dense beds
Zostera marina - patchy cover amongst Ruppia
Filamentous algae - extensive
Enteromorpha - sparse
Lamprothamnium papulosum - sparse

Peat, silt and gravel substrate

Marginal: Unchanged

Adjacent: Unchanged

2. Transects

Site: Lough Tanai	Transect code: A	
Location: Outlet to sea	Sample point: 2 Aquatic - 2m out	
Sample area: 16m2 (4x4)	Substrate: Peat, silt, cobbles	
Depth: 30 cm	Salinity: 32 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		80
Ruppia sp.	40	70
Zostera marina	60	10
Algae		60
Filamentous algae		50
Fucus c.f. vesiculosus	40	5
Fucus sp.	25	< 5
Phyllophora psuedo ceranoides	8	< 1
Lamprothamnium papulosum	15	10
Description: Dense Ruppia bed and frequent Zostera growing through and between patchy cover of filamentous algae with Lamprothamnium occurring where Ruppia density lower. Fucoids restricted to submerged rocks close to shore. Some Ruppia plants in bud, some in flower.		

Site: Lough Tanai	Transect code: A	
Location: Outlet to sea	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	70	80
Agrostis stolonifera	10	25
Glaux maritima	6	< 5
Aster tripolium	20	< 1
Triglochin maritima	10	< 1
Plantago maritima	8	< 1
Carex extensa	15	< 1
Description: Dense cover of Juncus maritimus tussocks over patchy cover of Agrostis stolonifera with sparse salt tolerant species. 8m. Grading to heath with Ulex gallii, Molinia caerulea, Erica cinerea and Daboecia cantabrica.		

Site: Lough Tanai	Transect code: B	
Location: Sheltered bay and isolated pool	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt (depth c.40cm)	
Depth: 25 cm	Salinity: 30 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		30
Ruppia sp.	30	30
Zostera marina	35	< 5
Algae		85
Filamentous algae		80
Lamprothamnium papulosum	10	5
Description: Patchy cover of Ruppia amongst extensive filamentous algae with patchy Zostera and sparse Lamprothamnium. Some Ruppia plants in flower.		

Site: Lough Tanai	Transect code: B	
Location: Sheltered bay and isolated pool	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	70	75
Agrostis stolonifera	15	30
Aster tripolium	25	5
Glaux maritima	10	< 1
Triglochin maritima	15	< 1
Plantago maritima	10	< 1
Cochlearia anglica	6	< 1
Carex extensa	15	< 1
Description: Fairly dense cover of Juncus maritimus tussocks over salt tolerant vegetation dominated by patchy Agrostis stolonifera with associated species sparse. 18m.		

Site: Lough Tanai	Transect code: B	
Location: Sheltered bay and isolated pool	Sample point: 3 Marginal - Pool	
Sample area: 40m2 (10x4 - whole stand)	Substrate: Silt (depth c.50cm)	
Depth: 15 cm	Salinity: 21 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		20
Higher Plant		10
Ruppia sp.	15	10
Algae		10
Filamentous algae		10
Lamprothamnium papulosum	10	< 1
Description: Patchy cover of low growing Ruppia with open filamentous algae cover and very sparse Lamprothamnium. Both flowering and fruiting Ruppia present. Shallow isolated pool. 80% of substrate is unvegetated silt.		
Backing Juncus maritimus dominated community as sample point 2. 10m.		
Grading to Sphagnum spp. - Molinia caerulea - Calluna vulgaris bog vegetation.		

Site: Lough Tanai	Transect code: C	
Location: Freshwater inflow	Sample point: 1 Aquatic - 3m out	
Sample area: 16m2 (4x4)	Substrate: Silt (depth c.30cm)	
Depth: 10 cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		10
Ruppia sp.	6	10
Algae		100
Filamentous algae		100
Description: Patches of Ruppia growing through filamentous algae in shallow water. Ruppia low growing, both flowering and fruiting plants present.		

Site: Lough Tanai	Transect code: C	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 8m2	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		90
Puccinellia maritima	8	90
Triglochin maritima	10	5
Glaux maritima	6	< 1
Spergularia marina	5	< 1
Aster tripolium	15	< 1
Plantago maritima	8	< 1
Limonium humile	20	< 1
Description: Dense cover of Puccinellia dominant over sparse species-poor salt tolerant associates. This community occurs here as patches (average area c.8m2) interlaced with unvegetated silt.		

Site: Lough Tanai	Transect code: C	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritinus	80	90
Agrostis stolonifera	15	20
Triglochin maritima	10	5
Glaux maritima	6	< 1
Aster tripolium	20	< 1
Cochlearia anglica	6	< 1
Plantago maritima	8	< 1
Limonium humile	20	< 1
Description: Dense cover of Juncus maritimus tussocks with sparse species-poor understorey dominated by patchy Agrostis stolonifera. 20m. Backing Ulex gallii - Calluna vulgaris - Erica cinerea dominated heath.		

14.3.4 Evaluation

'Valuable'

This site shows a high degree of spatial salinity variation (5-32 parts per thousand at time of survey), with low salinities around the major freshwater inflow and high salinities around the outlet channel and elsewhere. Species composition seems to suggest that the freshwater influence is localised.

Fucoid algae are abundant and well distributed around the shore. Phyllophora pseudo ceranoides also occurs here. Ruppia and Zostera marina are abundant around much of the site in dense, often mixed stands. It is considered notable that both Ruppia maritima and R.cirrhosa occur here.

This is the second new Irish station for the rare charophyte Lamprothamnium papulosum (the other being Lettermullen Pool), previously known from only three sites. Lamprothamnium is more or less frequent around most of the shore and abundant in places, often growing amongst Ruppia beds. Its presence here is reason enough in itself to regard this site as valuable.

A distinct zonation of algal and higher plant species occurs along the rockier shores with dense Ruppia and Zostera beds, frequently with Lamprothamnium, lying beyond a narrow belt of fucoids.

Marginal vegetation is restricted due to the rocky, steep-sided nature of much of the site. No emergent species occur here. The dominant marginal community is species-poor salt tolerant vegetation dominated by Juncus maritimus.

Loch Tanai is a good representative of a highly saline lagoon with a permanent connection to the sea. Species composition and shore zonation are interesting, frequency and abundance of most species are high and a rare charophyte has been found here in abundance.

A full aquatic survey is recommended.

14.4 ECOTONAL COLEOPTERA

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14.4.1 Site Description

Bayhead brackish lagoon with c.7m wide inlet without surface barrier, surrounded by heath (incl. *Pteridium*) and blanket bog on glacial deposits with rock outcrops and boulders. Summer spring/neap cycle tidal response of >0.2m. Lake shore with exposed granite rock, boulders, cobbles and pebbles, peat cliffs and sheltered lake bay peat-flats dominated by *Juncus maritimus* and grass/sedge/*Juncus* sp. swards (Plate 1). These swards much larger than at the nearby L. Carafinla, but several hectares of *Juncus maritimus* vegetation (unvisited) appears to occur north of L. Carafinla, and east of L. Atawny.

Subsites (see Fig 14.4.1)

1. Sedge/grass/*Juncus* sp. (North) (L 950306) Plate 2
c. 0.1 ha stand of *Juncus maritimus* with *Glaux maritima, Triglochin maritima, Plantago maritima, Eleocharis ?-uniglumis*, grading into grass/sedge/*Juncus* sp. sward on very gently sloping peat shore, in relatively sheltered northern bay of lake. Bare peat exposed (July) downshore of *Juncus maritimus* stands.

2. *Juncus maritmus* / grass (South) (L 952304)
Juncus maritimus grading into grass-dominated sward on southern sheltered bay of lake, although with more irregular and in places more sloping topography.

2. Cobble shore (L 952305)
Shore with granite cobbles and large pebbles on coarse sand/peat, covered during flooding. Also *Juncus* litter and fibrous algal mats in places.

14.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

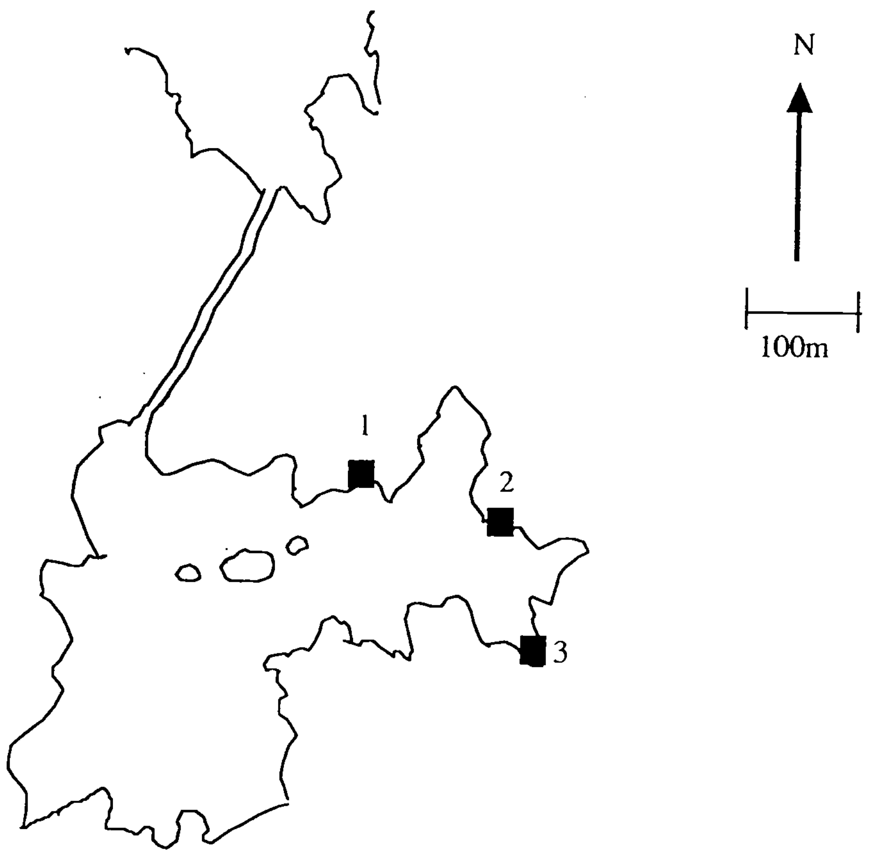

Fig. 14.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Lough Tanaí, Co. Galway.

1 - Pitfall traps, S-vac, Ground search
2 - Cobble search
3 - Pitfall traps

Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 14.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter

(0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 14.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) Sedge/grass/*Juncus* sp. (North) area - S-vac suction sampler (16 viii 1996), c. 2 m^2;
(2) Sedge/grass/*Juncus* sp. (North) area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (6 vi - 16 viii 1996);
(3) *Juncus maritmus* / grass (South) area - 6 pitfall traps (16 viii - 28 ix 1996);
(4) Cobble shore - cobbles search (n = 80 cobbles) (6 vi 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; <u>and</u>, (2) they

are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

14.4.3 Results

Three species of carabid and seventeen species of staphylinid were recorded, two species of which are regarded as indicator species (Table 14.4.2). No carabids or staphylinids were recorded under cobbles.

Philonthus fumarius appears to be local in Ireland (Johnson and Halbert 1902, Lott and Bilton 1991) and is recorded as very local in Great Britain (Hyman and Parsons 1994). It is not rare in Central Europe, but rather rare elsewhere (Horion 1965). The species is restricted to marshes including muddy and marshy freshwater shores (Horion 1965, Koch 1989), and especially on coastal marshes (Hyman and Parsons 1994).

TABLE 14.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Lough Tanaí. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

	Species	No. individuals	
Carabidae			
	Agonum gracile (Gyll.)	1	
	Elaphrus cupreus Duft.	1	
	Pterostichus niger (Schall.)	3	
Staphylinidae			
	Amischa analis (Grav.)	1	
	Atheta volans (Scriba)	1	
	Drusilla canaliculata (F.)	3	
	Erichsonius cinerascens (Grav.)	2	
	Euaesthetus ruficapillus Bois. Lac.	7	
	Lathrobium quadratum (Payk.)	1	
	Lathrobium terminatum Grav.	3	
	Lesteva sicula Er.	1	
	Paederus fuscipes Curt.	2	
*	*Philonthus fumarius* (Grav.)	1	**Indicator species**
	Philonthus nigrita (Grav.)	1	
	Stenus brunnipes Steph.	1	
	Stenus canaliculatus Gyll.	1	
	Stenus fuscipes Grav.	5	
	Stenus incrassatus Er.	76	
	Stenus nitidiusculus Steph.	2	
*	*Stenus opticus* Grav.	4	**Indicator species**

There is a single Irish record (1929) of *Stenus opticus* from Ballynahinch Lake (Co. Galway) (Anderson 1984), and the species is listed by Hyman and Parsons (1994) as very local in Great Britain. It is not particularly rare in northern or north-eastern Europe, but local in western Europe (Horion 1963). The species is restricted to marshes, alder carr and bogs, occurring in *Sphagnum* and *Carex* (Horion 1963, Koch 1989).

The staphylinid assemblage in the sedge/grass/*Juncus* sp. area was characterised by most species being associated with bogs or marshy shores (Table 14.4.3).

TABLE 14.4.3. Staphylinid assemblage from sedge/grass/*Juncus* sp. area, Lough Tanaí (S-vac suction sample and pitfall traps combined). Abund. Cat. refers to category of relative abundance (no. individuals: 1, 2-10,11+).

Abund. Cat.	Species	No.	Main biotope
Dominant	*Stenus incrassatus*	76	Eurytopic, wet soils incl. bogs
Intermediate	*Drusilla canaliculata*	2	Heaths, bogs & grassland
	Erichsonius cinerascens	2	Eurytopic, wet soils incl. bogs
	Euaesthetus ruficapillus	7	Marshes, also bogs
	Lathrobium terminatum	2	Marshes, also bogs
	Stenus fuscipes	5	Mesotrophic/eutrophic marshes, riparian
	Stenus nitidiusculus	2	Eurytopic, incl. blanket bogs
	Stenus opticus	4	Flooded soils, also blanket bogs
Present	*Amischa analis*	1	Eurytopic, incl. disturbed agricultural land
	Atheta volans	1	Marshy shores incl. upper sea shores
	Lathrobium fennicum	1	Marshes, also bogs
	Lathrobium quadratum	1	Marshes, also bogs
	Lesteva sicula	1	Marshes, also bogs
	Philonthus fumarius	1	Marshes and marshy shores
	Philonthus nigrita	1	Bogs
	Stenus brunnipes	1	Woods & grassland incl. freshwater shores
	Stenus canaliculatus	1	Eurytopic, incl. muddy sea shores and bogs

14.4.4 Evaluation

Of <u>average</u> but potentially <u>exceptional</u> conservation value for terrestrial ecotonal community. This requires further investigation to confirm or refute this potential rating.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of two indicator species (Table 14.4.2), plus a majority of staphylinid species associated with bogs and wetlands (Table 14.4.3), indicates ecologically well-developed habitat. The diversity of wetland species and large numbers of *Stenus incrassatus*, a eurytopic but local (Anderson 1984) species, indicate that this assemblage is at least seasonally associated with the habitat sampled, and not occasionally vagrant from the surrounding bog. Many of these species have been recorded from wet *Sphagnum* in bogs, and may benefit from the high water table maintained at the lagoon shore during the dry season (summer).

Lough Tanaí (and by extrapolation similar bayhead *Juncus maritimus* habitat in the vicinity) may be potentially exceptional for the following reasons : (1) The pitfall traps did not operate very efficiently on peat at this site, which may be a result of their placement too near the shore (i.e. indicator species occur further up the shore), so further indicator species may have been missed; (2) The two indicator species occurred in a well-defined peat ecotonal habitat; (3) The hypothesis is proposed that the bayhead lagoon margin peat-flat habitat surrounded by blanket bog may maintain a dry-season water table, while a similar freshwater lake would provide poor habitat due to drying out, or a barrier lagoon would be prone to flooding if a barrier was present blocking outflow; (4) This peat/lagoon ecotonal habitat may be unique to Atlantic coasts. However, this potential rating requires to be confirmed or refuted by further more detailed investigation.

15.4.5 References

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Plate 1 Lough Tanaí, Co. Galway

Plate 2 *Juncus* and grass on peat shore at Lough Tanaí, Co. Galway

14.5 SUMMARY AND EVALUATION

Loch Tanaí is a medium-sized (12 ha) **natural saline lake** in peat with a long, possibly artificial, tidal inlet through peatland.

The lake is not part of a proposed NHA but lies close to the proposed Kinvarra saltmarsh NHA (Site Code No. 2075)

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion.

Geomorphology	Moderate/High
Aquatic Fauna	High/Exceptional
Vegetation	Exceptional
Ecotonal Coleoptera	Average/Potentionally Exceptional

Geomorphology.

Loch Tanaí is an unusual type of **natural saline lake** in peat with a long, possibly artificial, tidal inlet. It may have originated in old peat cuttings. It is one of several similar lakes in the peatland area south of Camus Bay all of which have long inlets and may have similar origins. Although not a lagoon in the strict sense because the barrier is neither sedimentary or of rock, it presents many of the characteristics of lagoons e.g. it is shallow and brackish. It could be described as a lagoon with a peat barrier.

As an unusual type if saline lake in good condition, the lake is rated as of high conservation value.

Aquatic Fauna

Among 36 taxa recorded, six species are lagoonal specialists.

In spite of the soft substrate, much of which was unconsolidated peat, burrowing forms were relatively well represented throughout the lake and were not more abundant or diverse at stations with more sand or silt. The most abundant species at all stations was *Praunus flexuosus*. *Cerastoderma glaucum* was represented by both adults and juveniles.

Faunistically, the lake is a good example of a lagoon with salinity in the middle to upper range. A wide range of ecological types of invertebrate was represented and there were some unusual species present, e.g. *Akera bullata* and *Syngnathus typhle*, but no rare species were recorded.

Loch Tanaí, and the other similar lakes in the area, appear to be unknown to marine biologists and their communities have not, therefore, been investigated. The habitat is unusual for brackish species.

Based on the high faunal richness and the number of lagoonal specialists, the lake is rated high/exceptionl.

Vegetation

Species distribution reflected a high degree of spatial variation in salinity. Fucoid algae were abundant and well distributed around the shore. *Phyllophora pseudo-ceranoides* also occured here. *Ruppia* and *Zostera marina* were abundant around much of the site in dense, often mixed stands. It is considered notable that both *Ruppia maritima* and *R. cirrhosa* occur here.

This is the second new Irish station for the rare charophyte *Lamprothamnium papulosum* (the other being Lettermullen Pool), previously known from only three sites. It was more or less frequent around most of the shore and abundant in places, often growing amongst *Ruppia* beds. Its presence here is reason enough in itself to regard this site as valuable.

A distinct zonation of algal and higher plant species occured along the rockier shores with dense *Ruppia* and *Zostera* beds, frequently with *Lamprothamnium*, lying beyond a narrow belt of fucoids.

Marginal vegetation was restricted due to the rocky, steep-sided nature of much of the site. No emergent species occurred here. The dominant marginal community is species-poor salt tolerant vegetation dominated by *Juncus maritimus.*

Loch Tanai is a good representative of a highly saline lagoon with a permanent connection to the sea. Species composition and shore zonation are interesting, frequency and abundance of most species were high and *Lamprothamnium* was abundant. For these reasons, the lake is rated as of exceptional conservation value

A full aquatic survey is recommended.

Ecotonal Coleoptera

Three species of carabid and seventeen species of staphylinid were recorded, two species of which are regarded as indicator species. No carabids or staphylinids were recorded under cobbles.

Philonthus fumarius appears to be local in Ireland and is recorded as very local in Great Britain. It is not rare in Central Europe, but rather rare elsewhere. The species is restricted to marshes including muddy and marshy freshwater shores and especially on coastal marshes.

There is a single Irish record (1929) of *Stenus opticus* from Ballynahinch Lake (Co. Galway), and the species is listed by as very local in Great Britain. It is not particularly rare in northern or north-eastern Europe, but local in western Europe . The species is restricted to marshes, alder carr and bogs, occurring in *Sphagnum* and *Carex*.

The presence of two indicator species, plus a majority of staphylinid species associated with bogs and wetlands, indicates ecologically well-developed habitat.

The rating of average but potentially exceptional conservation value requires further investigation.

Summary

Loch Tanaí is an unusual type of natural saline lake in peat which presents many of the characteristics of lagoons. It could be described as a lagoon with a peat barrier. It is valued as moderate/high for its geomorphology because the type is rare, and possibly unique, in the European context.

A wide range of ecological types of aquatic fauna are represented, and a relatively high proportion of lagoonal specialists. The habitat is unusual for brackish species (see also Cloonconeen Pool).

Species composition and shore zonation of the vegetation are interesting, frequency and abundance of most species are high and *Lamprothamnium* was abundant.

The presence of two indicator species of ecotonal Coleoptera, plus a majority of staphylinid species associated with bogs and wetlands, indicates ecologically well-developed habitats. This peat/lagoon ecotonal habitat may be unique to Atlantic coasts. However, the potential rating requires to be confirmed or refuted by further more detailed investigation

Overall, the site is rated as of high and possibly exceptional conservation value as an unusual type of saline lake with rich and interesting fauna and vegetation.

Its designation as a proposed SAC is recommended and study of some similar lakes in the area is worth consideration.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

15. LOUGH ACONEERA

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

15. LOUGH ACONEERA

CONTENTS

15. LOUGH ACONEERA, Co. Galway.

OS Grid Reference: L 875 369, 1:50,000 Sheet No. 44
Alternative names: Loch Conaortha, Loughoneera

15.1 STUDY AREA

General features

Lough Aconeera is situated on the northern shore of Kilkieran Bay, western Connemara, 6 km north of Kilkieran. The lake is relatively large and deep in places and differs from many of the coastal lakes of Connemara in that it lies at the base of a mountain range, Cnoc Mordáin, which rises to 354 m within 1 km of the lake (Fig. 15.1.1). The lake has formed in what appears to be a flooded block field at the base of the mountain which may at one time have been blanketed in lowland peat. The bed of the lake is mostly composed of granite bedrock and detached blocks and boulders, with patches of coarse sand and unconsolidated peat in the sheltered areas. An apparently permanent stream enters the lake on the northwest shore which at times is likely to be torrential. Numerous other smaller streams are likely to appear during periods of heavy rainfall. An outlet runs under the road from the lake through an area of peat and rock in the southeast of the lake. The lake is exposed to strong winds, intensified by the presence of the mountain, which can quickly produce waves on the lake.

Lough Aconeera is included as a good example of a type of lagoon, rare in a European context, but characteristic of parts of the west coast of Ireland, especially in Connemara, which are permanent, brackish, with restricted tidal influence due to the presence of a "barrier" of peat. These "peat" lagoons are of particular interest as very little appears to be known about any aspect of the functioning of brackish lakes situated in acid peat lands.

Very little is known about the lake. It appears to have no protective status but does not appear to be under any immediate threat.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is around 5.5 °C in January and 14 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8.5, and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1400 mm, and the number of rain days (1 mm or more) is approximately 200. Winds are mainly from the southwest. Mean annual hourly wind speeds are between 5-6 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

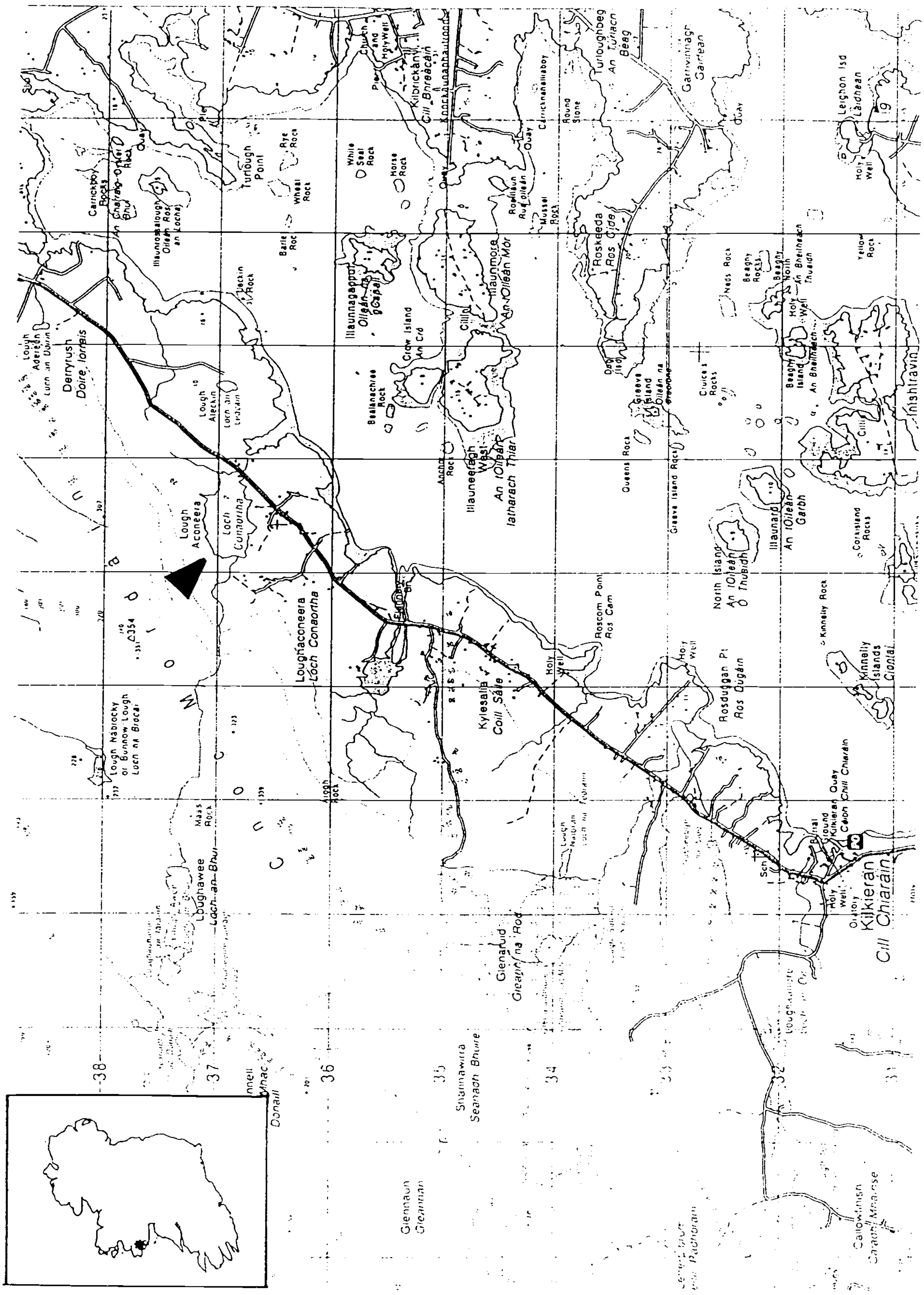

Fig. 15.1.1 Section of 1 50 000 map showing locality of Lough Aconeera

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Kilkieran is 4.2 m (Admiralty Tide Tables). Sea temperatures are lowest in February (around 7°C) and highest in August (14.5 °C).

Landscape and Geology The Connemara region of Galway is a glaciated plain of rolling lowland with granite outcrops and Atlantic type blanket bog. The granite bedrock is impervious and drainage density is high. Soils other than peat are shallow podzols with very limited land-use capability (R.I.A. 1979). The area was described by Haughton (1957) as a "wilderness of bare rock, glacial erratics, water and peat". Lough Aconeera differs from many of the coastal lakes of Connemara in that it lies at the base of a high mountain range and lies in what appears to be a flooded block field at the base of the mountain which may at one time have been blanketed in lowland peat.

Land surrounding the lough consists of small irregular fields of semi-improved pasture, bare rock, small peatbogs and wet heathland.

Lake Topography The lagoon is approximately 750 m from west to east, 400 m from north to south and covers about 28 ha. Water depth is 1 - 1.5 m over most of the lake but greater than 5 m in one central area at the eastern end. The bed of the lake is mostly composed of granite bedrock and detached blocks and boulders, with patches of coarse sand or unconsolidated peat and silts in the sheltered areas.

It is possible that peat was once cut in the area occupied by the lake. The channel connecting the lake to the sea appears to have been cut deliberately but it is not known at what date. It is possible that it was cut when the road and bridge were constructed to avoid flooding of the road. According to local information, seawater used to enter the lake during storms in an area further to the southwest until the level of the road at that point was raised.

Hydrology Fresh water enters the lake through a stream in the northwest, and presumably through several others during periods of high rainfall. Undoubtedly freshwater also enters through the slow release of groundwater from the saturated peat higher in the valley and also in direct rainfall. Seawater appears to enter on all tides, through the channel which leads under the bridge. It is not known if seawater can still enter by any other means.

There is an apparent daily tidal fluctuation in water level of c.10 cm during neap tides and a difference of c.30 cms between the mean water level at spring tides and that during neaps. A seasonal pattern is likely, whereby water levels rise in the winter with the increased rainfall and storm frequency, and gradually decline in the summer. The peaty soils of the surrounding land would, however, through absorption and slow release of water, affect the delivery time of both surface- and ground-water flows to the lake.

Salinity and water quality Despite the fact that seawater appears to enter on every tide the lake is also likely to receive large volumes of freshwater runoff from the mountain and surrounding land. Salinity levels are likely to be mesohaline through most of the year, with a rise during the summer and decline in the winter. The peaty soils of the surrounding land would, however, affect the flows of both surface- and ground-water to the lake. The prolonged flow of freshwater to the pool during the "dry" months may result in lower salinities than might be expected. On the other hand, winter storms may result in a higher volume of seawater entering the lake and raising salinity levels at a time when they might be expected to fall.

The depth of the lake is likely to cause stratification although exposure to strong winds would ensure regular mixing.

The surrounding land is relatively natural and even grazing land is likely to receive only limited fertilizer applications. Water quality appears to be high although quite a deep layer of organic silt has accumulated in some areas of the lake and there is a dense growth of pond weed and filamentous algae in the west where the freshwater stream enters. The regular flushing of the lake would restrict any problems caused by eutrophication.

15.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

15.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰ precision). A photographic record was made of the site and local information sought concerning background and recent history.

Faunal Sampling.

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and E in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists (e.g. Coleoptera). Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. *Jaera*, hydrobiids).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

15.2.2 Results

Lough Aconeera was sampled on the 13.vi.96 during the first part of the survey, and from 5-6.ix.96 during the more intensive survey.

Five sampling stations were selected in the lake to reflect the influences of substrate, and freshwater/seawater inflows. Fig. 15.2.1 shows the position of these sampling stations in the lagoon. Further details are given in the Results section.

Environmental Variables

Positions of the sampling stations are shown in Fig. 15.2.2.

Station A (OS 8787 3683) was located at the eastern end of the lake nearest to the road and the outlet channel which runs under the bridge and is the most tidal area of the lake (Plate 15.2.1). Water depth varied from 0 - 60 cm, substrate was smooth slabs of granite bedrock, stones of various sizes and small pockets of coarse sand and gravel. Salinity was surprisingly low and measured 13 ‰ at the outflow during low tide.

Station B (OS 8716 3683) was located in the southwest corner. Water depth was 0 - 60 cm, substrate consisted of small cobbles and coarse granite sand and salinity measured 13 ‰.

Station C (OS 8718 3700) was located in the northwest corner, near a bed of *Phragmites* . Water depth was 0 -30 cm, substrate was coarse granite sand and salinity measured 10 ‰.

Station D (OS 8728 3692 ?) was located on the northern shore of the lake where a stream enters (Plate 15.2.3). Depth varied from 0 cm - 1.2 m, substrate was rock with pockets of soft organic mud and salinity measured 12 ‰.

Station E (OS 8769 3714) was located on the northeast shore among *Phragmites* (Plate 15.2.2). Water depth varied from 0 - 1.2 m., substrate consisted of coarse granite sand, organic silt and fibrous roots, and salinity measured 12 ‰.

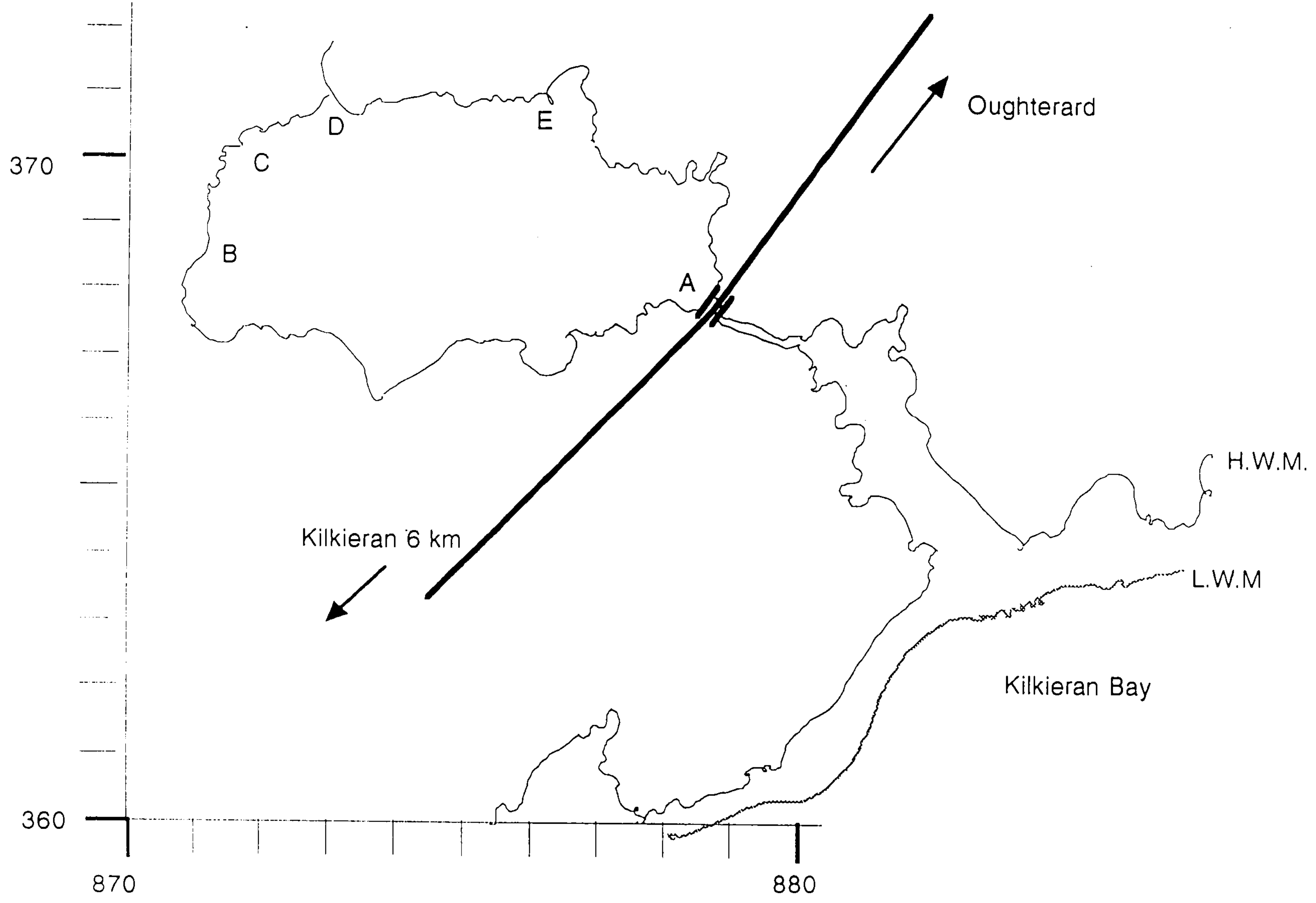

Fig. 15.2.1 Location Map of Sampling Stations in Lough Aconeera, Co. Galway.

Table 15.2.1 Fauna Recorded in Lough Aconeera. June and September, 1996.
( ) = records from June.

		Sampling Stations	(L.T. = light-trap)							
		A	L.T.A	B	C	L.T.C	D	L.T.D	E	L.T.E
Porifera										
Cnidaria										
Turbellaria		(+)		+					+	
Nemertea										
Annelida	*Arenicola marina*			+	+					
Crustacea										
Ostracoda										
Copepoda										
Cirripedia										
Mysidacea	*Neomysis integer*	a	250	+	a	200	c	200	a	800
Isopoda	*Idotea sp.*	+	1							
	Jaera nordmanni	+	+			+				
	Lekanesphaera hookeri	a	150	+	c	100	a	250	c	50
Amphipoda	*Corophium volutator*	+								
	Gammarus duebeni	+		+	+	+	+		+	+
	G. zaddachi	+	+	+		+	+			
Tanaidacea										
Decapoda	*Carcinus maenas*	+			F, 1				F, 2	
	Palaemonetes varians	(+)							+	1
Arachnida										
Insecta										
Thysanura										
Ephemeroptera		(+)								
Odonata	*Ischnura elegans*	+			+				+	4
Plecoptera										
Trichoptera	(cases)						+			
Hemiptera										
Coleoptera	*Gyrinus caspius*	(+)								
Diptera	Chironomidae	+		+	+		+			
Mollusca										
Prosobranchia	*Potamopyrgus antipodarum*	+		+	+		+		+	
Opisthobranchia										
Pulmonata										
Bivalvia	*Cerastoderma glaucum*				a					
	Mya arenaria	+			+		+			
	Mytilus edulis			+						
Bryozoa	*Conopeum seurati*	+		+					+	
Echinodermata										
Tunicata										
Teleostei	*Anguilla anguilla*		F, 2						F, 7	
	Gasterosteus aculeatus	c	1	c	c	3	c	3	c	26
	Platichthys flesus	F, 5								
	Pomatoschistus microps	c	1	c	c	4	c	6	c	7

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 15.2.1. Among 22 taxa listed, 20 are identified to species. The list (excluding marginal species) comprises 1 marine species, 3 poly-mesohaline, 12 euryhaline, and 3 oligo-mesohaline; no limnic species was recorded (Table 15.2.2). Four species are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Table 15.2.2 Ecological categories of the recorded taxa in Lough Aconeera (excluding marginal species). L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Mytilus edulis*	
Poly-mesohaline	*Arenicola marina*	
	Cerastoderma glaucum	L
	Mya arenaria	
Euryhaline	*Neomysis integer*	
	Lekanesphaera hookeri	L
	Jaera nordmanni	
	Gammarus zaddachi	
	Gammarus duebeni	
	Palaemonetes varians	L
	Carcinus maenas	
	Conopeum seurati	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
	Platichthys flesus	
Oligo-mesohaline	*Ischnura elegans*	
	Potamopyrgus antipodarum	
	Gyrinus caspius	
Limnic	None	

Many species appeared to be patchily distributed but there were no conspicuous differences between stations in spite of the different substrates. *Arenicola marina* was present only in sandy areas, but the burrowing amphipod *Corophium volutator* was only found at A where the substrate was mainly rock. *Neomysis integer, Lekanesphaera hookeri, Gasterosteus aculeatus* and *Pomatoschistus microps* were abundant at all stations. *Cerastoderma glaucum* was confined to A nearest to the outlet.

15.2.3 Discussion

The species assemblage typifies a lagoon fed principally by non-point sources of freshwater, with small incursions of seawater by way of an open inlet. The species composition is characteristic of middle to low salinity waters not subject to frequent colonisation from the sea. The salinity was similar on both sampling occasions in 1996 and 7‰ was measured in March 1994. The absence of limnic species indicates that there is always a significant marine influence.

Cerastoderma glaucum was present here in abundance at much lower salinity than at other sites where it occurred. This was the only site at which live *Mya arenaria,* a common species of estuaries, were present. None of the recorded species can be described as rare in Ireland

15.2.4 Threats

No immediate threats to the lake were apparent.

15.2.5 Evaluation

Lough Aconeera is a **natural saline lake** with a natural, partly tidal, inlet.

It is a good example of a large lake of a type, probably also frequent in Scotland, which can be classified as a saline peat lake. It differs from others in the region in being somewhat deeper and having a substratum composed of a larger proportion of bedrock and large boulders. As little appears to be known about the functioning of peat lakes, this one may be worthy of further study but it is a different type from the more shallow, dominantly peat lagoons..

The fauna was typical of a lagoon in the middle to low salinity range, and included four lagoonal specialists but nothing of special interest. No rare species has been recorded..

The lake lies close to the edge of a proposed NHA (Site Code 2008) and could be included in that area. Its designation as a proposed SAC is recommended.

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15. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

15.3.1 Site Description (Fig. 15.3.1)

Lough Aconeera lies between Cnoc Mordain and the sea. The site is bordered by heath,
bog and associated grassland. Rock outcrops and dry stone walls are frequent across the surrounding landscape. The area is subject to grazing.

There is an area of small hand-cut hayfields between the south eastern shore and the public road.

Shores are predominantly rocky, of both steeply sloping exposed bedrock and boulders, with low peat cliffs in places. The only exceptions are the small swampy areas of sheltered bayheads and the south eastern shore, where Phragmites and Schoenoplectus swamp is more extensive. This is the point of entry for the major freshwater inflow. Several other small inflow streams join the lough along its northern shore.

The outlet channel exits at the south eastern corner.

15.3.2 Methods

Two survey methods were employed in the course of fieldwork:

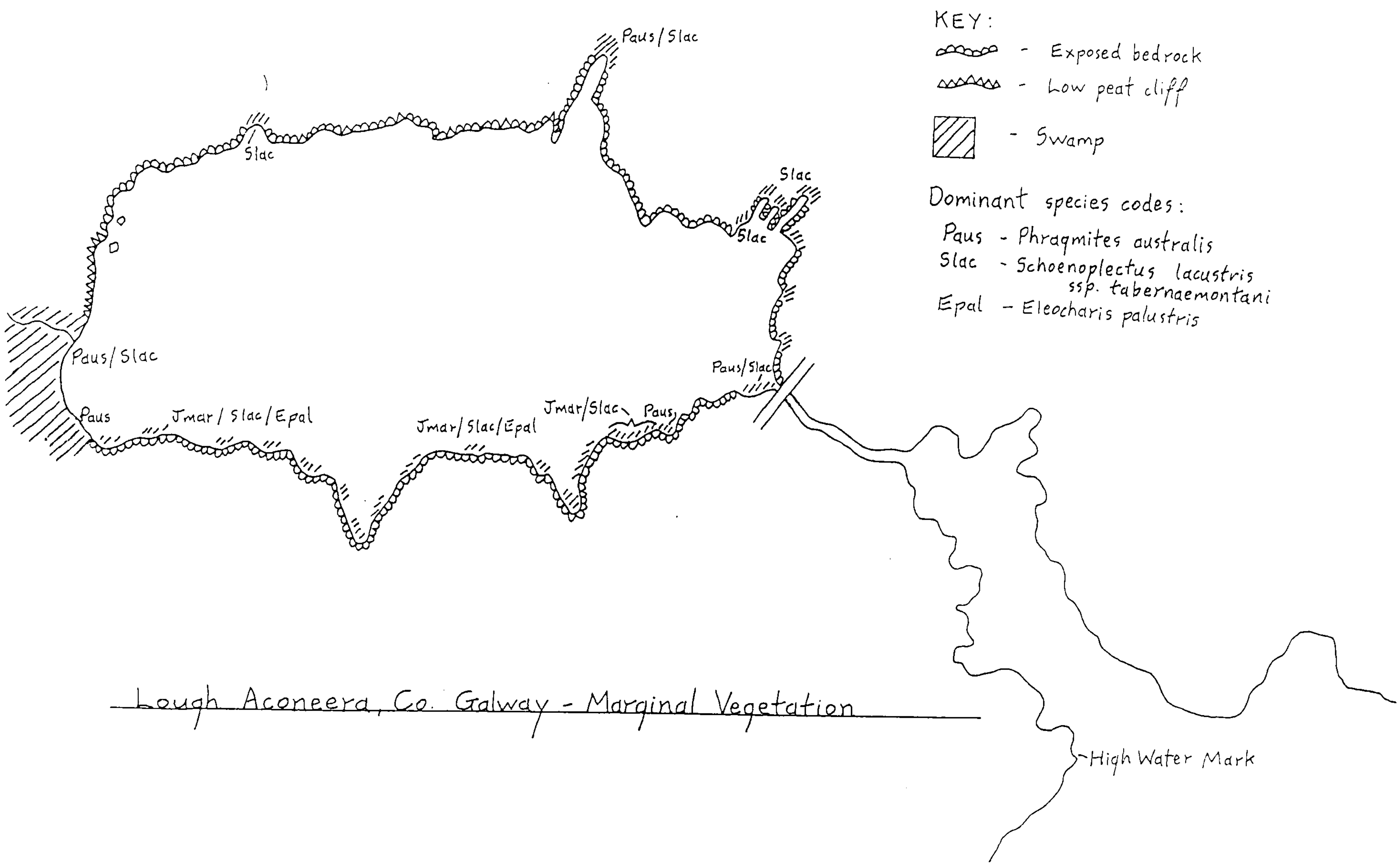
1. Transects
2. Shore-based survey

1. Transects

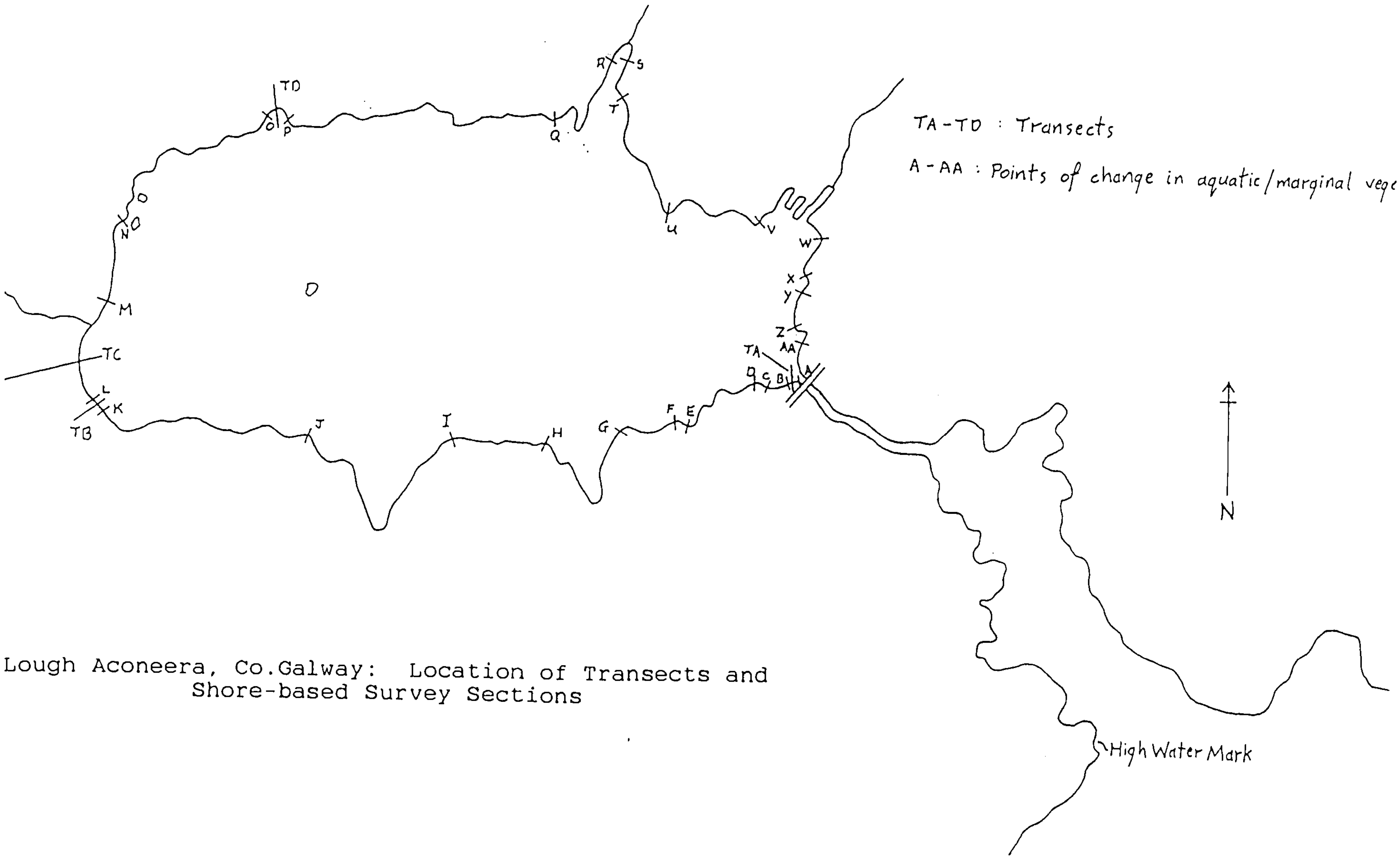
The locality of these is shown in Fig. 15.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.



Lough Aconeera, Co. Galway - Marginal Vegetation



Lough Aconeera, Co.Galway: Location of Transects and Shore-based Survey Sections

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin .	10	91-100 %
	9	76-90 %
	8	51-75 %
	7	34-50 %
	6	26-33 %
	5	11-25 %
	4	4-10 %

3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency V	81-100 %
IV	61-80 %
III	41-60 %
II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A '*Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A '*Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

15.3.3 Results

1. Shore-based survey

Section A-B (Transect A)

Aquatic: Ruppia cirrhosa - patchy cover <8m out only
Potamogeton pectinatus - sparse <8m out only
Enteromorpha - extensive
Fucus sp.- patchy cover >8m out only

Silt and cobble substrate

Marginal: Open Schoenoplectus lacustris ssp tabernaemontani single species swamp.
15m

Dense Juncus maritimus with sparse understorey of salt tolerant species.
1-2m

Adjacent: Ulex gallii - Calluna vulgaris - Erica cinerea heath on rocky outcrop with frequent Dabeoica cantabrica

Section B-C

Aquatic: Ruppia cirrhosa - cover unchanged
Enteromorpha - cover unchanged

Marginal: Phragmites australis swamp with Cladium mariscus frequent on landward edge. 20-25m

Adjacent: 45 degree bank to public road

Section C-D

Aquatic: Unchanged

Marginal: Juncus maritimus with species-poor salt tolerant vegetation as A-B. 3-5m
Backing 50cm peat cliff

Adjacent: Heath as A-B

Section D-E

Aquatic: Ruppia cirrhosa - sparse
Potamogeton pectinatus - fairly dense, extensive
Enteromorpha - fairly sparse
Fucus sp. - sparse, <2m out only
Chara baltica - sparse

Gravel substrate with frequent cobbles and boulders

Marginal: Exposed bedrock shore - average slope c.40 degrees - with crustose, foliose and fruticose lichens

Adjacent: Unchanged

Section E-F

Aquatic: Potamogeton pectinatus
Enteromorpha
Chara baltica

Marginal: Single species Phragmites swamp. 5m
Backing to lichenous bedrock shore - slope c.70 degrees

Adjacent: Unchanged

Section F-G

Aquatic: Potamogeton pectinatus
Enteromorpha
Fucus sp.
Chara baltica

Marginal: Juncus maritimus and Schoenoplectus lacustris ssp tabernaemontani in a mosaic of mono-dominant stands among scattered boulders. Both as A-B. 4 -8m
Backing to bedrock shore as E-F

Adjacent: Unchanged

Section G-H

Aquatic: Unchanged

Marginal: Juncus maritimus, Schoenoplectus and Eleocharis palustris in small scattered patches - average area c.3m2. 5-10m
Backing to lichenous bedrock shore - slope varying c.15-c.90 degrees

Adjacent: Bog vegetation with dominant Molinia caerulea and frequent Sphagnum spp.,
Myrica gale, Trichophorum cespitosum, Erica tetralix, Potentilla erecta
Heath as A-B occuring on rocky outcrops

Section H-I

Aquatic: Potamogeton pectinatus
Enteromorpha
Fucus sp.

Marginal: Unchanged

Adjacent: Heath as A-B

Section I-J

Aquatic: Potamogeton pectinatus
Ruppia cirrhosa
Enteromorpha

Marginal: Unchanged

Adjacent: Unchanged

Section J-K

Aquatic: Ruppia cirrhosa
Potamogeton pectinatus - extensive in small sheltered bays only
Enteromorpha
Filamentous algae
Chara baltica - >5m out only

Marginal: Unchanged

Adjacent: Holcus lanatus - Potentilla anserina pasture

Section K-L (Transect B)

Aquatic: Ruppia cirrhosa
Potamogeton pectinatus
Enteromorpha
Filamentous algae

Silt and gravel substrate with cobbles

Marginal: Sparse Phragmites swamp with sparse aquatics. 3-4m
Phragmites dominated swamp with frequent Schoenoplectus. 2-3m
Backing to tall dense Phragmites stand with species-poor freshwater understorey.
25-30m

Adjacent: Flush vegetation associated with freshwater spring. Juncus effusus and Agrostis stolonifera dominant with abundant Iris psuedacorus, Mentha aquatica, Myosotis scorpioides

Section L-M (Transect C)

Aquatic: Ruppia cirrhosa - dense beds
Potamogeton pectinatus - dense beds
Chara baltica - abundant around freswater inflow

Marginal: Phragmites dominant with frequent Schoenoplectus on silt substrate. 10-20m
Schoenoplectus dominant with frequent low growing Phragmites on silt substrate.
25-40m. Grazed and poached

Adjacent: Heath as A-B and bog vegetation as G-H

Section M-N

Aquatic: Ruppia cirrhosa
Potamogeton pectinatus
Enteromorpha

Gravel substrate with cobbles and boulders

Marginal: 1m peat cliff with occasional crustose lichen covered boulders and exposed bedrock. Sparse Phragmites and Schoenoplectus shoots in sheltered areas

Adjacent: Bog vegetation as G-H

Section N-O

Aquatic: Ruppia cirrhosa
Potamogeton pectinatus
Enteromorpha
Chara baltica

Marginal: Exposed lichen covered bedrock and boulders with occasional 30-40cm peat cliff Occasional Juncus maritimus tussocks amongst boulders

Adjacent: Bog vegetation as G-H and heath as A-B

Section O-P (Transect D)

Aquatic: Filamentous algae
Chara baltica

Silt substrate

Marginal: Fairly dense single species Schoenoplectus swamp. 10-15m
Open Schoenoplectus cover over sparse freshwater species. 3-8m

Adjacent: Unchanged

Section P-Q

Aquatic: Ruppia cirrhosa
Potamogeton pectinatus - particularly dense in sheltered bays
Filamentous algae
Enteromorpha

Gravel substrate with cobbles and boulders

Marginal: Exposed lichen covered bedrock and boulders with occasional Juncus maritimus and Schoenoplectus in small stands of <c.2m2 among boulders

Adjacent: Unchanged

Section Q-R

Aquatic: Ruppia cirrhosa
Potamogeton pectinatus
Filamentous algae
Enteromorpha
Chara baltica

Marginal: Exposed lichen covered bedrock and boulders with occasional Juncus maritimus tussocks

Adjacent: Heath as A-B

Section R-S

Aquatic: Unchanged

Silt substrate with cobbles and boulders

Marginal: Phragmites dominated swamp with frequent Schoenoplectus as Transect C. 10-15m

Adjacent: Bog vegetation as G-H

Section S-T

Aquatic: Species unchanged

Gravel substrate with cobbles and boulders

Marginal: As N-O

Adjacent: Bog vegetation as G-H with heath as A-B

Section T-U

Aquatic: Filamentous algae
Enteromorpha

Marginal: Unvegetated boulder shore

Adjacent: Unchanged

Section U-V

Aquatic: Potamogeton pectinatus
Filamentous algae
Enteromorpha

Marginal: Unchanged

Adjacent: Unchanged

Section V-W

Aquatic: Potamogeton pectinatus
Filamentous algae
Enteromorpha
Chara baltica

Marginal: Single species Schoenoplectus swamps - average area c.150m2 - in sheltered bays between small promontories of exposed lichen covered bedrock

Adjacent: Unchanged

Section W-X

Aquatic: Ruppia cirrhosa
Potamogeton pectinatus
Enteromorpha

Marginal: As P-Q

Adjacent: Heath as A-B

Section X-Y

Aquatic: Unchanged

Marginal: Open cover of emergent Schoenoplectus, Phragmites and Juncus maritimus with occasional Schoenus nigricans tussocks. 5-8m

Adjacent: Bog vegetation as G-H

Section Y-Z

All as W-X

Section Z-AA

Aquatic: Unchanged

Marginal: Mixed Phragmites - Schoenoplectus swamp as Transect C. 6-8m

Adjacent: Bog vegetation as G-H

2. Transects

Site: Lough Aconeera	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Cobbles	
Depth: 50 cm	Salinity: 14 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Fucus sp.	15	40
Enteromorpha	20	20
Description: Fucus dominant with frequent Enteromorpha on rocky substrate.		

Site: Lough Aconeera	Transect code: A	
Location: Outlet to sea	Sample point: 2 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Silt, cobbles	
Depth: 50 cm	Salinity: 14 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		20
Ruppia cirrhosa	40	20
Potamogeton pectinatus	25	< 1
Algae		80
Enteromorpha	20	80
Substrate		
Cobbles		80
Silt		20
Description: Ruppia (including plants in flower and fruit) growing up through extensive cover of Enteromorpha. Potamogeton pectinatus very sparse.		

Site: Lough Aconeera	Transect code: A	
Location: Outlet to sea	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt (de-oxygenated)	
Depth: 15 cm	Salinity: 14 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		50
Schoenoplectus lacustris ssp tabernaemontani	60	50
Description: Open low growing single species Schoenoplectus swamp. 20m. Cover increasing to landward.		

Site: Lough Aconeera	Transect code: A	
Location: Outlet to sea	Sample point: 4 Marginal	
Sample area: 10m2 (10x1)	Substrate: Silt	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		90
Juncus maritimus	70	85
Schoenoplectus lacustris ssp tabernaemontani	70	5
Glaux maritima	6	< 1
Triglochin maritima	10	< 1
Plantago maritima	8	< 1
Samolus valerandi	8	< 1
Chenopodium rubrum	6	< 1
Carex extensa	15	< 1
Description: Juncus maritimus dominant at dense cover with sparse salt tolerant associates in 1m strip.		
Backing Ulex gallii - Calluna vulgaris dominated heath with Erica cinerea, Daboecia cantabrica, Molinia caerulea.		

Site: Lough Aconeera	Transect code: B	
Location: Swamp associated with spring	Sample point: 1 Aquatic - 1m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: 1m	Salinity: 14 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia cirrhosa		
Potamogeton pectinatus		
Enteromorpha		
Filamentous algae		
Description:		

Site: Lough Aconeera	Transect code: B	
Location: Swamp associated with spring	Sample point: 2 Marginal	
Sample area: 20m2 (10x2)	Substrate: Silt, gravel, cobbles	
Depth: 80 cm	Salinity: 14 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		10
Phragmites australis	130	5
Potamogeton pectinatus	50	5
Ruppia cirrhosa	15	< 1
Algae		50
Filamentous algae		45
Enteromorpha	10	5
Substrate		
Silt and gravel		90
Cobbles		10
Description: Open Phragmites swamp. Substrate largely covered by mat of filamentous algae and decaying Phragmites material. Sparse low growing Ruppia and slightly more extensive, more developed Potamogeton pectinatus with Enteromorpha confined to cobbles. 3m.		

Site: Lough Aconeera	Transect code: B	
Location: Swamp associated with spring	Sample point: 3 Marginal	
Sample area: 20m2 (10x2)	Substrate: Silt	
Depth: 20 cm	Salinity: 11 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Phragmites australis	250	75
Schoenoplectus lacustris ssp tabernaemontani	70	15
Description: Fairly dense Phragmites swamp with frequent Schoenoplectus lacustris. 2m.		

Site: Lough Aconeera	Transect code: B	
Location: Swamp associated with spring	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Galium palustre sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	300	90
Equisetum fluviatile	40	5
Lycopus europaeus	30	5
Mentha aquatica	30	< 1
Galium palustre	15	< 1
Description: Dense Phragmites bed on water-logged sloping ground (c.15 degrees) with sparse species-poor fen vegetation. 30m.		
Grading to spring flush vegetation dominated by Juncus effusus and Agrostis stolonifera with Iris psuedacorus, Mentha aquatica, Myosotis scorpioides, Lotus corniculatus, Galium palustre abundant.		

Site: Lough Aconeera	Transect code: C	
Location: Freshwater inflow	Sample point: 1 Aquatic - 0-200m out - dive	
Sample area: 0 - 200m out - dive survey	Substrate:	
Depth: 1.5 - 2.5 m	Salinity: 14 parts per thousand at 1m out	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia cirrhosa	100+	
Potamogeton pectinatus	200+	
Chara baltica		
Description: Ruppia cirrhosa and Potamogeton pectinatus in mixed and single species beds. Continuous cover to 2m depth then more patchy cover to 2.5m, unvegetated 2.5 - 3m (maximum depth). Temperature inversion at c.2m depth. Chara baltica restricted to < 1.5m on organic substrate in area of freshwater inflow.		

Site: Lough Aconeera	Transect code: C	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt (de-oxygenated)	
Depth: 40 cm	Salinity: 10 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		85
Phragmites australis	130	80
Schoenoplectus lacustris ssp tabernaemontani	70	5
Description: Fairly dense Phragmites swamp with sparse cover of Schoenoplectus. 15m.		

Site: Lough Aconeera	Transect code: C
Location: Freshwater inflow	Sample point: 3 Marginal
Sample area: 100m2 (10x10)	Substrate: Silt
Depth: 5 cm	Salinity: 5 parts per thousand
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community	

	Height (cm)	Cover (%)
Total Plant		60
Schoenoplectus lacustris ssp tabernaemontani	70	50
Phragmites australis	60	10

Description: Open low growing Schoenoplectus dominated swamp with frequent Phragmites. Both species grazed, substrate poached. 30m.

Backing peat bank (c.75 degree slope to 70cm height) with scattered Salix.

Backing to Ulex gallii - Calluna vulgaris heath (as Transect A) and Sphagnum - Molinia caerulea - Potentilla erecta bog vegetation.

Site: Lough Aconeera	Transect code: D
Location: Marginal swamp	Sample point: 1 Aquatic - 1m out - grapnel
Sample area: Grapnel only	Substrate: Silt
Depth: 1 m	Salinity: 14 parts per thousand
NVC community: -----	

	Height (cm)	Cover (%)
Chara baltica		
Filamentous algae		

Description:

Site: Lough Aconeera	Transect code: D	
Location: Marginal swamp	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 5 - 40 cm	Salinity: 10 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		60
Schoenoplectus lacustris ssp tabernaemontani	80	60
Description: Open, fairly low growing single species Schoenoplectus swamp. 15m.		

Site: Lough Aconeera	Transect code: D	
Location: Marginal swamp	Sample point: 3 Marginal	
Sample area: 50m2 (10x5 - whole stand)	Substrate: Silt and peat	
Depth: 0 - 5 cm	Salinity: 0 parts per thousand	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		45
Schoenoplectus lacustris ssp tabernaemontani	80	30
Hydrocotyle vulgaris	5	10
Anagallis tenella	1	< 5
Ranunculus flammula	30	< 1
Triglochin palustris	10	< 1
Potamogeton natans	5	< 1
Juncus articulatus	20	< 1
Eriophorum angustifolium	30	< 1
Eleocharis palustris	20	< 1
Eleogiton fluitans	5	< 1
Description: Open cover of Schoenoplectus dominant over sparse freshwater flush		
vegetation. 5m.		
Grading to Sphagnum spp - Molinia caerulea - Potentilla erecta wet heath		
vegetation.		

15.3.4 Evaluation

'Valuable'

Chara baltica was found here during the course of this survey. This is the first confirmed Irish record for this charophyte species and is grounds in itself for the designation of this site as valuable. It occurs frequently around the site within approximately 10m of the
shore and was found in abundance in the vicinity of the major freshwater inflow at the western end of the lagoon during a diving survey undertaken by Jim Ryan of the National Parks and Wildlife Service.

Ruppia cirrhosa and Potamogeton pectinatus were found growing in dense mixed and single species beds at the western end to a depth of about 2.5 metres.

Both species are frequent within ten metres of the shore around most of the site with P.pectinatus particularly dense in sheltered bays.

A fucoid species occurs more or less abundantly along the rockier southern shores and around the mouth of the outlet channel.

Marginal vegetation shows some degree of diversity. The southern and eastern shores are largely exposed bedrock with occasional low peat cliff. Juncus maritimus dominated saltmarsh vegetation occurs here and along most of the northern shore. Schoenoplectus lacustris ssp tabernaemontani occurs in small occasional stands around much of the site, frequently with Phragmites in sheltered eastern bays. Phragmites forms dense beds at the
western end, one associated with a freshwater spring and another, with frequent Schoenoplectus, associated with the major inflow stream.

Lough Aconeera is regarded as valuable primarily for the presence of Chara baltica and for its extensive stands of aquatic macrophytes.

A full aquatic survey is recommended.

15.4 ECOTONAL COLEOPTERA

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15.4.1 Site Description

Large coastal brackish lake with road-bridge (R 340) and inlet channel (Plate 1) with seawater incursion at high spring tide. Lake shore exposed with boulders, cobbles, coarse sand and peat margins (Plate 2). Inlet flood area of c. 0.5 ha mainly *Juncus maritimus* dominated vegetation on peaty soil. Lake shore, at least at eastern part of lake, of eroded rock or peat/soil cliffs with water apparently covering nearly all gradually sloping or bare areas. The relatively large fetch and exposed location of the lake result in a high level of disturbance of the shore. The lack of a sedimentary barrier also reduces habitat availability.

Subsites (see Fig. 15.4.1)

1. *Juncus maritimus* (L 878367)

Approx. 0.5 ha *Juncus maritimus*, *Puccinellia maritima*, *Festuca rubra*, *Plantago maritima* and *Triglochin maritima*, grading into *Schoenus nigra*, on peat. Water in channel from Lough Aconeera to sea was c. 3 cm below top of bank on 28 September 1996 during spring tide (salinity 11 ‰); probably floods *Juncus maritmus* area during winter, but with lower salinity due to large outflow from lake. Derelict house walls, stone pathway and drains indicate that this area was probably managed in at least the last century.

2. Island in lough (L 878368)

Small island of boulders and peat with *Pteridium* heath with c. 4m boulders and open water separation from land near bridge. Grassy banks with *Festuca rubra*, *Crepis* sp. *Triglochin maritima*, *Plantago lanceolata* and *P. Maritima*./

14.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles.

Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 15.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as

'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 15.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques
Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare

sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :
(1) *Juncus maritimus* area - S-vac suction sampler (7 ix 1996), c. 2 m^2;
(2) *Juncus maritimus* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (7 - 28 ix 1996);
(3) Island (near bridge) in lough - 6 pitfall traps (7 - 28 ix 1996);
(4) Flotation sampling of peat cliff of inlet below road-bridge (7 ix 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

15.4.3 Results

Nine species of carabid and thirteen species of staphylinid were recorded, two species of which are regarded as indicator species (Table 15.4.1). Both *Agonum nigrum* and *Stenus lustrator* were recorded from the *Juncus maritimus* area.

TABLE 14.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Lough Aconeera.
Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

	Species	No. individuals	
Carabidae			
	Abax parallelipedus (Pill.Mitt.)	3	
*	*Agonum nigrum* Dej.	2	**Indicator species**
	Bembidion mannerheimi Sahlb.	6	
	Dromius linearis (Ol.)	1	
	Notiophilus palustris (Duft.)	3	
	Pterostichus diligens (Sturm)	2	
	Pterostichus niger Schall.)	7	
	Pterostichus strenuus (Panz.)	1	
	Trechus obtusus Er.	1	
Staphylinidae			
	Cryptobium fracticorne (Payk.)	1	
	Geostiba circellaris (Grav.)	8	
	Lesteva sicula Er.	1	
	Ocypus olens (Müll.)	1	
	Quedius fuliginosus (Grav.)	1	
	Quedius molochinus (Grav.)	1	
	Quedius semiaeneus (Steph.)	1	
	Rugilus erichsoni (Fauv.)	1	
	Staphylinus dimidiaticornis Gemm.	1	
	Stenus brunnipes Steph.	1	
	Stenus clavicornis (Scop.)	3	
	Stenus impressus Germ.	1	
*	*Stenus lustrator* Er.	1	**Indicator species**

Agonum nigrum is widespread but local in Great Britain (Hyman and Parsons 1992), and has been recorded from Ireland (Speight *et al.* 1982). It occurs on the shores of standing water (freshwater and brackish) and in bogs (Koch 1989), and its range is restricted to western Europe and the Mediterranean (Freude 1976).

There are three pevious Irish records of *Stenus lustrator* (Anderson 1984), which appears to be local in Europe (Horion 1963). The species is tyrphophilous (associated with peat), but also occurs on marshy shores and flood meadows, according to Koch (1989). The Irish records are from bogs (Anderson 1984), and the species was also recorded at Faranamanagh Lake and Drongawn Lake in this survey, both of which possess peat margins or adjacent bog.

The staphylinid assemblage recorded from the *Juncus maritimus* area had low numbers of species and very low numbers of individuals (Table 15.4.2). The species that were recorded were mainly grassland and marsh species (Table 15.4.3).

TABLE 15.4.3. Staphylinid assemblage from *Juncus maritimus* area, Lough Aconeera (suction sample and pitfall traps combined).

Species	No.	Main biotope
Cryptobium fracticorne	1	Peatland
Lesteva heeri	1	Marsh
Ocypus olens	1	Grassland
Quedius molochinus	1	Grassland
Stenus brunnipes	1	Grassland
Stenus clavicornis	1	Grassland
Stenus lustrator	1	Marsh

15.4.4 Evaluation

Of <u>low</u> conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of two indicator species indicates conservation interest, but this cannot be attributed to the lagoonal processes, for the following two reasons: (1) Both species are associated with surrounding habitats (peatland and salt-marsh); and (2) their low numbers indicate that the population in the *Juncus maritimus* area may be small and derive from these surrounding habitats. Furthermore, this area dominated by *Juncus maritimus* is small relative to other lagoon and bayhead sites. Also, the very low number of staphylinid individuals and species found here (Table 2) suggest that the area is too disturbed by flooding. The lake and inlet lack shallow margins to any great extent, and the lake itself has a margin disturbed by wave action, where for the most part it appears that the terrestrial fauna abuts the aquatic fauna with little ecotonal habitat.

15.4.5 References

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15.5 SUMMARY AND EVALUATION

Lough Aconeera is a large (28 ha) **natural saline lake** with a natural, partly tidal, inlet.

The lake lies close to the edge of a proposed NHA (Site Code 2008) and could be included in that area.

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion

Geomorphology	Moderate
Aquatic Fauna	Moderate
Vegetation	Exceptional
Ecotonal Coleoptera	Low

Geomorphology.

Lough Aconeera is a natural saline lake with a natural inlet through which seawater enters at all high tides. Tidal range is c. 10 cm at neaps and 30 cm at springs.

It is a good example of a large (28 ha) peat lake but differs from others in the region such as L. Tanaí which is shallow and mostly of peat, in being somewhat deeper and having a substratum composed of a larger proportion of bedrock and large boulders. It can be classified as a peat lake with a wide "barrier" composed of peat and rock..This type is not common in Europe but may correspond to the "obs" of northern Scotland.

The lake is rated as of moderate conservation value as a large, saline lake in good condition.

Aquatic Fauna

Among 22 taxa identified, 20 were identified to species and four are lagoonal specialists. In spite of the high proportion of rocky substrate, burrowing species were well represented e.g. *Arenicola marina, Corophium arenarium, Mya arenaria and Cerastoderma glaucum. Mya arenaria* (soft clam), which was recorded as juveniles only, was not recorded at any other site during the survey but adults are deep burrowers and could have been overlooked. *Gammarus* (2 spp.) were particularly abundant).

The species composition is characteristic of middle to low salinity waters not subject to frequent colonisation from the sea but the absence of limnic species indicates that there is always a significant marine influence and that there are no permanent freshwater inflows of significance.

None of the recorded species can be described as rare in Ireland.

Based on aquatic fauna, the site can be rated as of moderate conservation value only.

Vegetation

Ruppia cirrhosa and *Potamogeton pectinatus* grew in dense mixed and single species beds at the western end to a depth of about 2.5 metres and within 10 m of the shore around most of the site with *P. pectinatus* particularly dense in sheltered bays.

Chara baltica was frequent around the site and was particularly abundant near a freshwater inflow. This is the first confirmed Irish record for this species and is grounds in itself for the designation of this site as valuable.

Some *Fucus* was present near the tidal inlet. Marginal vegetation ws poorly developed and consisted of *Juncus maritimus* dominated saltmarsh vegetation with *Schoenoplectus lacustris* ssp *tabernaemontani* in small occasional stands and *Phragmites* in dense beds near freshwater inflows.

The site is rated as of exceptional conservation value for the presence of *Chara baltica.*

A full aquatic survey is recommended.

Ecotonal Coleoptera

Nine species of carabid and 13 species of staphylinid were recorded, two species of which are regarded as indicator species, both from the *Juncus maritimus* area.

Agonum nigrum is widespread but local in Great Britain and has been recorded from Ireland. It occurs on the shores of standing water (freshwater and brackish) and in bogs and its range is restricted to western Europe and the Mediterranean.

There are three pevious Irish records of *Stenus lustrator* which appears to be local in Europe. The species is tyrphophilous (associated with peat), but also occurs on marshy shores and flood meadows. The Irish records are from bogs. The species was also recorded at Faranamanagh Lake and Durnesh Lough in this survey, both of which possess peat margins or adjacent bog.

Summary

Lough Aconeera is a good example of a large, natural saline lake in peatland with a natural tidal inlet and a substrate comprising a large proportion of bedrock..

The aquatic fauna was typical of a lagoon in the middle to low salinity range and included four lagoonal specialists but the only species of interest was the soft clam, *Mya arenaria*.

The aquatic vegetation was well developed and remarkable chiefly for the presence of the rare lagoonal specialist *Chara baltica.* Marginal vegetation was poor.

Although two indicator species of ecotonal Coleoptera wererecorded, their presence cannot be attributed to lagoonal processes. Stands of *Juncus maritimus* in which the species occurred were small and staphylinid numbers were low.

Overall, the lake is rated as of exceptional conservation value for the presence of *Chara baltica*, but in other respects its rating is only moderate to low.

Designation as a proposed SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

16. MILL LOUGH

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

16. MILL LOUGH

CONTENTS

16. MILL LOUGH, Co. Galway.

OS Grid Reference: L 755 331, 1:50,000 Sheet No. 44
Alternative names: Loch an Mhuilinn

16.1 STUDY AREA

General features

Mill Lough is situated in the north of Ard Bay, western Connemara, 4 km west of Carna (Fig. 16.1.1). The lake lies in an area of rock and peat and has a short outlet to the sea under a bridge at the southern end. The bed of the lake is mostly composed of granite bedrock and detached blocks and boulders, with patches of coarse sand and unconsolidated peat in the sheltered areas. A freshwater stream enters the lake in the northeast and there are numerous small springs discharging groundwater to the lake from the surrounding areas of peat.

Mill Lough is included as a good example of a type of lagoon, similar to the Scottish "obs", which are characteristic of parts of the west coast of Ireland, especially in Connemara. They are permanent, shallow and brackish, with restricted tidal influence due to the presence of a "barrier" of peat, and in this case rock. These "peat" lagoons are of particular interest as very little appears to be known about any aspect of the functioning of brackish lagoons situated in acid peatbogs.

Very little is known about the lake. It appears to have no protective status but does not appear to be under any immediate threat.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 5.6 °C in January and 14.3 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1200 mm, and the number of rain days (1 mm or more) is around 180. Winds are mainly from the southwest. Mean annual hourly wind speeds are between 5 and 6 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4 0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1984). Tides are semi-diurnal and the tidal range (MHWS-MLWS) at Kilkieran is 4.2 m (Admiralty Tide Tables). Sea temperatures are lowest in February (around 7°C) and highest in August (14.6°C).

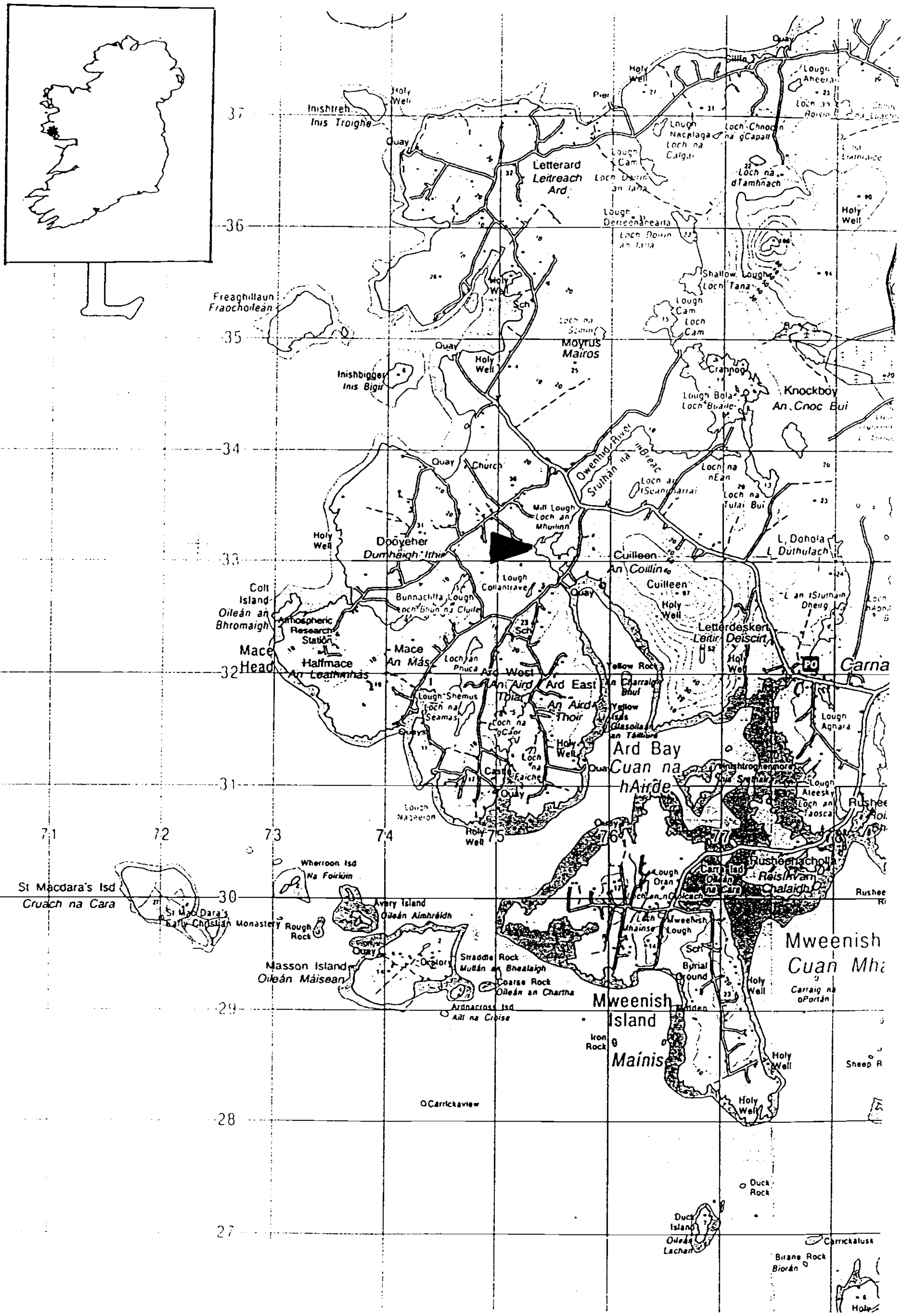

Fig. 16.1.1 Section of 1:50 000 map showing locality of Mill Lough

Landscape and Geology The Connemara region of Galway is a glaciated plain of rolling lowland with granite outcrops and Atlantic type blanket bog. The granite bedrock is impervious and drainage density is high. Soils other than peat are shallow podzols with very limited land-use capability (Royal Irish Academy 1979). The area was described by Haughton (1957) as a "wilderness of bare rock, glacial erratics, water and peat".

Land surrounding the lough consists of small irregular fields of semi-improved pasture, bare rock, small peatbogs and wet heathland.

Lake Topography The lagoon is approximately 400 m from north to south, 350 m from west to east at its widest point and covers about 5 ha. Water depth is 1 - 2 m over most of the lake. There is a deeper pool of 4-5 m at the southern end which, according to local information, was created by blasting and another deeper area in the northwest (2-3 m). The bed of the lake is mostly composed of granite bedrock and detached blocks and boulders, with patches of coarse sand or unconsolidated peat and silts in the sheltered areas. Reedbeds of *Phragmites* have become established in the small bays.

It is possible that peat was once cut in the area occupied by the lake. The channel connecting the lake to the sea runs through rock and peat and appears to be natural, but may have been modified to allow small boats to enter the lake.

Hydrology A freshwater stream enters the lake in the northeast and undoubtedly freshwater also enters through the slow release of groundwater from the saturated peat higher in the valley and also in direct rainfall. Seawater appears to enter on most tides, through the channel which leads under the bridge. A tidal range in water level of 1.3 m was measured at the bridge on 29.ix.96. A seasonal pattern is likely, whereby water levels rise in the winter with the increased rainfall and storm frequency, and gradually decline in the summer. The peaty soils of the surrounding land would, however, through absorption and slow release of water, affect the delivery time of both surface- and ground-water flows to the lake.

Salinity and water quality Despite the fact that seawater appears to enter on every tide the lake is also likely to receive large volumes of freshwater runoff from the surrounding land. Salinity levels are likely to vary considerably, both spatially and temporally, depending on precipitation and tides. Generally, salinity levels are likely to be relatively high throughout the year with a tendency to increase during the summer. However, the peaty soils would affect the flow of both surface- and ground-water to the lake. The prolonged flow of freshwater to the pool during the "dry" months may result in lower salinities than might be expected. On the other hand, winter storms may result in a higher volume of seawater entering the lake and raising salinity levels at a time when they might be expected to fall.

Stratification is only likely to occur for any prolonged period in the deeper pool as the high tidal exchange in a relatively small basin would cause mixing on a regular basis.

The surrounding land is relatively natural and even grazing land is likely to receive only limited fertilizer applications. Water quality appears to be high although quite a deep layer of organic silt has accumulated in some areas of the lake and there is some evidence of pollution in the northwest corner which has been used as a dumping area for domestic refuse from nearby houses and farms. The regular flushing of the lake would restrict any serious problems caused by eutrophication.

16.2 AQUATIC FAUNA

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16.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰ precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A and D in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by

Table 16.2.1. Fauna Recorded in Mill Lough, Co. Galway. June and September 1996.

Fauna		Sampling Stations (L.T. = light-trap)							
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D
Porifera									
Cnidaria	*Dynamena pumila*	+							
Turbellaria									
Nemertea									
Annelida	*Arenicola marina*	+							
	Hediste diversicolor	1						1	
Crustacea									
Cirripedia									
Mysidacea	*Leptomysis lingvura*					1			
	Neomysis integer	c	35	a	500	c	c100	c	c100
	Praunus flexuosus	1?							
Isopoda	*Jaera nordmanni*	c		o					
	Lekanesphaera hookeri		40	c	?	+	1	c	23
Amphipoda	*Corophium volutator*							c	
	Gammarus duebeni							+	
	G. zaddachi	+		+				+	
Tanaidacea									
Decapoda	*Carcinus maenas*	+		+		F, 5		c	
	Palaemon elegans	o							
	P. serratus					F, 1			
	Palaemonetes varians	o		o		c		c	4
Insecta									
Ephemeroptera									
Plecoptera									
Trichoptera									
Odonata									
Hemiptera									
Coleoptera	**Cercyon littoralis*								
Diptera	Chironomidae	c		o		c		o	
Mollusca									
Prosobranchia	*Hydrobia ulvae*	5						7	
	Littorina obtusata	1							
	Potamopyrgus antipodarum			1		+		1	
Opisthobranchia									
Pulmonata									
Bivalvia	*Cerastoderma glaucum*	c				c			
Bryozoa	*Conopeum seurati*	+		+		+		+	
	Flustrellidra hispida					+			
Echinodermata									
Tunicata	*Ascidiella scabra*	+							
Teleostei	*Anguilla anguilla*	F, 2		+		+			
	Gasterosteus aculeatus	o	1	o	3	+		c	
	Labrus bergylta	F, 1							
	Mugilidae					F, 12			
	Platichthys flesus	F, 1						o	
	Pomatoschistus microps	o		o	3			o	1

+ = present; o = occasional; c = common; a = abundant; F = fyke net.
* = Station not known - see text

inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists for confirmation. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (eg *Jaera*, hydrobiids).

All Diptera are identified to family level.

16.2.2 Results

Mill Lough was sampled on 12.vi.96 during the first part of the survey, and from 27-29.ix.96 during the more intensive survey.

Positions of the sampling stations are shown in Fig. 16.1.1.

Environmental Variables

Station A (OS 7559 3285) was located at the southern end of the lake nearest to the road and the outlet channel which runs under the bridge and is the most tidal area of the lake. Water depth varied from 0 - 80 cm, substrate was smooth slabs of granite bedrock, stones of various sizes and small pockets of gravel, coarse sand, silt and peat. Salinity measured 31 ‰.

Station B (OS 7543 3308) was located in the northwest corner near a *Phragmites* bed and area used for domestic refuse. Water depth was 0 - 60 cm, substrate consisted of soft organic mud and unconsolidated peat with occasional stones and salinity measured 34‰.

Station C (OS 7556 3319) was located in the northeast corner where a stream enters the lake, in a bed of *Phragmites* . Water depth was 0 - 1 m, substrate was rock, stones, coarse granite sand and organic silt/mud. This station was the most affected by freshwater inflows and salinity measured 2 - 6‰. A fyke net was used a short distance offshore in this area where water depth was 2-3 m and salinity may have been considerably higher at depth.

Station D (OS 7567 3309) was located in the bay at southeast corner of the lake. Depth varied from 0 - 1.5 m, substrate was rock with unconsolidated peat and soft organic mud. Salinity measured 20‰..

Station E (OS 8769 3714) was located on the northeast shore among *Phragmites*. Water depth varied from 0 - 1.2 m., substrate consisted of coarse granite sand, organic silt and fibrous roots, and salinity measured 12‰.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 16.2.1. Among 30 taxa listed, 28 are identified to species. The list comprises 9 marine species, 4 poly-mesohaline, 13 euryhaline, 1 oligo-mesohaline, and 1 limnic species (Table 16.2.2). Four species are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Table 16.2.2 Ecological categories of the recorded taxa in Mill Lough. L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Dynamena pumila*	
	Leptomysis lingvura	
	Palaemon elegans	
	P. serratus	
	Hydrobia ulvae	
	Littorina obtusata	
	Flustrellidra hispida	
	Ascidiella scabra	
	Labrus bergylta	
Poly-mesohaline	*Arenicola marina*	
	Praunus flexuosus	
	Corophium volutator	
	Cerastoderma glaucum	L
Euryhaline	*Hediste diversicolor*	
	Neomysis integer	
	Lekanesphaera hookeri	L
	Jaera nordmanni	
	Gammarus duebeni	
	Gammarus zaddachi	
	Palaemonetes varians	L
	Carcinus maenas	
	Conopeum seurati	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
	Platichthys flesus	
Oligo-mesohaline	*Potamopyrgus antipodarum*	
Limnic	*Cercyon lateralis*	

The greatest number of species was recorded at A, nearest to the sea inlet, which was the only station where some marine and polyhaline species were found (e.g. *Praunus flexuosus, Palaemon elegans, Littorina obtusata, Hydrobia ulvae, Ascidiella scabra*). *Potamopyrgus antipodarum* replaced *Hydrobia ulvae* in other parts of the lake and was the most abundant species at C where a freshwater stream enters. The commonest species at all stations were *Neomysis integer, Lekanesphaera hookeri* and chironomid larvae.

16.2.3 Discussion

The species assemblage typifies a brackishwater with a sea inlet and salinity in the main body of the lake in the medium to high salinity range. The scarcity of oligohaline species indicates that high salinities are too frequent to allow their survival, while the absence of barnacles and other sedentary marine species suggests that frequent low salinities also occur. There is evidence for this as in June 1996 the salinity at D was only 2‰. A few sedentary marine species were present e.g. *Flustrella hispida* and *Ascidiella scabra,* but they were represented by few individuals.

None of the recorded species can be described as rare in Ireland.

16.2.4 Threats

Refuse is dumped on the shore of the lake at one point.

Local inhabitants have noted a decline in the fish population which they attribute to agricultural runoff and domestic sources from small farms on a nearby hillside.

16.2.5 Evaluation

Mill Lough is a **natural saline lake** with a natural tidal inlet.

It is an example of a lake of a type, probably also frequent in Scotland, which can be classified as a saline peat lake. It differs from L. Aconeera in being smaller, with less rock and a greater tidal exchange. As little appears to be known about the functioning of peat lakes, this one may be worthy of further study but it is a different type from the more shallow, dominantly peat lagoons such as L. Tanaí.

The aquatic fauna was typical of a lagoon with a significant tidal inflow and a medium to high salinity. The component of marine species was therefore greater than in L. Aconeera. Localised areas of low salinity allow some oligohaline species to survive.

No rare or interesting species was recorded.

The lake does not lie in or near a proposed NHA.

In conclusion, as a result of the aquatic faunal survey, Mill Lough is rated as having a relatively low conservation value. It is not a true lagoon but is geomorphologically interesting.

16.2.6 References and Additional Sources of Information

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Plate 16.2.1 View across Mill Lough from the western shore, looking toward Station D.

Plate 16.2.2 View of ebb tide flowing from Mill Lough from Station A.

Plate 16.2.3 View of northwestern area of Mill Lough, Station B.

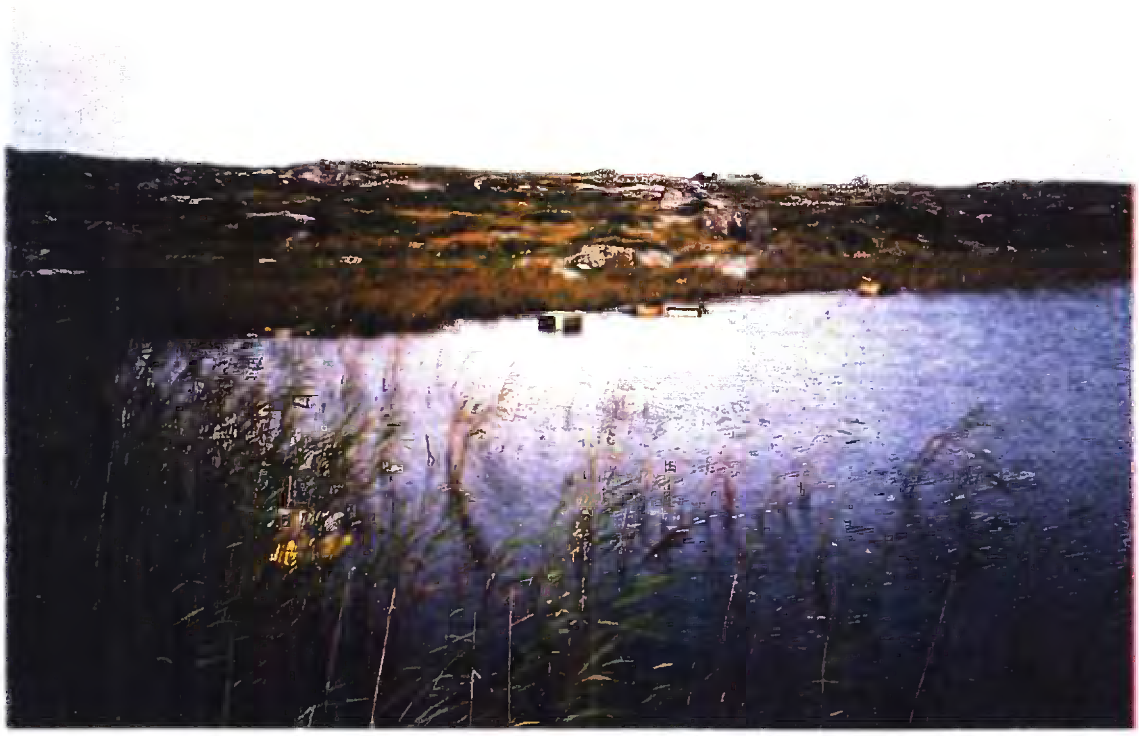

Plate 16.2.4 View of refuse in northwestern area of Mill Lough, near Station B.

16. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

16.3.1 Site Description (Fig. 16.3.1)

This is a rocky site set in a 'rolling' landscape of low hills. The area surrounding the lagoon is largely dominated by heath vegetation with frequent rock outcrops and is subject to grazing. A fairly extensive area of Juncus maritimus dominated vegetation lies to the north east of the lough.

The shores are largely exposed bedrock and boulders with occasional peat shores of shallow slope.

The major freshwater inflow enters the lagoon to the north east. Open Phragmites swamps occur here and in bays and other more or less sheltered areas in the north west and east. These are nowhere extensive.

The outlet to the sea joins the lough at its southern tip, passing beneath a road bridge which runs close to the south eastern shore.

16.3.2 Methods

Two survey methods were employed in the course of fieldwork:
1. Transects
2. Shore-based survey

1. Transects:

The locality of these is shown in Fig. 16.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

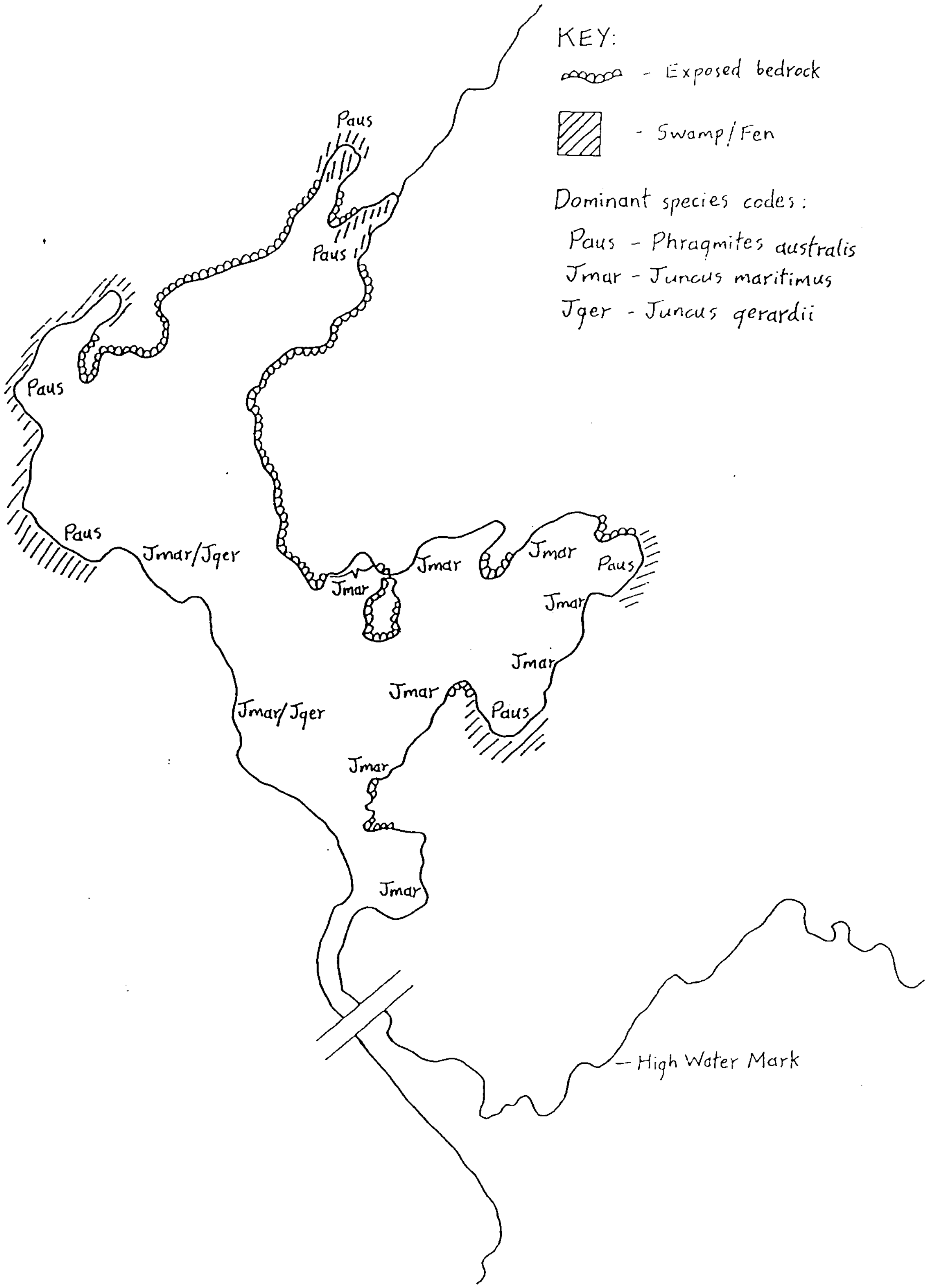

Fig. 16.3.1 Mill Lough, Co Galway - Marginal Vegetation

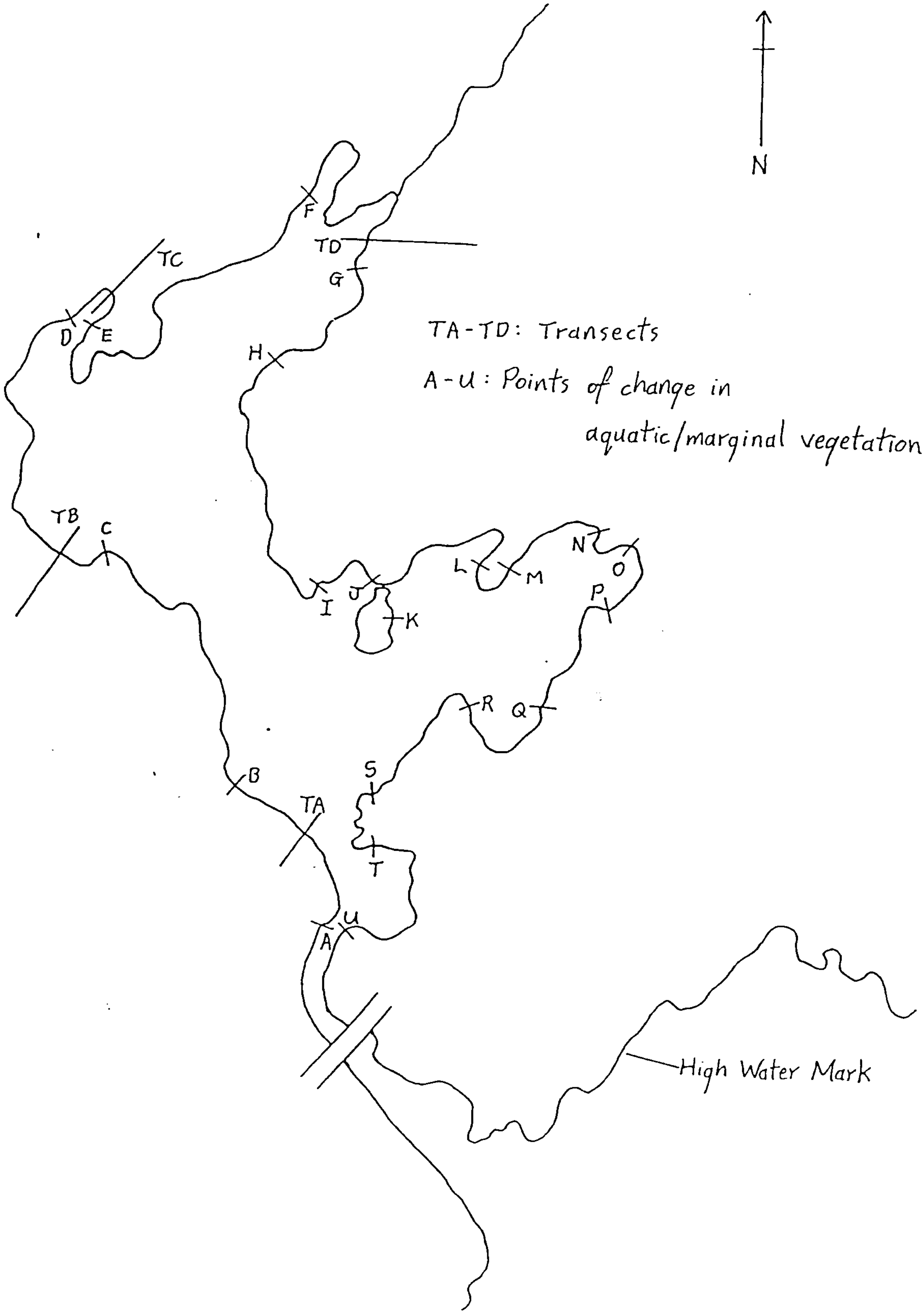

Fig. 16.3.2 Mill Lough, Co.Galway: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values
Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

16.3.3 Results

1. Shore-based survey

Section A-B (Transect A)

Aquatic: Enteromorpha - extensive
Filamentous algae - sparse
Fucus sp. - patchy

Gravel substrate with cobbles and boulders

Marginal: Open cover of low Juncus maritimus tussocks over salt tolerant species dominated by Juncus gerardii and Agrostis stolonifera on peat substrate. 3-15m Grazed and poached

Adjacent: Ulex gallii - Molinia caerulea - Potentilla erecta heath with frequent Daboecia cantabrica

Section B-C

Aquatic: Ruppia cirrhosa
Enteromorpha
Filamentous algae
Fucus sp.

Marginal: Unchanged

Adjacent: Unchanged

Section C-D (Transect B)

Aquatic: Ruppia cirrhosa - sparse, low growing
Enteromorpha - extensive mat, free floating
Filamentous algae - patchy

Silt substrate

Marginal: Dense Phragmites swamp with sparse Ruppia and free floating filamentous algae.
5-10m
Grading to species-poor salt tolerant community with fairly dense cover of Juncus maritimus tussocks and patchy Agrostis stolonifera dominant below. 5-100m. Grazed and poached

Adjacent: Unchanged

Section D-E (Transect C)

Aquatic: Ruppia cirrhosa - sparse, low growing
Enteromorpha - extensive, free floating

Marginal: Open Phragmites dominated swamp with frequent Schoenoplectus lacustris ssp tabernaemontani. 4 -5m
Grading to open cover of Schoenoplectus and Juncus maritimus with Eleocharis palustris and Agrostis stolonifera co-dominant below among salt tolerant species. c.20m

Adjacent: Iris psuedacorus dominated flush community with frequent Juncus effusus, Mentha aquatica, Filipendula ulmaria and Lotus corniculatus.

Section E-F

Aquatic: Ruppia cirrhosa
Filamentous algae

Gravel substrate with cobbles and boulders

Marginal: Exposed bedrock and boulder shore with crustose, foliose and fruticose lichens.
Occasional small patches of Juncus maritimus salt tolerant community as Transect A

Adjacent: Heath as A-B

Mill Lough

Section F-G (Transect D)

Aquatic: Ruppia cirrhosa - sparse
Filamentous algae - extensive

Silt substrate with cobbles

Marginal: Sparse Phragmites swamp growing through dense filamentous algae cover with sparse Ruppia in sheltered bays.
Backing to Juncus maritimus salt tolerant community. c.10m at bayheads, c.200m east of freshwater inflow, 1-2m strip elsewhere

Adjacent: Bog vegetation at bayheads. Dominant species Molinia caerulea, Schoenus nigricans, Myrica gale, Sphagnum spp.
Heath as A-B elsewhere

Section G-H

As E-F

Section H-I

Aquatic: Ruppia cirrhosa
Filamentous algae
Fucus sp.

Marginal: Unchanged

Adjacent: Unchanged

Section I-J

Aquatic: Ruppia cirrhosa
Filamentous algae

Marginal: Juncus maritimus dominated salt tolerant community as Transect A. 1-5m

Adjacent: Unchanged

Section J-K

Aquatic: Ruppia cirrhosa
Filamentous algae
Fucus sp.

Marginal: As E-F

Adjacent: Unchange

Section K-L

Aquatic: Ruppia cirrhosa
Filamentous algae

Marginal: As I-J with occasional boulders and exposed bedrock

Adjacent: Unchanged

Section L-M

Aquatic: Ruppia cirrhosa
Filamentous algae
Fucus sp.

Marginal: Exposed bedrock shore with crustose, foliose and fruticose lichens

Adjacent: Unchanged

Section M-N

Aquatic: Ruppia cirrhosa
Filamentous algae

Marginal: Juncus maritimus dominated salt tolerant community as Transect D. c.150-200m

Adjacent: Unchanged

Section N-O

As E-F

Section O-P

Aquatic: Unchanged

Marginal: Open Phragmites swamp with sparse low growing Ruppia. 15-20m
Backing to Juncus maritimus dominated community as Transect D. 5-15m

Adjacent: Dry stone wall
Public road

Section P-Q

Aquatic: Ruppia cirrhosa
Filamentous algae
Fucus sp. - sparse

Marginal: Juncus maritimus strip - 1-4m - almost continuous with scattered lichen covered
boulders and bedrock outcrops forming shore in places.

Adjacent: Heath as A-B

Section Q-R

Aquatic: Unchanged

Marginal: Open single species Phragmites swamp. 10-15m
Backing to Juncus maritimus dominated community as Transect D. 3-c.50m

Adjacent: Unchanged

Section R-S

Aquatic: Species unchanged
Fucus now more extensive

Marginal: As P-Q

Adjacent: Unchanged

Section S-T

Aquatic: Filamentous algae
Enteromorpha
Fucus sp.

Marginal: Unchanged

Adjacent: Unchanged

2. Transects

Site: Mill Lough	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Gravel, cobbles, boulders	
Depth: 5 - 20 cm	Salinity: 21 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Enteromorpha	10	70
Filamentous algae		20
Fucus sp.	10	10
Description: Enteromorpha dominant with frequent filamentous algae and Fucus on rocky		
substrate.		

Site: Mill Lough	Transect code: A	
Location: Outlet to sea	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		75
Juncus maritimus	50	50
Juncus gerardii	25	10
Agrostis stolonifera	10	10
Glaux maritima	6	5
Aster tripolium	15	< 5
Triglochin maritima	15	< 1
Plantago maritima	10	< 1
Leontodon autumnalis	15	< 1
Description: Open cover of low Juncus maritimus tussocks over salt-tolerant community		
dominated by Juncus gerardii and Agrostis stolonifera. 10m. Poached and grazed.		
Grading to Ulex gallii - Molinia caerulea - Potentilla erecta heath with Daboecia		
cantabrica.		

Site: Mill Lough	Transect code: B	
Location: Marginal swamp	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Silt	
Depth: 50 cm	Salinity: 21 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		< 1
Ruppia cirrhosa	20	< 1
Algae		100
Enteromorpha		80
Filamentous algae		20
Description: A mat of free floating algae with very sparse, mostly low growing Ruppia.		
Several Ruppia plants in flower and fruit.		

Site: Mill Lough	Transect code: B	
Location: Marginal swamp	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 15 cm	Salinity: 20 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		90
Phragmites australis	160	90
Ruppia cirrhosa	10	< 5
Algae		30
Filamentous algae		30
Description: Dense Phragmites swamp with sparse low growing Ruppia and free floating algae		
10m.		

Site: Mill Lough	Transect code: B	
Location: Marginal swamp	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		90
Juncus maritimus	60	70
Phragmites australis	40	5
Agrostis stolonifera	20	10
Puccinellia maritima	10	< 5
Aster tripolium	20	< 5
Glaux maritima	8	< 5
Triglochin maritima	10	< 1
Plantago maritima	8	< 1
Description: Juncus maritimus dominant over species-poor salt tolerant vegetation. 100m.		
Grazed. Substrate poached and water-logged.		
Grading to Ulex gallii - Molinia caerulea - Potentilla erecta heath.		

Site: Mill Lough	Transect code: C	
Location: Swamp associated with spring	Sample point: 1 Aquatic - 3m out	
Sample area: 16m2 (4x4)	Substrate: Silt	
Depth: 45 cm	Salinity: 16 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		< 5
Ruppia cirrhosa	20	< 5
Algae		100
Enteromorpha		100
Description: Sparse low growing Ruppia with extensive cover of free floating Emteromorpha		

Site: Mill Lough	Transect code: C	
Location: Swamp associated with spring	Sample point: 2 Marginal	
Sample area: 24m2 (6x4 - whole stand)	Substrate: Silt	
Depth: 0 - 45 cm	Salinity: 11 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		60
Phragmites australis	150	40
Schoenoplectus lacustris ssp tabernaemontani	100	20
Description: Open Phragmites dominated swamp with frequent S. lacustris. 4m.		

Mill Lough

Site: Mill Lough	Transect code: C	
Location: Swamp associated with spring	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	60	25
Juncus maritimus	50	25
Eleocharis palustris	30	20
Agrostis stolonifera	15	20
Juncus gerardii	20	5
Glaux maritima	8	5
Cochlearia anglica	6	< 1
Triglochin maritima	15	< 1
Plantago maritima	10	< 1
Samolus valerandi	10	< 1
Carex otrubae	40	< 1
Description: Open cover of Schoenoplectus and Juncus maritimus with Eleocharis and Agrostis co-dominant below among salt tolerant species. 20m.		
Grading to Iris pseudacorus dominated community with frequent Juncus effusus, Mentha aquatica, Filipendula ulmaria, Lotus corniculatus.		

Site: Mill Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 1 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Bedrock, silt	
Depth: 80 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Ruppia cirrhosa	50	5
Description: Sparse Ruppia only.		

Site: Mill Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 20m2 (10x2)	Substrate: Silt	
Depth: 20 - 50 cm	Salinity: 4 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		60
Phragmites australis	150	60
Description: Open single species Phragmites swamp. 3m.		
Backing 50cm peat cliff.		

Site: Mill Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Juncus maritimus	60	50
Schoenus nigricans	40	20
Agrostis stolonifera	15	15
Juncus gerardii	15	10
Festuca rubra	15	5
Glaux maritima	8	< 5
Plantago maritima	10	< 1
Leontodon autumnalis	20	< 1
Samolus valerandi	8	< 1
Carex extensa	15	< 1
Description: Open cover of Juncus maritimus tussocks with Schoenus nigricans locally		
co-dominant. Patchy cover of Agrostis stolonifera and Juncus gerardii among ground layer		
of otherwise sparse salt tolerant species. c.200m.		
Backing to Ulex gallii - Molinia caerulea - Potentilla erecta heath		

16.3.4 Evaluation

'Potentially Valuable'

This is a rocky site with a high degree of spatial salinity variation at time of survey (5 parts per thousand in the sheltered bays of the north east and south east, 21 parts per thousand around the mouth of the outlet channel and along the western shore).

A Fucus species has a fairly wide distribution, occurring frequently along the rocky shores of both the east and west to within approximately 100 metres of the main freshwater inflow.

Ruppia cirrhosa occurs around the whole site. It has a sparse cover near the shallower shores and was not found in dense beds in this site.

Some Zostera fragments were found washed up on the shore in places.

Marginal vegetation is more or less uniform. Juncus maritimus salt tolerant community is dominant between stretches of bedrock shore. Small open Phragmites swamps occur in sheltered areas of the north and south east.

Mill Lough would seem to be a species-poor site with no particularly notable aquatic species. However, Ruppia cirrhosa is frequent to abundant and, bearing in mind the restricted nature of aquatic survey at this site, a more in depth survey could well yield more interesting results.

Full aquatic survey is recommended.

16.4 ECOTONAL COLEOPTERA

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16.4.1 Site Description

Coastal brackish lake with road-bridge and short inlet channel, with seawater incursion at high spring tide. Lake shore exposed with boulders, cobbles and peaty soil margins. Flood areas of c. 0.05 ha mainly *Juncus* /grass and mostly submerged*Phragmites* beds on peaty soil on more sheltered western shore.

Subsites (see Fig 16.4.1)

1. *Juncus maritimus* (L 755328)

Approx. 0.05 ha *Juncus maritimus, Juncus gerardi, Puccinellia maritima, Armeria maritima, Plantago maritima* and *Triglochin maritima* on peat. Salinity of water near shore was 12 ‰, and the area was completely flooded by spring high tide in late September 1996. The area is grazed by cattle.

2. *Juncus gerardi* (L 755329)

Approx. 0.03 ha grass sward with *Juncus gerardi* near *Ulex galii* herb-rich heath/grassland. Partly flooded at high spring tide (evidence from flooded traps).

3. Inlet margin (L 755328)

Lake shore at inlet riffle area, with broken angular rocks, cobbles and pebbles on coarse sand/organic substrate. Unvegetated area, flooded at high spring tide. The isopod *Ligia oceanica* and amphipods abundant.

16.4.2 Methods

Site Rating using Indicator Species
Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

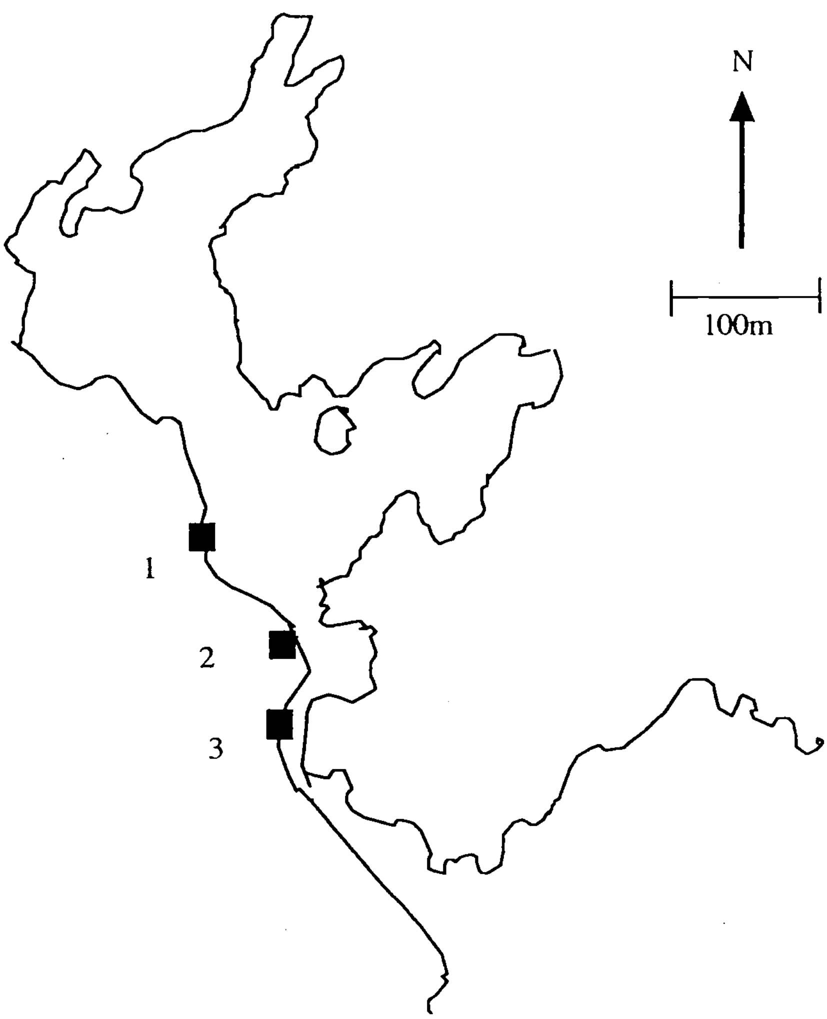

Fig. 16.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Mill Lough, Co. Galway

1 - Pitfall traps
2 - Pitfall traps, S-vac
3 - Cobble search

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species
Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings
The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy
At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques
The sampling methods used are listed in Table 16.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held

pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 16.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is

not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References
Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.
Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :
(1) *Juncus maritimus* area - S-vac suction sampler (6 ix 1996), c. 2 m^2;
(2) *Juncus maritimus* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (6 - 28 ix 1996);
(3) *Juncus gerardi* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (6 - 28 ix 1996);
(4) Cobble search (n=30) from inlet shore (6 ix 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; <u>and</u>, (2) they

are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

16.4.3 Survey Results

Only a single species of carabid and five species of staphylinid were recorded, none of which are regarded as indicator species (Table 16.4.2).

The staphylinid assemblage recorded from the *Juncus maritimus* area had very low numbers of species and individuals (Table 16.4.2). The species that were recorded were grassland and marsh species (Table 16.4.3).

TABLE 16.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Mill Lough. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989).

Species	No. individuals
Carabidae	
Pterostichus niger (Schall.)	13
Staphylinidae	
Atheta melanocera (Thoms.)	1
Lathrobium brunnipes (F.)	1
Ocypus olens (Müll.)	3
Philonthus politus (L.)	1
Stenus nitidiusculus Steph.	1

TABLE 16.4.3. Staphylinid assemblage from *Juncus maritimus* area, Mill Lough (suction sample and pitfall traps combined).

Species	No.	Main biotope
Atheta melanocera (Thoms.)	1	Ripicolous, marshes
Philonthus politus (L.)	1	Woodland, riparian
Stenus nitidiusculus Steph.	1	Ripicolous, peatland, grassland

16.4.4 Evaluation

Of no recorded conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The very low numbers of individuals and species (Table 1) indicates a large amount of disturbance by the apparent regular flooding (and probably drying between the spring tide periods). The few eurytopic non-halophilous ripicolous species (Table 2) probably find the sampled areas too disturbed by flooding, but there is insufficient marine influence to encourage salt-marsh species. The size of the uneroded shore areas containing margin vegetation is also probably too small to provide sufficient total area of suitable habitat.

References

Lohse, G.A. and Lucht, W.H. (1989) *Die Käfer Mitteleuropas*. **12**. *1. Supplementband mit Katalogteil.* Goecke & Evers, Krefeld.
Lucht, W.H. (1987) *Die Käfer Mitteleuropas. Katalog*. Goecke & Evers, Krefeld.

16.5 SUMMARY AND EVALUATION

Mill Lough is a small (5 ha) **natural saline lake** with a natural tidal inlet.

The lake does not lie in or near a proposed NHA.

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion

Geomorphology	Moderate
Aquatic Fauna	Moderate
Vegetation	Potentially High
Ecotonal Coleoptera	None

Geomorphology.

Mill Lough is a good example of a saline lake in peatland with a tidal inlet, but it is smaller than L. Aconeera with less rock and a greater tidal exchange. The salinity varies more widely, both temporally and spatially. Water floods extensive areas of the shoreline at spring tides.

It can be classified as a peat lake with a wide "barrier" composed of peat and rock.This type is not common in Europe but may correspond to the "obs" of northern Scotland.

Mill Lough is rated as of moderate conservation value as a good example of a natural saline lake with tidal inlet in rocky peatland.

Aquatic Fauna

Among 30 taxa recorded 28 were identified to species and four were lagoonal specialists. The greatest number of species was recorded near the sea inlet. One limnic species, a beetle, was recorded from near the freshwater inlet.

The aquatic fauna was typical of a lagoon with a significant tidal inflow and a medium to high salinity. The component of marine species was therefore greater than in L. Aconeera. Sedentary marine species such as tunicates and bryozoans were occasional near the sea inlet. Localised areas of low salinity allow some oligohaline species to survive e.g. near a stream inlet where one beetle species was taken.

No rare or interesting species was recorded.

Based on aquatic fauna, the lake is rated as of moderate conservation value.

Vegetation

Ruppia cirrhosa occurs around the whole site but was not found in dense beds. Some *Zostera* fragments were found washed up on the shore in places. Fucoid algae were common in the tidal inlet and one species occurring frequently along the rocky shores of both the east and west to within approximately 100 metres of the main freshwater inflow.

Marginal vegetation was more or less uniform. *Juncus maritimus* salt tolerant community was dominant between stretches of bedrock shore. Small open *Phragmites* swamps occurred in sheltered areas of the north and south east.

Mill Lough would seem to be a species-poor site with no particularly notable aquatic species. However, a survey of the deeper regions could well yield more interesting results and the site is therefore rated as "potentially valuable".

Full aquatic survey is recommended.

Ecotonal Coleoptera

Only a single species of carabid and five species of staphylinid were recorded, none of which are regarded as indicator species.

The staphylinid assemblage recorded from the *Juncus maritimus* area had very low numbers of species and individuals which indicates a large amount of disturbance by the apparent regular flooding (and probably drying between the spring tide periods). Areas of marginal vegetation may be too small, and there is insufficient marine influence to encourage salt-marsh species. The species that were recorded were grassland and marsh species. The site is therefore rated as of no conservation interest for ecotonal Coleoptera.

Summary

Mill Lough is a natural tidal lake in peatland with a natural tidal inlet. It is similar to L. Aconeera but smaller and more saline. There is some evidence of pollution from domestic and agricultural sources but the effects do not appear to be severe and are probably limited by tidal flushing.

The aquatic fauna and vegetation were typical of a lagoon with a significant tidal inflow and a medium to high salinity but little of special interest was recorded.

The vegetation appeared to be species poor but deeper areas were not sampled.

Ecotonal Coleoptera were poorly represented and no indicator species were recorded.

Overall, the lake is rated as of moderate conservation value as a good example of a small, natural saline lake with typical fauna and vegetation but of less value than L. Aconeera. Proposal as an SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

17. CORRAGAUN LOUGH

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Pat Hatch
Jervis Good

February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

17. CORRAGAUN LOUGH

CONTENTS

17. CORRAGAUN LOUGH, Co. Mayo.

OS Grid Reference: L 748 698, 1:50,000 Sheet No. 37
Alternative names:

17.1 STUDY AREA

General features
Corragaun Lough is situated on the west Mayo coast, 5 km north of Killary Harbour and 7 km from Killadoon (Fig. 17.1.1). The lake lies at the head of a long, shallow tidal inlet impounded by the formation of a dune barrier. The dunes are transgressive and the lake has been considerably reduced in size since the early maps were drawn due to infilling of the lake and the onshore movement of the dunes. The bed of the lake is sand, with silt and peat at the eastern landward end where a reedbed of *Phragmites* has formed. A freshwater stream enters the lake at the eastern end which drains from high land to the east.

Part of the area at present occupied by the lake may have been cut for peat. Some areas in the surrounding land have been cut in the past and are still cut at present on a small scale.

Praeger (1934) described the area as "utterly windswept" but "would well repay further study". A report for the Netherlands Commission for International Nature Protection describes the area as unique for Europe and Eire as a landscape, geologically, geomorphologically and botanically (Westermann & Westhoff, 1974). The National Coastline study regarded Corragaun within an exceptional landscape, warranting declaration as a "National Park" or similar (see Roonah Lough, 2.18).

Instability of the dunes and exposure to strong winds from the Atlantic cause the landforms of the area to be highly dynamic. Bekkers *et al.* (1976) state that the Ordnance survey map of 1839 differs strikingly from that of 1919, the latter showing lakes and dunes previously non-existent. Corragaun also changed shape between 1919 and 1976 (Bekkers *et al.* 1976) and according to local information has been reduced in size considerably over the last 20 years.

The lake is part of the large proposed NHA which includes the Mweelrea Mountains (Site Code No. 1932).

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6°C in January and 14.5-15.0 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 2000 mm, and the number of rain days (1 mm or

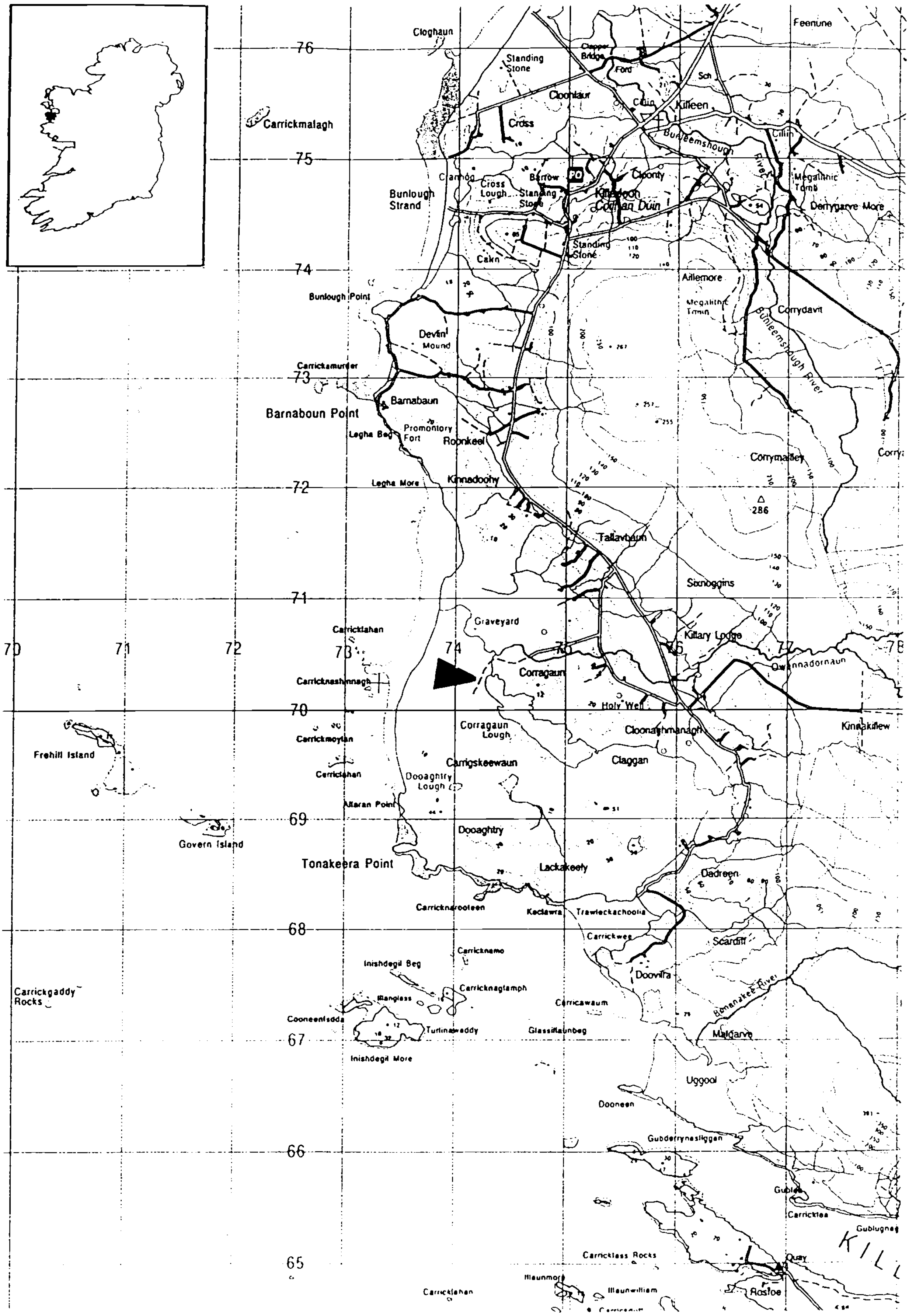

Fig. 17.1.1 Section of 1:50 000 map showing locality of Corragaun Lough

more) is approximately 200. Winds are mainly from the southwest. Mean annual hourly wind speeds are between 6 and 7 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and sea temperatures are lowest in February and highest in August.

Landscape and Geology Bedrock is Ordovician, mica-schist, gneiss and quartzite. Soils other than peat are mostly peaty gleys. Inland the steep slopes with shallow soils are of extremely limited land use capability (Royal Irish Academy, 1979). Land surrounding the lough consists of small irregular fields of semi-improved pasture, bare rock, peatbogs and wet heathland with machair, saltmarsh and sand-dunes along the coast..

Lake Topography The lagoon at present is approximately 400 m from northwest to southeast, 200 m across and covers about 7 ha. Water depth is 20-70 cm over most of the lake with slightly deeper water in the main channel draining from the lake. The bed of the lake is mostly composed of sand with more silt and unconsolidated peat at the eastern end where the river enters. The lake is bordered by rock in several places and by low cliffs of peat along the northern shoreline. Sandbanks have formed at the outlet to the lake.

Hydrology A small river enters the lake in the southeast and undoubtedly freshwater also enters through the slow release of groundwater from the saturated peat higher in the valley and also in direct rainfall. Seawater appears to enter on most tides, through a long sinuous channel. A tidal variation in water level is noticeable in the outlet channel but is less noticeable in the main body of the lake.

Salinity and water quality Despite the fact that seawater appears to enter on every tide the lake is also likely to receive large volumes of freshwater runoff from the surrounding land. Salinity levels may vary considerably, both spatially and temporally, depending on precipitation and tides. The peaty soils of the surrounding land would affect the delivery time of both surface- and ground-water flows to the lake through absorption and slow release of water. The prolonged flow of freshwater to the lake during the "dry" months may result in lower salinities than might be expected. On the other hand, winter storms may result in a higher volume of seawater entering the lake and raising salinity levels at a time when they might be expected to fall.

Stratification is not likely to occur at any period of the year due to the shallow nature of the lake and regular flushing.

The surrounding land is relatively natural and even grazing land is likely to receive only limited fertilizer applications. However, a deep layer of organic silt and unconsolidated peat has accumulated in the area where the river enters and this may indicate erosion higher in the catchment.

17.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

17.2.1 Methods

Environmental variables

Water depths were measured from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰ precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations C and D in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of

the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (eg *Jaera*, hydrobiids).

17.2.1 Results

Corragaun Lough was sampled on 12.vi.96 during the first part of the survey, and from 17-19.ix.96 during the more intensive survey.

Six sampling stations were selected in the lake to reflect the influences of substrate, and freshwater/seawater inflows. Fig.17.2.1 shows the position of these sampling stations in the lagoon.

Environmental Variables

Station A (OS 7469 6982) was located in the bay between the southern shoreline and the sandbank at the mouth of the outlet (Plate 17.2.2). Water depth varied from 0 - 30 cm, substrate was sand and salinity measured 25‰ in September and 0-1‰ in June.

Station B (OS 7465 7049) was located on the north side of the outlet channel in a bay surrounded by low peat cliffs on three sides and rock to the east. Substrate consisted of rock, solid peat and a mixture of fine sand, silt and unconsolidated peat. Water depth varied from 0 - 25 cm and salinity measured 32‰.

Station C (OS 7499 6973) was located on the shore of a rock outcrop in the central, narrow part of the lake. Substrate was solid rock and sand. Water depth varied from 0 - 1 m in the channel running past the rock and salinity measured 32‰.

Station D (OS 7523 6982) was located in the northwest corner of the lake, among *Phragmites,* in the main area of freshwater influence (Plate 17.2.4). Depth varied from 0 - 25 cms, substrate was fine sand and silt over peat and salinity measured 16 - 25‰.

Station E (OS 7506 6963) was located in the southwest corner near an area of recently cut *Phragmites* (Plate 17.2.2 & 4) Water depth varied from 0 - 25 cms, substrate consisted of soft anoxic mud and peat and salinity measured 28‰.

Station F (OS 7482 6965?) was located along the southern shoreline on a stony beach. Substrate consisted of bedrock, stones of various sizes and pockets of fine silt and sand. Water depth varied from 0 - 25 cms and salinity measured 32 ‰..

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 17.2.1. Among 20 taxa listed, 17 are identified to species. The list comprises 2 marine species, 4 poly-mesohaline, 10 euryhaline, and 1 oligohaline species (Table

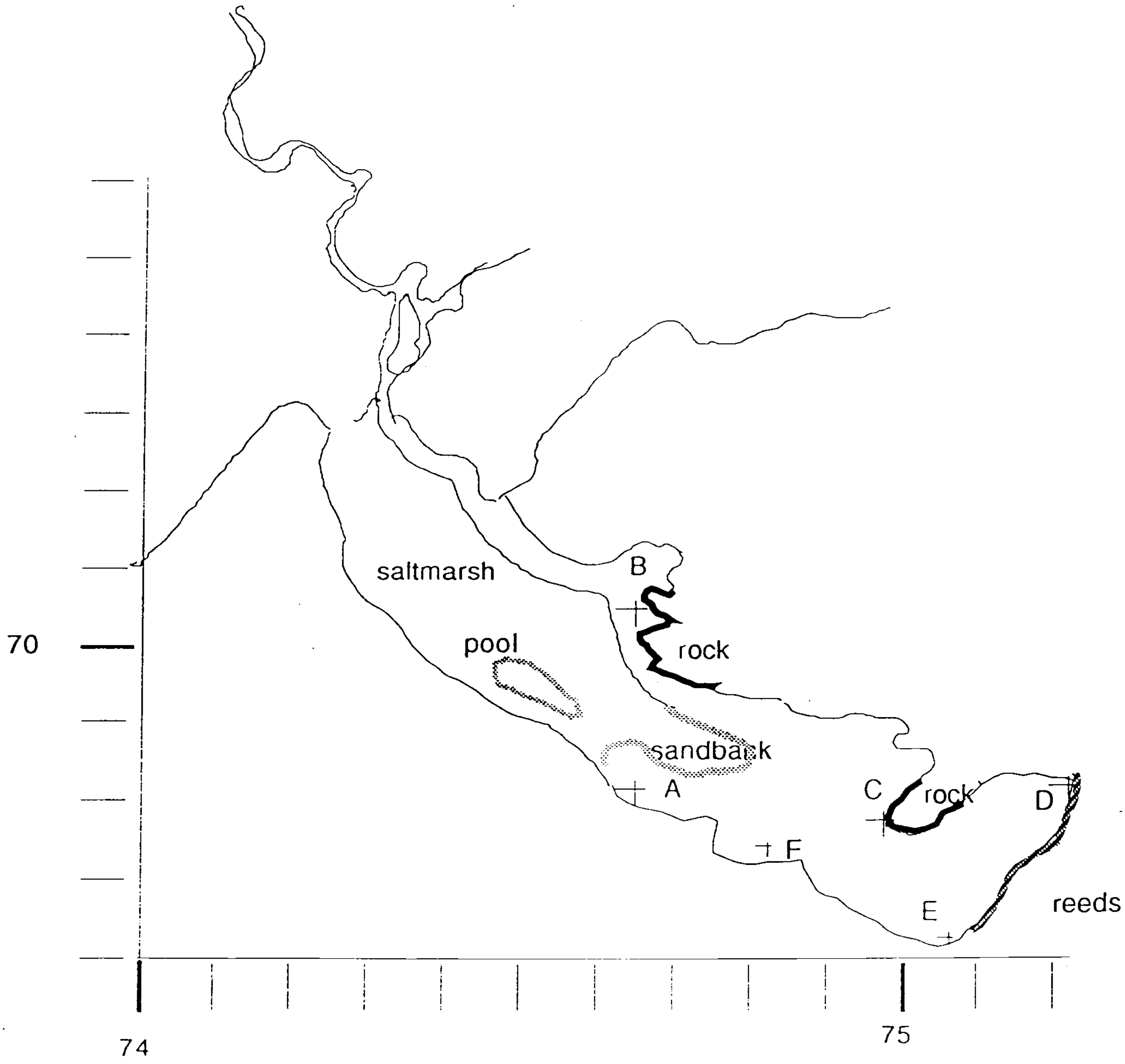

Fig. 17.2.1 Location Map of Sampling Stations in Corragaun Lough, Co. Mayo.

Table 17.2.1. Fauna Recorded in Corragaun Lough, Co. Mayo. June and September, 1996.
( ) = records from June.

Fauna		Sampling Stations	(L.T. = light-trap)								
		A	B	L.T.B	C	L.T.C	D	L.T.D	E	F	L.T.F
Porifera											
Cnidaria											
Turbellaria											
Nemertea											
Annelida	*Arenicola marina*	+									
Crustacea											
Ostracoda											
Copepoda											
Cirripedia											
Mysidacea	*Neomysis integer*	a	c	350	a	500	a	300	c	o	150
Isopoda	*Eurydice pulchra*			1							
	Jaera nordmanni				+					+	
Amphipoda	*Corophium volutator*	c					o				
	Gammarus duebeni		+							+	
	G. zaddachi	+	+		+	+	+		+	+	+
	Orchestia gammarella				+						
Tanaidacea											
Decapoda	*Crangon crangon*	c	c	3	c	5				o	
	Carcinus maenas	+	+		+		+		+	+	+
	Palaemon serratus		o		o						
	Palaemonetes varians				o						
Arachnida											
Insecta											
Thysanura											
Ephemeroptera											
Odonata											
Plecoptera											
Trichoptera											
Hemiptera	Corixidae						c	10	+	+	+
	Sigara stagnalis						+	+	+	+	+
Coleoptera					(+)						
Diptera	Chironomidae				+		+		+	+	
	Tipulidae	o									
Mollusca											
Prosobranchia	*Potamopyrgus antipodarum*				+		+		+		
Opisthobranchia											
Pulmonata											
Bivalvia	*Mya arenaria*	shells	shells								
	Scrobicularia plana	shells	shells								
Bryozoa											
Echinodermata											
Tunicata											
Teleostei	*Anguilla anguilla*		+		F, 31		F, 1			+	1
	Gasterosteus aculeatus	+	a	73	a	52	a	85	o	a	
	Mugilidae				F, 4		F, 1				
	Platichthys flesus	+	+		F, 1		+		+	+	

+ = present; o = occasional; c = common; a = abundant; F = fyke net

17.2.2). Two of the species are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Species distribution can be correlated with both salinity and habitat. Marine or poly-mesohaline species were mostly present in the seaward sector of the lake (*Arenicola, Eurydice, Palaemon serratus*) while corixids were found in the mid and landward sectors. The cryptic species *Jaera nordmanni* occurred only at C and F where there were stones.

Table 17.2.2 Ecological categories of the recorded taxa in Corragaun Lough (excluding marginal species). L = lagoonal specialist according to Davidson *et al.* (1991)

Marine	*Eurydice pulchra*	
	Palaemon serratus	
Poly-mesohaline	*Arenicola marina*	
	Corophium volutator	
	Crangon crangon	
	Mugilidae	
Euryhaline	*Neomysis integer*	
	Jaera nordmanni	
	Gammarus duebeni	
	Gammarus zaddachi	
	Palaemonetes varians	L
	Carcinus maenas	
	Sigara stagnalis	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Platichthys flesus	
Oligo-mesohaline	*Potamopyrgus antipodarum*	
Limnic	None	

17.2.3 Discussion

The fauna was rather poor in spite of open contact with the sea and a gradient in species occurrence from the sea - inland. The explanation may be the wide fluctuations in salinity which occur. On 16 June 1996, the salinity throughout the lake was only 0-1‰ compared with 16-32‰ during sampling in September. Variations of this magnitude, especially if changes are sudden, would not be tolerated by the more sensitive species. The presence of shells of *Mya arenaria* and *Scrobicularia plana,* both estuarine species, suggests that conditions may have been different in the past.

None of the species identified is of special interest or can be described as rare in Ireland.

17.2.4 Threats

The whole coastline in this area is highly dynamic. Corragaun Lough has changed shape considerably in the past century and has, according to local information, been notably reduced in size. The reduction is size is believed to be mainly attributable to the deposition of sand from the dunes and beach. Additionally, the sediment and nutrient loading of the river may have increased.

Farming in the catchment area. could be contributing higher levels of nutrients to the system, especially by way of the small river. This is suggested by the large amount of *Cladophora* in the lake.

Phragmites appears to have been cut in one area.

17.2.5 Evaluation

Corragaun Lough is a completely **natural sedimentary lagoon** with a natural tidal inlet and is therefore a site of international importance based on geomorphology alone.

It lies in an area of coastline subject to dynamic changes in sedimentation patterns. It is one of a number of lagoons, and "former lagoons" on the south Mayo coast which vary in their geomorphology and degree of marine influence. Some are entirely fresh, others saline, while barriers may be of sand or cobbles, or both. Corragaun Lough is the only one of this series with a permanent tidal inlet through which the sea enters at each high tide.

The post-glacial history of parts of this coastline has been studied in detail and continues to be of great interest to geomorphologists.

The coastal lagoons of this area are of botanical and ornithological value.

Corragaun Lough undergoes wide fluctuations in salinity which limit faunal diversity. Relatively few species of aquatic fauna were present and none was interesting or rare.

The lake is part of a proposed NHA (Site Code No. 1932).

The lake has little conservation on its own on the basis of aquatic fauna but as one of a series it sheds light on the history and geomorphological processes of this section of the coastline. It is recommended that the complete series of lakes, from L. Polimore in the north to L. Doovilra in the south be designated as a proposed SAC.

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Plate 17.2.3 View of northern shoreline of Corragaun Lough showing low peat cliffs and stranded mats of *Cladophora.*

Plate 2.17.4 View of the eastern area of Corragaun Lough, Stations D (left) and E (right)

Plate 17.2.1 View of Corragaun Lough looking west toward the dune system.

Plate 17.2.2 View of Corragaun Lough, looking east to the Mweelrea Mountains.
Station A on the right, E in the distance.

17. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

17.3.1 Site Description (Fig. 17.3.1)

This fairly small, sandy lagoon lies in a narrow valley of heath, grassland and frequent rock outcrops. Grazed Nardus stricta grassland borders the site to the north and east, wet Molinia caerulea grassland, flushes and heathy outcrops to the south and saltmarsh on low-lying sandy ground to the west. A narrow band of hazel scrub runs across part of the southern slopes.

Most of the shore is either low peat cliff or exposed bedrock with marginal areas typically narrow. Swamp vegetation occurs at the eastern end of the lough, where it is associated with the main freshwater inflow and at one part of the north central shore where a smaller inflow emerges.

The saltmarsh at the western end also borders the outlet to the sea, which joins the lough here.

17.3.2 Methods

Two survey methods were employed in the course of fieldwork:
1. Transects
2. Shore-based survey

1. <u>Transects</u>

The locality of these is shown in Fig. 17.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

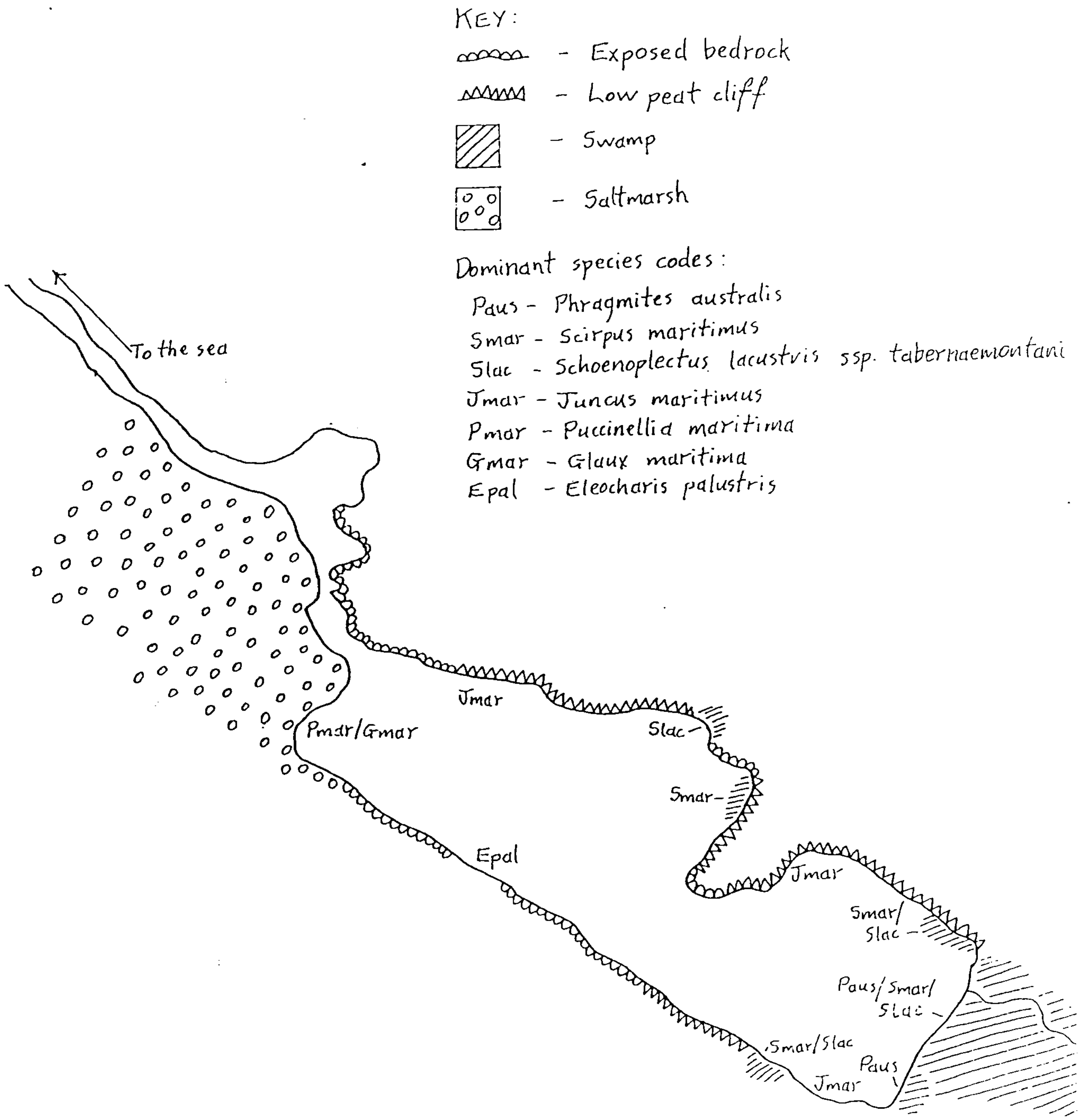

Fig. 17.3.1 Corragaun Lough, Co. Mayo - Marginal Vegetation

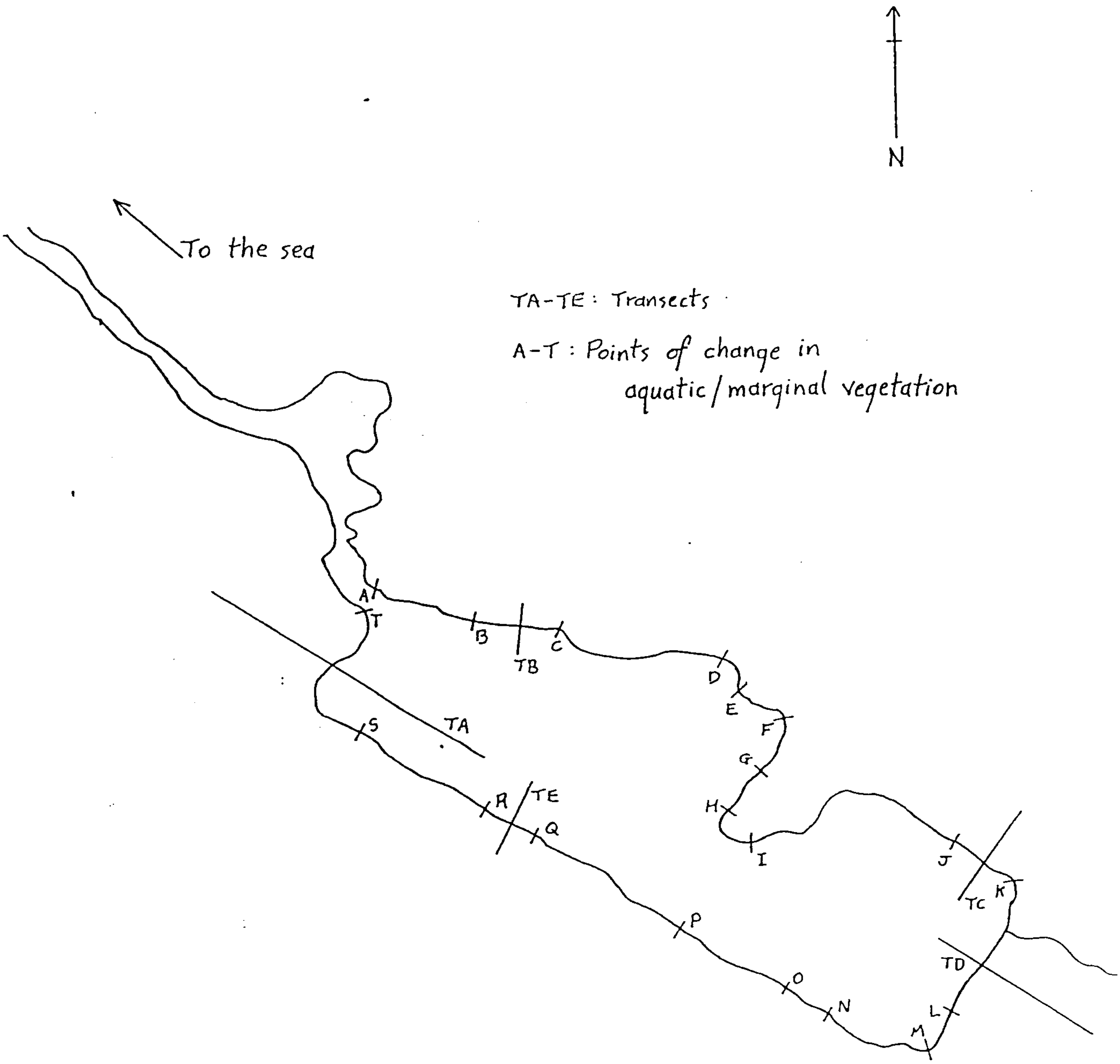

Fig. 17.3.2 Corragaun Lough, Co. Mayo: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values
Frequency of each species within the total number of samples is expressed as follows:

Frequency V	81-100 %
IV	61-80 %
III	41-60 %
II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

17.3.3 Results

1 Shore-based survey

Section A-B

Aquatic: Enteromorpha only - sparse
Sand substrate

Marginal: Exposed bedrock with crustose lichens
Occasional peat cliff - average height 40cm - with Juncus maritimus patches

Adjacent: Nardus stricta grassland - grazed

Section B-C (Transect B)

Aquatic: Ruppia c.f. maritima - low growing - patchy cover
Enteromorpha - free floating - sparse
Filamentous algae - free floating - sparse

Marginal: Peat cliff - average height 1m

Adjacent: Juncus maritimus - Festuca rubra - Agrostis stolonifera community with salt tolerant species. 30-40m
Backing Nardus stricta grassland as A-B

Section C-D

Aquatic: Unchanged

Marginal: Peat cliff - average height 50cm

Adjacent: Nardus stricta grassland as A-B

Section D-E

Aquatic: Unchanged

Marginal: Schoenoplectus lacustris ssp tabernaemontani swamp with occasional Scirpus maritimus and Phragmites shoots. 15m
Backing Puccinellia maritima dominated saltmarsh to c.30m

Adjacent: Unchanged

Section E-F

Aquatic: Unchanged

Marginal: Exposed bedrock with crustose lichens

Adjacent: Unchanged

Section F-G

Aquatic: Unchanged

Marginal: Scirpus maritimus swamp with occasional Schoenoplectus lacustris ssp tabernaemontani and Phragmites shoots. c.20m
Backing peat cliff - average height 50cm

Adjacent: Backing Juncus maritimus - Festuca rubra - Agrostis stolonifera community on promontory
Grading to Nardus stricta grassland as before

Section G-H

Aquatic: Unchanged

Marginal: Peat cliff - average height 1m

Adjacent: Backing Juncus maritimus community as before
Grading to Nardus stricta grassland as before

Section H-I

Aquatic: Unchanged

Marginal: Exposed bedrock with crustose lichens

Adjacent: Calluna vulgaris - Erica cinerea dominated heath on rocky outcrop
Backing Juncus maritimus community as before
Grading to Nardus stricta grassland as before

Section I-J

Aquatic: Unchanged

Marginal: Peat cliff - average height 50cm

Adjacent: Juncus maritimus community as before
Grading to Nardus stricta grassland as before

Section J-K (Transect C)

Aquatic: Unchanged

Marginal: Swamp vegetation with Scirpus maritimus and Schoenoplectus lacustris ssp tabernaemontani each locally dominant with occasional Phragmites shoots. c.30m
Backing peat cliff - average height 40cm

Adjacent: Unchanged

Section K-L (Transect D)

Aquatic: Unchanged

Marginal: Phragmites australis single species swamp. c.50m
Grading to Scirpus maritimus dominated swamp with frequent Phragmites. c.100m
Grading to Schoenoplectus lacustris ssp tabernaemontani swamp with frequent Scirpus maritimus and Phragmites. c.20m

Adjacent: Molinia caerulea dominated flush vegetation with frequent Myrica gale, Potentilla erecta, Ranunculus acris.
Grading to Nardus stricta grassland as before

Section L-M

Aquatic: Unchanged

Marginal: Phragmites australis single species swamp. c.30m

Adjacent: Agrostis stolonifera - Festuca rubra - Plantago coronopus grassland
Grading to Nardus stricta grassland as before

Section M-N

Aquatic: Enteromorpha
Filamentous algae

Marginal: Juncus maritimus community as before. c.20m

Adjacent: Nardus stricta grassland as before

Section N-O

Aquatic: Unchanged

Marginal: Swamp with Scirpus maritimus and Schoenoplectus lacustris ssp tabernaemontani
each locally dominant. 5-20m

Adjacent: Unchanged

Section O-P

Aquatic: Unchanged

Marginal: Peat cliff c.70cm

Adjacent: Juncus maritimus community. 1-2m
Grading to flush vegetation dominated by Molinia caerulea with frequent Myrica gale, Schoenus nigricans, Potentilla erecta, Succissa pratensis, Narthecium ossifragum

Section P-Q

Aquatic: Ruppia c.f. maritima
Enteromorpha
Filamentous algae

Marginal: Exposed bedrock with crustose lichens

Adjacent: Flush vegetation as O-P with occasional patches of Calluna vulgaris dominated
heath on drier ground. 30-50m
Backing Corylus avellana scrub. c.50m

Section Q-R (Transect E)

Aquatic: Unchanged

Marginal: Open Eleocharis palustris dominated community with salt tolerant species on
stony shore. 4m

Adjacent: Unchanged

Section R-S

As P-Q

Section S-T (Transect A)

Aquatic: Unchanged

Marginal: Saltmarsh dominated by Puccinellia maritima and Glaux maritima. c.500m

Adjacent: Ammophila arenaria dune grassland (barrier)

2. Transects

Site: Corragaun Lough	Transect code: A	
Location: Saltmarsh bordering outlet to sea	Sample point: 1 Aquatic - 150m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 40 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		50
Higher Plant		40
Ruppia c.f. maritima	6	40
Algae		10
Enteromorpha		10
Description: Low growing Ruppia dominant with frequent free-floating Enteromorpha. Same species at more or less constant cover from 60m - 150m out.		

Site: Corragaun Lough	Transect code: A	
Location: Saltmarsh bordering outlet to sea	Sample point: 2 Aquatic - 50m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 20 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		50
Higher Plant		5
Ruppia c.f. maritima	6	5
Algae		45
Enteromorpha		45
Description: Enteromorpha dominant. Low growing Ruppia now sparse. More or less unchanging 40m - 60m out.		

Site: Corragaun Lough	Transect code: A	
Location: Saltmarsh bordering outlet to sea	Sample point: 3 Aquatic - 25m out	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 10 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		90
Enteromorpha		90
Description: Dense cover of free-floating Enteromorpha. More or less same cover 0 - 40m out.		

Site: Corragaun Lough	Transect code: A	
Location: Saltmarsh bordering outlet to sea	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		20
Puccinellia maritima	3	10
Glaux maritima	3	10
Description: Open patchy cover of Puccinellia and Glaux on sandflat. c.100m		

Site: Corragaun Lough	Transect code: A	
Location: Saltmarsh bordering outlet to sea	Sample point: 5 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		50
Puccinellia maritima	3	20
Glaux maritima	4	20
Agrostis stolonifera	6	5
Plantago coronopus	4	5
Plantago maritima	5	< 1
Description: Puccinellia - Glaux dominated species-poor saltmarsh vegetation. c.400m.		
Cover increasing to landward. Grading to Ammophila arenaria dune grassland (barrier).		

Site: Corragaun Lough	Transect code: B	
Location: Peat cliff shore	Sample point: 1 Aquatic - 20m out	
Sample area: 16m2 (4x4)	Substrate: Sandy and silt	
Depth: 20 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		50
Higher Plant		40
Ruppia c.f. maritima	6	40
Algae		10
Enteromorpha		10
Description: Low growing Ruppia dominant. Some plants in flower and fruit. Enteromorpha		
free-floating only.		

Site: Corragaun Lough	Transect code: B	
Location: Peat cliff shore	Sample point: 2 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Sand, cobbles	
Depth: 20 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		95
Filamentous algae		70
Enteromorpha	15	30
Substrate		
Sand		90
Cobbles		10
Description: Filamentous algae dominant with Enteromorpha confined to scattered cobbles.		
No higher plant species.		
Backing 60cm peat cliff.		

Site: Corragaun Lough	Transect code: B	
Location: Peat cliff shore	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	70	90
Festuca rubra	30	50
Agrostis stolonifera	30	40
Leontodon autumnalis	15	5
Glaux maritima	10	< 1
Cochlearia anglica	4	< 1
Description: Dense cover of Juncus maritimus tussocks with Agrostis stolonifera and Festuca		
rubra co-dominant in species-poor salt-tolerant community. 40m.		
Grading to Nardus stricta grassland with frequent rock outcrops. Grazed.		

Site: Corragaun Lough	Transect code: C	
Location: Marginal swamp	Sample point: 1 Aquatic - 1m out - grapnel	
Sample area: Grapnel only	Substrate: Peaty silt	
Depth: 40 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia c.f. maritima		
Enteromorpha		
Filamentous algae		
Description:		

Site: Corragaun Lough	Transect code: C	
Location: Marginak swamp	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peaty silt	
Depth: 30 - 40 cm	Salinity: 0 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		65
Schoenoplectus lacustris ssp tabernaemontani	100	60
Phragmites australis	80	5
Description: Open Schoenoplectus lacustris swamp with sparse Phragmites shoots. 10m.		

Site: Corragaun Lough	Transect code: C	
Location: Marginal swamp	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peaty silt	
Depth: 10 - 30 cm	Salinity: 0 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Scirpus maritimus	70	100
Phragmites australis	80	< 1
Description: Dense Scirpus maritimus swamp with sparse Phragmites shoots. 16m.		
Backing 40cm peat cliff.		

Site: Corragaun Lough	Transect code: C	
Location: Marginal swamps	Sample point: 4 Marginal	
Sample area: 16m2 (4x4)	Substrate: Peat	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus maritimus	120	75
Festuca rubra	30	50
Agrostis stolonifera	30	30
Leontodon autumnalis	20	< 5
Glaux maritima	15	< 5
Cochlearia anglica	6	< 1
Triglochin maritima	15	< 1
Samolus valerandi	15	< 1
Plantago lanceolata	15	< 1
Hydrocotyle vulgaris	3	< 1
Description: Tall, fairly dense cover of Juncus maritimus with Festuca rubra and Agrostis		
stolonifera co-dominant. 70m.		
Grading to Nardus stricta grassland with frequent rock outcrops. Grazed.		

Site: Corragaun Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 1 Aquatic - 1m out - grapnel	
Sample area: Grapnel only	Substrate: Peaty silt	
Depth: 60 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia c.f. maritima		
Enteromorpha		
Filamentous algae		
Description:		

Site: Corragaun Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 50 cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		70
Phragmites australis	180	70
Description: Fairly dense single species Phragmites swamp. 60m.		

Site: Corragaun Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		95
Scirpus maritimus	70	75
Phragmites australis	100	20
Agrostis stolonifera	30	40
Festuca rubra	30	25
Cochlearia anglica	10	< 5
Leontodon autumnalis	20	< 1
Glaux maritima	15	< 1
Samolus valerandi	15	< 1
Bare peat		10
Description: Scirpus maritimus dominant amongst open, low growing Phragmites cover with open ground cover of salt tolerant species dominated by Agrostis stolonifera and Festuca rubra. 30m.		

Site: Corragaun Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 15 cm	Salinity: 0 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		95
Scirpus maritimus	80	90
Phragmites australis	100	5
Agrostis stolonifera	30	< 1
Description: Fairly dense Scirpus maritimus swamp with low growing, sparse Phragmites cover. 80m.		

Site: Corragaun Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 5 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 10 cm	Salinity: 0 parts per thousand	
NVC community: S20 Shoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-comunity		
	Height (cm)	Cover (%)
Total Plant		95
Schoenoplectus lacustris ssp tabernaemontani	100	50
Scirpus maritimus	50	10
Phragmites australis	80	5
Agrostis stolonifera	30	60
Glaux maritima	15	< 1
Description: Open low growing swamp vegetation with Schoenoplectus dominant amongst		
the tall emergents and Agrostis stolonifera forming a fairly open mat below. 20m.		

Site: Corragaun Lough	Transect code: D	
Location: Freshwater inflow	Sample point: 6 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Molinia caerulea	100	90
Myrica gale	40	5
Potentilla erecta	15	< 5
Ranunculus acris	15	< 5
Iris psuedacorus	130	< 1
Angelica sylvestris	100	< 1
Filipendula ulmaria	40	< 1
Mentha aquatica	30	< 1
Galium palustre	15	< 1
Description: Dense cover of Molinia tussocks with sparse freshwater flush vegetation. c.100m		
Grading to Nardus stricta grassland with frequent rock outcrops. Grazed.		

Site: Corragaun Lough	Transect code: E	
Location: Open shore	Sample point: 1 Aquatic - 70m out - grapnel	
Sample area: Grapnel only	Substrate: Silt and sand	
Depth: 40 cm +	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia c.f. maritima		
Enteromorpha		
Description:		

Site: Corragaun Lough	Transect code: E	
Location: Open shore	Sample point: 2 Aquatic - 50m out	
Sample area: 16m2 (4x4)	Substrate: Silt and sand	
Depth: 30 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		95
Enteromorpha		95
Description: Dense cover of Enteromorpha only. Same species at more or less same cover		
20 - 70m out.		

Site: Corragaun Lough	Transect code: E	
Location: Open shore	Sample point: 3 Aquatic - 15m out	
Sample area: 16m2 (4x4)	Substrate: Silt and sand	
Depth: 30 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		40
Higher Plant		20
Ruppia c.f. maritima	6	20
Algae		20
Enteromorpha	20	20
Description: Low -growing Ruppia co-dominant with Enteromorpha. Same species at more or less same cover 8 - 20m out.		

Site: Corragaun Lough	Transect code: E	
Location: Open shore	Sample point: 4 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Silt and sand	
Depth: 0 - 15 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Enteromorpha	15	100
Description: Dense Enteromorpha only. 0 - 8m out.		

Site: Corragaun Lough	Transect code: E	
Location: Open shore	Sample point: 5 Marginal	
Sample area: 16m2 (4x4)	Substrate: Gravel, cobbles, boulders	
Depth: 0 cm	Salinity: -----	
NVC community: S19 Eleocharis palustris swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		20
Eleocharis palustris	20	5
Puccinellia maritima	10	5
Agrostis stolonifera	10	5
Glaux maritima	8	5
Spergularia marina	5	< 1
Triglochin palustris	8	< 1
Plantago coronopus	5	< 1
Plantago maritimus	8	< 1
Cochlearia anglica	6	< 1
Isolepes cernua	6	< 1
Bare substrate		80
Gravel		70
Cobbles		10
Boulders		< 1
Description: Sparse shore community dominated by Eleocharis, Puccinellia and Agrostis stolonifera. 4m.		
Backing 45 degree slope with wet heath vegetation dominated by Schoenus nigricans, Molinia caerulea, Calluna vulgaris, Potentilla erecta with Erica tetralix, Succisa pratensis, Narthecium ossifragum, Myrica gale.		

17.3.4 Evaluation

'Potentially Valuable'

This is a small sandy lagoon of low salinity (0-4 parts per thousand) at time of survey.

Ruppia c.f. maritima was the only aquatic macrophyte recorded during this survey. It has a wide distribution around the site at sparse to patchy cover and is low-growing.

Filamentous algae and Enteromorpha were the only other aquatic plants found during this survey.

Diversity of marginal communities is notable here. Scirpus maritimus, Schoenoplectus lacustris ssp tabernaemontani and Phragmites swamps occur west of the rocky promontory on the north shore and more extensively at the eastern end of the lough, associated with the major freshwater inflow.

Juncus maritimus dominated salt tolerant community occurs above low peat cliff along much of the northern shore. Exposed bedrock forms most of the southern shore with one open stony area of Eleocharis palustris dominated salt tolerant vegetation. Puccinellia maritima - Glaux maritima saltmarsh borders the lagoon on its low, sandy western shore.

This would seem to be a particularly species-poor lagoon but deeper areas of the eastern and central areas were not surveyed and could contain additional species.

Full aquatic survey is recommended.

17.4 ECOTONAL COLEOPTERA

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17.4.1 Site Description

Coastal brackish lake with sandflats and inlet channel crossed by narrow disued artificial cobble trackway, with seawater incursion into lake at least at spring tide. Lake shore with boulders, cobbles, medium-textured sand and peat margins. Sheep pasture on peaty soil with rock outcrops surrounding lake. Stands of *Juncus maritimus* on deep peat with cliffs to sand; also mixed sand/organic pasture. Inflow river to lake with large watershed.

Subsites (see Fig. 17.4.1)

1. *Juncus maritimus* (L 748699)
Approx. 0.1 ha of *Juncus maritimus* on sandy peat, on c. 0.5 - 1.0 m cliff to standing water on sandflat. Dried pools in bare sandy peat with *Bledius* castings. Water salinity (neap part of tidal cycle, 13 viii 1996) offshore was 7‰.

2. Sandflat (L 748699)
Mostly anaerobic sandflat sheltered by outcropping rock near Subsite 1.

17.4.2 Methods

Site Rating using Indicator Species
Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

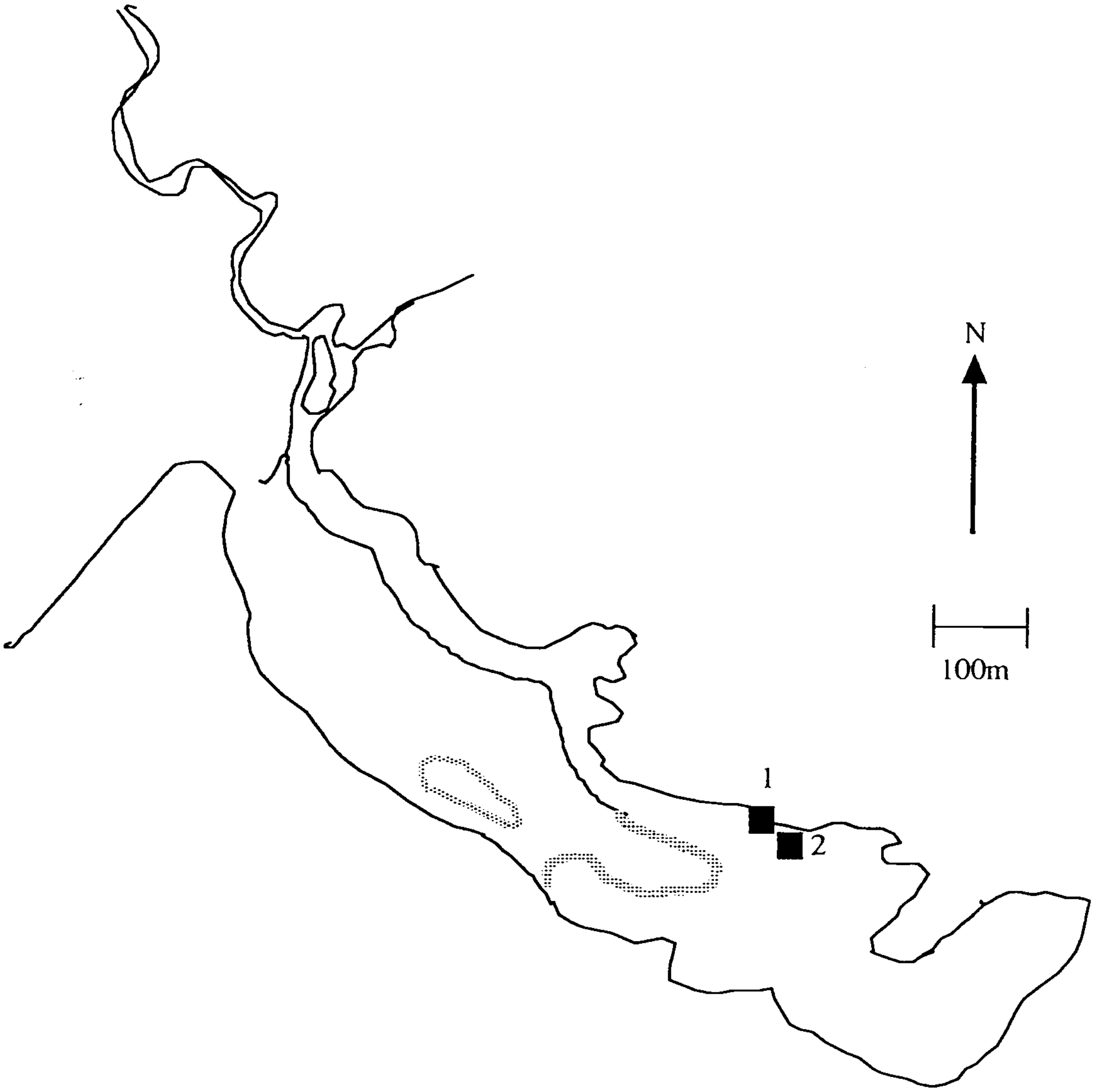

Fig. 17.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Corragaun Lough, Co. Mayo

1 - Pitfall traps, S-vac, Flotation
2 - Ground search

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 17.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 17.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques
Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References
Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Juncus maritimus* area - S-vac suction sampler (13 viii 1996), c. 2 m^2;
(2) *Juncus maritimus* area - 2 sets of 6 plastic pitfall traps with funnels and ethylene glycol preservative (13 viii - 27 ix 1996, 28 ix - 17 x 1996);
(3) *Juncus maritimus* area - Flotation samples of sandy peat dry pool (12 subsamples of 5 x 5 x 10 cm, 13 viii 1996);
(4) Sandflat - Flotation samples (12 subsamples of 5 x 5 x 10 cm, 13 viii 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; <u>and</u>, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

17.4.3 Results

Seven species of carabid, one species of heterocerid and fourteen species of staphylinid were recorded, none of which are regarded as indicator species (Table 17.4.2).

TABLE 17.4.2 Carabidae and Staphylinidae (Coleoptera) recorded from Corragaun Lough. Nomenclature follows Lucht (1987) and Lohse and Lucht (1989), with the exception of *Diglotta* which follows Good (in preparation).

Species	No. individuals
Carabidae	
Bembidion mannerheimi Sahlb.	1
Dyschirius politus (Dej.)	2
Leistus fulvibarbis Dej.	1
Loricera pilicornis (F.)	1
Nebria brevicollis (F.)	1
Notiophilus aquaticus (L.)	1
Pterostichus niger (Schall.)	2
Heteroceridae	
Heterocerus flexuosus Steph.	21
Staphylinidae	
Atheta vestita (Grav.)	14
Bledius fergussoni Joy	6
Bledius limicola Totth.	9
Carpelimus corticinus (Grav.)	1
Cryptobium fracticorne (Payk.)	1
Diglotta mersa (Hal.)	1
Drusilla canaliculata (F.)	1
Ocypus ater (Grav.)	7
Ocypus olens (Müll.)	1
Quedius molochinus (Grav.)	1
Sepedophilus nigripennis (Steph.)	5
Stenus nitidiusculus Steph.	1
Tachinus laticollis Grav.	1
Xantholinus longiventris Heer	3

17.4.4 Evaluation

Of no recorded conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional)

Scientific Argument for Rating

Indicator species were absent.

17.4.5 References

Lohse, G.A. and Lucht, W.H. (1989) *Die Käfer Mitteleuropas*. **12**. *1. Supplementband mit Katalogteil.* Goecke & Evers, Krefeld.

Lucht, W.H. (1987) *Die Käfer Mitteleuropas. Katalog*. Goecke & Evers, Krefeld.

17.5 SUMMARY AND EVALUATION

Corragaun Lough is a completely **natural sedimentary lagoon** with a natural tidal inlet and is therefore a site of international importance based on the Habitats Directive.

The lake lies within the large proposed NHA which includes the Mweelrea Mountains (Site 1932).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion

Geomorphology	Moderate
Aquatic Fauna	Low
Vegetation	Moderate/Potentially High
Ecotonal Coleoptera	None

Geomorphology

The lake is a small (7 ha), shallow, completely natural sedimentary lagoon with a long, sinuous tidal inlet in an area of coastline subject to dynamic changes in sedimentation patterns. Although the lake is defined as a lagoon, it could also be considered part of the tidal inlet. Seawater appears to enter on most tides through a long sinuous inlet and the lake water is subject to wide fluctuations in salinity.The locality of the inlet and the size of the lagoon have changed considerably in recent years.

Based on size and shape, and distance from the sea, the lake is rated as of moderate conservation value as a lagoon

Aquatic Fauna

The fauna was poor in spite of open contact with the sea and a gradient in salinity. Species poverty may be due to wide, and possibly sudden salinity fluctuations. Among 20 taxa recorded, only two were lagoonal specialists. The fauna was dominated by euryhaline and polyhaline species and no limnic species was recorded.

The fauna typified a lagoon subject to strong tidal influence with regular tidal scouring and no areas allowing low salinity species to survive. No interesting or rare species were recorded.

Based on the paucity of species and lagoonal specialists, the lagoon is rated as of low conservation value.

Vegetation

Ruppia c.f. *maritima* was the only aquatic macrophyte recorded. It was low growing and had a wide but patchy distribution. Filamentous algae and *Enteromorpha* were the only other aquatic plants found during this survey.

Diversity of marginal communities was notable. *Scirpus maritimus, Schoenoplectus lacustris* ssp. *tabernaemontani* and *Phragmites* swamps occurred on the north shore and more extensively associated with the major freshwater inflow.

Juncus maritimus dominated salt tolerant community occurred above low peat cliffs along much of the northern shore and there was one open stony area of *Eleocharis palustris* dominated salt tolerant vegetation. *Puccinellia maritima - Glaux maritima* saltmarsh bordered the lagoon on its low, sandy western shore.

This would seem to be a particularly species-poor lagoon but deeper areas of the eastern and central areas were not surveyed and could contain additional species. It is therefore rated as of moderate but potentially high conservation value.

A full aquatic survey is recommended.

Ecotonal Coleoptera

Seven species of carabid, one species of heterocerid and fourteen species of staphylinid were recorded, none of which are regarded as indicator species. The site is therefore of no recorded conservation interest for its terrestrial ecotonal community.

Summary

Corragaun Lough is a completely natural sedimentary lagoon with a long tidal inlet in an area of coastline containing a number of lagoons, and "former lagoons", on the south Mayo coast which vary in their geomorphology and degree of marine influence. Some are entirely fresh, others saline, while barriers may be of sand or cobbles, or both. Corragaun Lough is the only one of this series with a permanent tidal inlet through which the sea enters at each high tide.

The post-glacial history of parts of this coastline has been studied in detail and continues to be of great interest to geomorphologists.

The lough undergoes wide fluctuations in salinity and tidal scour which limit diversity of fauna and vegetation. The aquatic vegetation was species poor but there was a variety of marginal communities. The vegetation of the lake and its surrounds were surveyed in the 1970s.

The shores are of no conservation value for ecotonal Coleoptera.

Corragaun Lough has little conservation value for aquatic fauna and flora on its own but is of interest as the most marine of a series displaying a range of ecological conditions (see also Roonah L.). It is recommended that the complete series of lakes, from L. Polimore in the north to L. Doovilra in the south be designated as a proposed SAC and that further studies of the entire series be undertaken.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

18. ROONAH LOUGH

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Geoff Oliver
Pat Hatch
Jervis Good

February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

18. ROONAH LOUGH

CONTENTS

18. ROONAH LOUGH, Co. Mayo.

OS Grid Reference: L 755 765, 1:50,000 Sheet No. 37
Alternative names:

18.1 STUDY AREA

General features

Roonah Lough is situated on the west Mayo coast, 10 km north of Killary Harbour and 2 km from Killadoon (Fig. 18.1.1). The Carrowninsky river drains into the lagoon from the north and the smaller Bunleemshough river drains into it from the southeast. Water from the two rivers are impounded by a low cobble barrier through which a modified natural outlet runs. The lagoon is shallow and sandy away from the barrier and is bordered to the east by grassland and wet heath.

Part of the area at present occupied by the lake may have been cut for peat. Some areas in the surrounding land have been cut in the past and are still cut at present on a small scale.

The whole coastline from Killary harbour to Roonah Point consists of a complex and dynamic barrier system of dunes and cobbles with lagoons of various sizes and salinities. Praeger (1934) described the Dooaghtry area only 6 km to the south and really part of the same system as an area "utterly windswept" but which "would well repay further study". A report for the Netherlands Commission for International Nature Protection describes the Dooaghtry area as unique for Europe and Eire as a landscape, geologically, geomorphologically and botanically (Westermann & Westhoff, 1974). The National Coastline study regarded the area as an exceptional landscape, warranting declaration as a "National Park" or similar. (see Corragaun, Part 17).

Roonah is of additional interest as two rivers in which salmon spawn run through the lagoon and it also attracts small numbers of waterfowl and waders.

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 6°C in January and 14.5-15.0 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 2000 mm, and the number of rain days (1 mm or more) is approximately 200. Winds are mainly from the southwest. Mean annual hourly wind speeds are between 6 and 7 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum

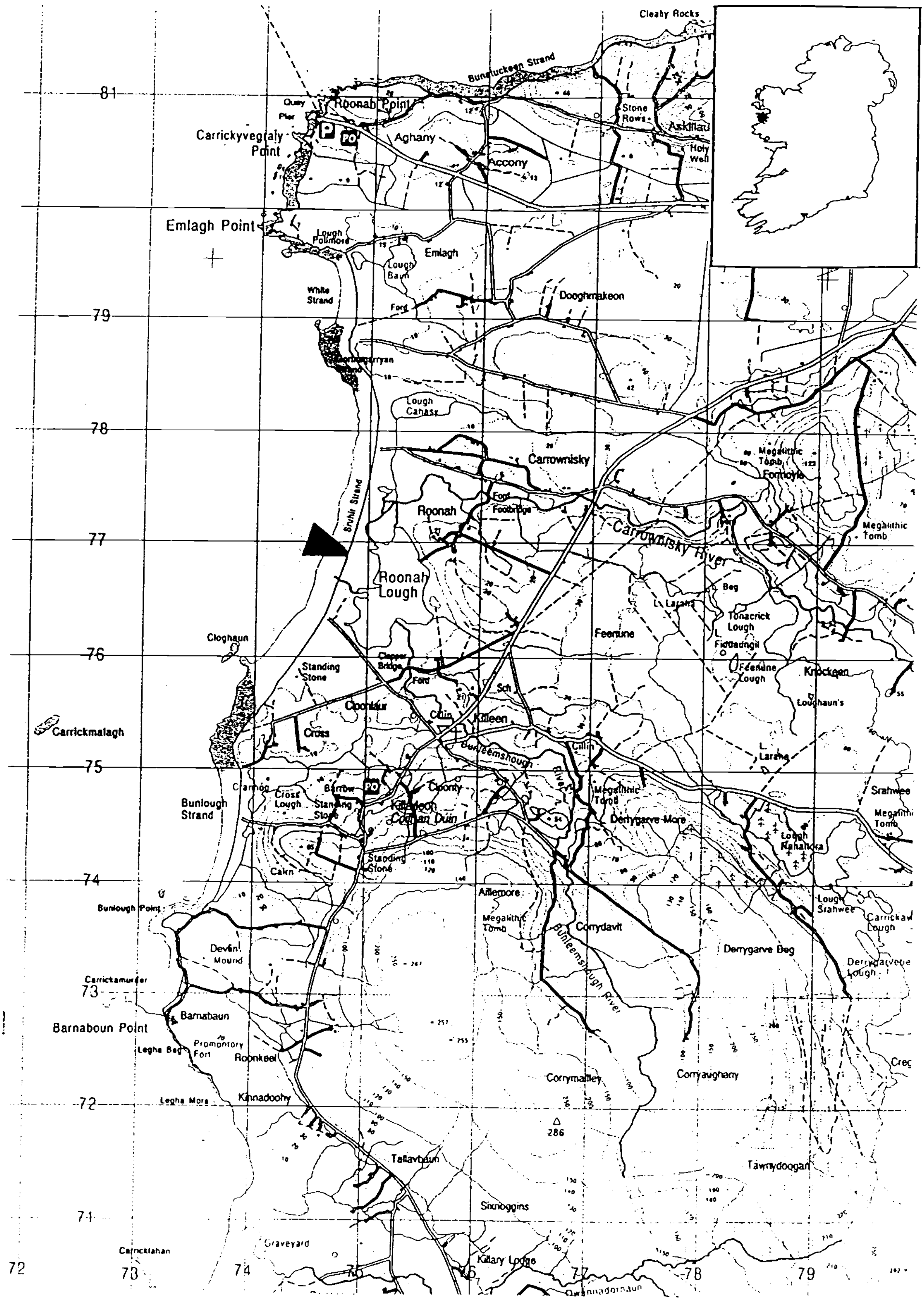

Fig. 18.1.1 Section of 1:50 000 map showing locality of Roonah Lough

wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and sea temperatures are lowest in February and highest in August.

Landscape and Geology Bedrock is Ordovician, mica-schist, gneiss and quartzite. Soils are mostly peaty gleys. Inland the steep slopes with shallow soils are of extremely limited land use capability (Royal Irish Academy, 1979). Land surrounding the lough consists of some quite large fields of improved pasture, together with smaller fields of wet grassland and heath.

Between Roonah and Cross Lough to the south, is an area of peat which was being cut in 1996.

Lake Topography The lagoon is approximately 1 km from southwest to northeast, 600 m across and covers about 50 ha. Water depth is 25-80 cm over most of the lake with slightly deeper water in the channels draining into and out of the lake. Two rivers enter the lake at the eastern end and run through the lake to the northwest. The bed of the lake is mostly composed of sand with more silt and unconsolidated peat at the eastern end where the river enters.

Hydrology The Carrowninsky River drains into the lagoon from the north and the smaller Bunleemshough River drains into it from the southeast. Water from the two rivers are impounded by a low cobble barrier through which a outlet runs which is natural, though relocated. A road now runs along the old channel and a new outlet has been formed. Seawater appears to enter the lake on spring tides only and what seawater does enter is soon flushed from the lagoon by the volume of fresh water entering from the rivers A tidal variation in water level is noticeable in the outlet channel but is less noticeable in the main body of the lake.

Salinity and water quality Despite the fact that seawater enters at regular intervals, the lake is also likely to receive large volumes of freshwater runoff from the surrounding land. Salinity levels may vary considerably, both spatially and temporally, depending on precipitation and tides. Generally salinity levels are likely to be relatively low throughout the year with a tendency to increase during the summer. However, the peaty soils of the surrounding land would affect the delivery time of both surface- and ground-water flows to the lake through absorption and slow release of water. The prolonged flow of freshwater to the lagoon during the "dry" months may result in lower salinities than might be expected. On the other hand, winter storms may result in a higher volume of seawater entering the lake and raising salinity levels at a time when they might be expected to fall.

Stratification is not likely to occur at any period of the year due to the shallow nature of the lake and regular flushing.

The coastal plain in this area appears to be quite intensively grazed and is likely to receive heavy fertilizer applications. However, flushing of the lagoon by both fresh- and seawater is likely to restrict any problems of eutrophication.

18.2 AQUATIC FAUNA

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18.2.1. Methods

Environmental variables

Water depths were measured from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1 ‰. precision). A photographic record was made of the site and local information sought concerning background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used near stations A and B in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by

inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available. Finally, some soft-bodied groups were particularly difficult to identify when preserved.

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

18.2.2 Results

Roonah Lough was sampled on the 14.vi.96 during the first part of the survey, and from 15-16.ix.96 during the more intensive survey.

Six sampling stations were selected in the lake to reflect the influences of substrate, and freshwater/seawater inflows. Fig. 18.2.1 shows the position of these sampling stations in the lagoon.

Environmental Variables

Station A (OS 7488 7644) was located on the western shoreline at the mouth of the outlet. Water depth varied from 0 - 1 m, substrate was mostly sand in the main channel with cobbles along the edges of the barrier. Salinity of the outflowing water measured 0 ‰

Station B (OS 7517 7623) was located on the southeast shore where the Bunleemshough River enters the lagoon. Substrate consisted of sand and fine organic silt, water depth varied from 0 - 60 cm and salinity measured 0 ‰

Station C (OS 7490 7629) was located on the southern shore, closest to the road from Killadoon where a drainage ditch enters the lagoon. Water depth varied from 0-60 cm, substrate was a mixture of peat, silt and small stones, salinity measured 0‰

Station D (OS 7551 7625) was located on the southeastern shore just north of the Bunleemshough river. Depth varied from 0 - 25 cms, substrate was fine sand and silt with occasional stones and salinity measured 0 ‰

Station E (OS 7539 7687) was located along the northeast shore where a track runs down to a stony beach. Substrate consisted of small stones, fine sand and silt. Cattle use this area and the ground was heavily poached and manured. Water depth varied from 0 - 10 cms and salinity measured 0 ‰.

Station F (OS 7527 7738) was located at the north end where the Carrowninsky river enters the lagoon. The river channel is deep at this point and only the edges of the channel were sampled. Water depth varied from 50 - 125 cms, substrate consisted of silty sand with patches of peat. Salinity measured 0 ‰.

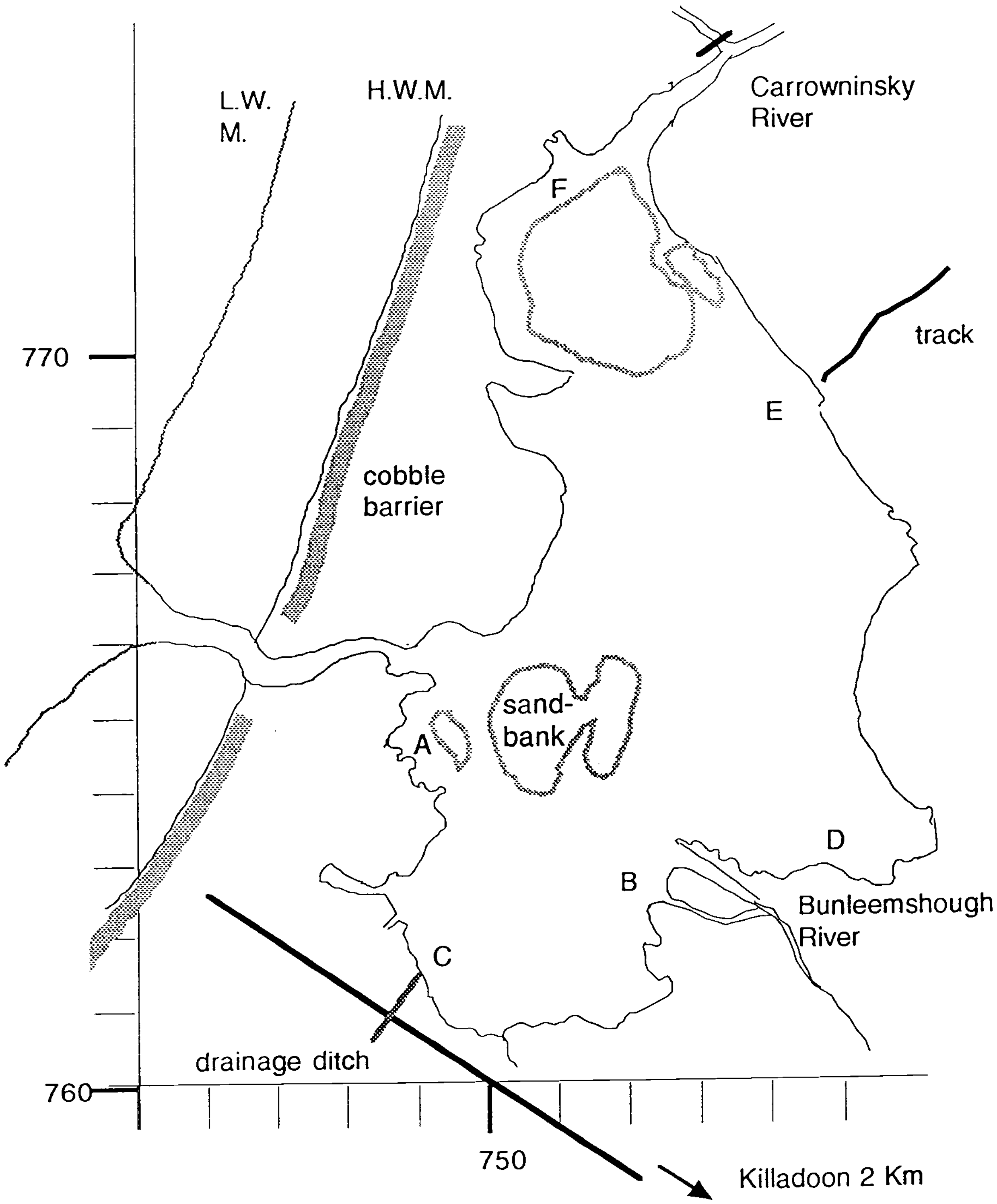

Fig 18.2.1 Location Map of Sampling Stations in Roonah Lough, Co. Mayo.

Table 18.2.1. Fauna Recorded at Roonah Lough, Co. Mayo. June and September 1996.
( ) = records from June.

Fauna		Sampling Stations (L.T. = light-trap)									
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	F
Porifera											
Cnidaria											
Turbellaria											
Nemertea											
Annelida	Hirudinea	(+)									
Crustacea											
Ostracoda											
Copepoda											
Cirripedia											
Mysidacea	*Neomysis integer*	a	2000	c	250	a	500	a	1000	o	
Isopoda											
Amphipoda	*Gammarus duebeni*	+				+					
Tanaidacea											
Decapoda	*Carcinus maenas*	+									
Arachnida											
Insecta											
Thysanura											
Ephemeroptera	*Cloeon simile*										+
Odonata	*Ischnura elegans*					+		+			c
Plecoptera		+									
Trichoptera	(cases)					c		+			
Hemiptera	Corixidae	+	+	+	1	c	+	c	50		c
	Cymatia bonsdorffi					+					
	Callicorixa praeusta										+
	Corixa panzeri					+					
	Sigara dorsalis	+	+	c		c	+	c	c		+
	S. semistriata			+							
	S. stagnalis			+							
Coleoptera		o		+		c		o	1	1	c
	**Agabus montanus*										
	**Elmis aenea*										
	Haliplus lineatocollis				+	+					
	H. wehnckei				+	+			+		
	**Hydroporus memnonius*										
	Laccobius minutus					+					
	Llybius fuliginosus							+			
	Nebrioporus depressus				+				+		
Diptera	Chironomidae	+		+		+		+		c	c
Mollusca											
Prosobranchia	Hydrobiidae	a		c	1	a	15	+	3	o	a
	Potamopyrgus antipodarum	+	+	+	+	+	+	+	+	+	+
Pulmonata	*Aplexa hypnorum*										+
	Lymnaea palustris										+
	L. peregra			+		+		+	4		a
	Planorbis leucostoma										+
	Sementina complanata										+

\+ = present; o = occasional; c = common; a = abundant; F = fyke net
* = Stations not known

Table 18.2.1. cont.. Fauna Recorded at Roonah Lough, Co. Mayo. June and September 1996.
( ) = records from June.

Fauna		Sampling Stations (L.T. = light-trap)									
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	F
Opisthobranchia											
Bivalvia	*Pisidium sp.*										shells
Bryozoa	*Plumatella repens*							+			
Echinodermata											
Tunicata											
Teleostei	*Anguilla anguilla*	+		+		+	1	+			
	Gasterosteus aculeatus	+	10	+	24	+	10	a	95		+
	Platichthys flesus	+		+		+		+			

+ = present; o = occasional; c = common; a = abundant; F = fyke net

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 18.2.1. Among 31 taxa listed, 29 are identified to species. The list comprises 7 euryhaline, 2 oligo-mesohaline and 21 limnic taxa (Table 18.2.2). Only one of the species is listed as a lagoonal specialist in Britain (Davidson *et al.* 1991).

Faunal species were more or less evenly distributed throughout the lake and no gradient between the sea inlet and other stations could be detected. *Neomysis* was abundant at all stations and large numbers were taken in light traps. Corixidae and *Potamopyrgus* were also common. Most of the limnic species were confined to Station F. *Sigara dorsalis* was the dominant corixid.

Table 18.2.2 Ecological categories of the recorded taxa in Roonah Lough (excluding Trichoptera). L = lagoonal specialist according to Davidson *et al.* (1991)

Marine	None	
Poly-mesohaline	None	
Euryhaline	*Neomysis integer*	
	Gammarus duebeni	
	Carcinus maenas	
	Sigara stagnalis	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Platichthys flesus	
Oligo-mesohaline	*Ischnura elegans*	
	Potamopyrgus antipodarum	
Limnic	Hirudinea	
	Cloeon simile	
	Cymatia bonsdorffi	
	Callicorixa praeusta	
	Corixa panzeri	
	Sigara dorsalis	
	Sigara semistriata	
	Agabus montanus	
	Elmis aenea	
	Haliplus lineatocollis	
	H. wehnckei	
	Hydroporus memnonius	
	Laccobius minutus	
	Llybius fuliginosus	
	Nebrioporus depressus	
	Lymnaea palustris	
	L. peregra	
	Aplexa hypnorum	
	Planorbis leucostoma	
	Sementina complanata	
	Plumatella repens	

18.2.3 Discussion

The assemblage typifies a slightly saline lake receiving occasional small incursions of seawater. Oligohaline and freshwater species predominated. Corixids and beetles were common and diverse. Crabs and flounder were the only species present which can be assumed to have colonised diectly from the sea. Salinity readings of 0‰ were recorded on both visits, and it is evident that the brackishwater species present are capable of surviving in freshwater for long periods.

This was the only site at which *Cymatia bonsdorffi, Sigara semistriata, Agabus montanus* and *Laccobius minutus* were recorded. The only species of interest is the bryozoan, which needs to be confirmed. None of the species identified can be described as rare in Ireland.

18.2.4 Threats

Agriculture in the area is relatively intensive and fertilizer applications are likely to contribute to high nutrient levels in the lake, but flushing, mostly by freshwater but occasionally by spring tides, is likely to prevent severe effects on the invertebrate fauna. Cows graze the shores and cause considerable poaching and manuring in some areas of the lagoon itself.

Some extraction of barrier material appears to be taking place.

The present outlet channel appears to have been artificially created. A track now appears to run along the original outlet channel. It may be that this was done to facilitate access to an amenity area and that efforts are being made to encourage tourism.

18.2.5 Evaluation

Roonah Lough is a **natural sedimentary lagoon** with a cobble barrier and a modified natural outlet. These features qualify it as a site of international importance based on geomorphology.

The lake lies in an area of coastline subject to dynamic changes in sedimentation patterns. It is one of a number of lagoons, and "former lagoons" on the south Mayo coast which vary in their geomorphology and degree of marine influence. Some are entirely fresh, others saline, while barriers may be of sand or cobbles or both. Roonah Lough is the only one of this series with an apparently persistent low salinity, rather than being completely fresh or tidal.

The post-glacial history of parts of this coastline has been studied in detail and continues to be of great interest to geomorphologists.

The coastal lagoons of this area are of botanical and ornithological value.

The aquatic fauna characterised a slightly saline lake in which freshwater and oligohaline species predominated. Only one lagoonal specialist was present and only the freshwater bryozoan, which awaits confirmation, is of any special interest among the species identified.

The lake has little scientific value except as an example of a lagoon evolving into a freshwater lake. Little appears to be known about the tolerance of most freshwater invertebrates to saline influences and this lake, together with others in the area with various salinity regimes, could provide useful scientific information.

The lake is part of a proposed NHA (Site Code No. 1529).

The lake has little conservation value on its own on the basis of its aquatic fauna but as one of a series it sheds light on the history and geomorphological processes of this section of the coastline. It is recommended that the complete series of lakes, from L. Polimore in the north to L. Doovilra in the south be designated as a proposed SAC.

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Plate 18.2.3 View of northern part of Roonah Lough showing gravel/sand barrier and inlet of River Carrowninsky, Station F.

Plate 18.2.4 View of Roonah Lough looking southwest. Stations D (left) and E (right).

Plate 18.2.1 View of Roonah Lough in the distance, showing agricultural land and peat cutting (on the left)

Plate 18.2.2 View of Roonah Lough showing inlet in the barrier and Clare Island.

18. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

18.3.1 Site Description (Fig. 18.3.1)

Roonah Lough is a shallow sandy lagoon set in a fairly low-lying landscape. Pastoral farmland borders the lough to the north, south and east. The sea lies beyond low dune grassland to the west.

The Carrownisky River is the main freshwater inflow, approaching from the east and discharging into the lagoon at two points at its northern end. A smaller stream, the Bunleemshough River, flows in from the south east. Several ditches drain into the lough from surrounding farmland.

Much of the shoreline is low earth cliff, backing along the eastern shores to a narrow strip of wet rush and Iris grassland. Scirpus and Schoenoplectus swamp vegetation is confined to fairly sheltered areas of the south and south east shores.

The outlet channel runs from about mid-way along the western shore.

18.3.2 Methods

Two survey methods were employed in the course of fieldwork:

1. Transects
2. Shore-based survey

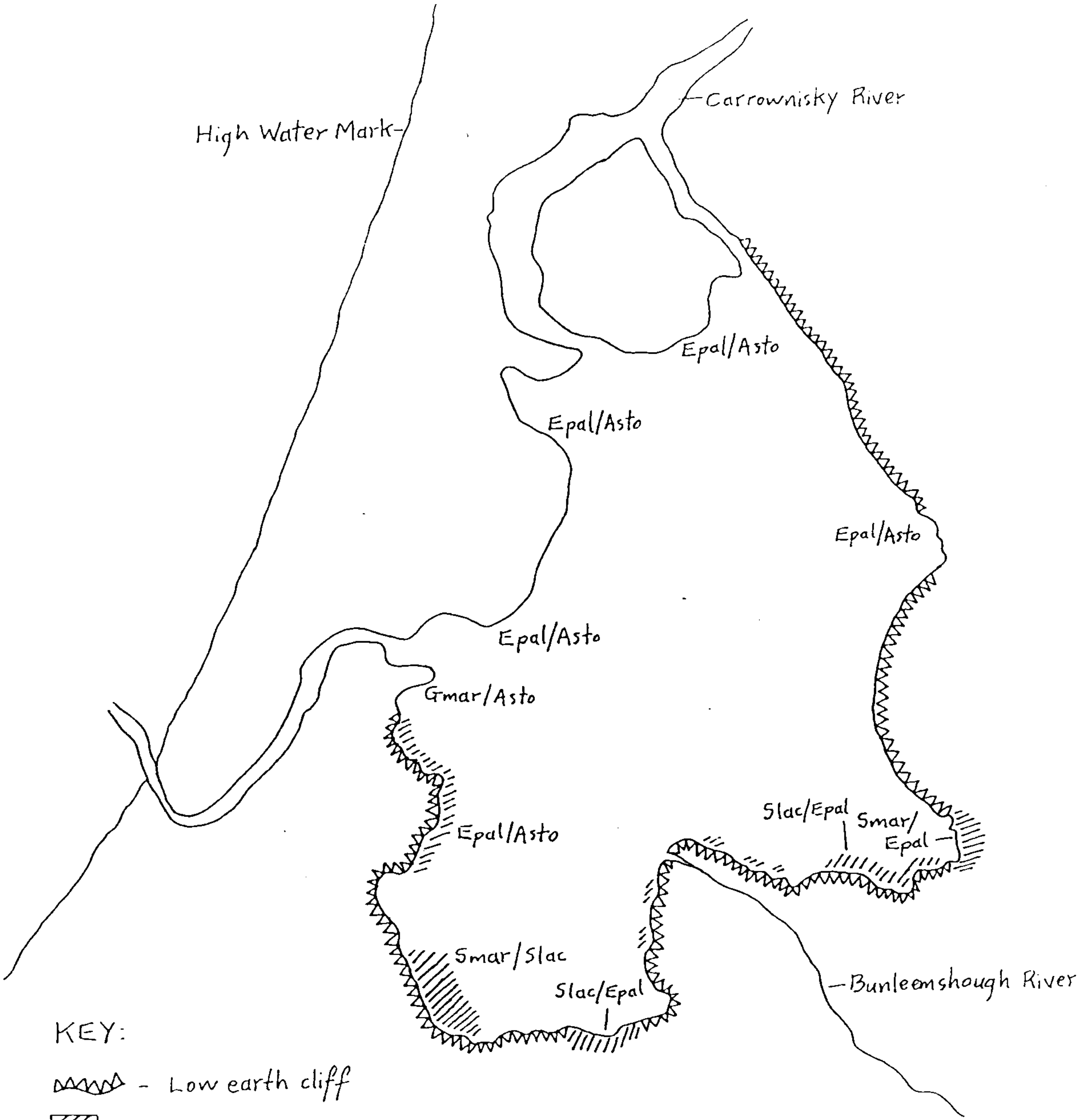
1. <u>Transects:</u>

The locality of these is shown in Fig. 18.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.



KEY:

- Low earth cliff
- Swamp

Dominant species codes:

Smar - *Scirpus maritimus*
Slac - *Schoenoplectus lacustris ssp. tabernaemontani*
Epal - *Eleocharis palustris*
Asto - *Agrostis stolonifera*
Gmar - *Glaux maritima*

Fig. 18.3.1 Roonah Lough, Co. Mayo - Marginal Vegetation

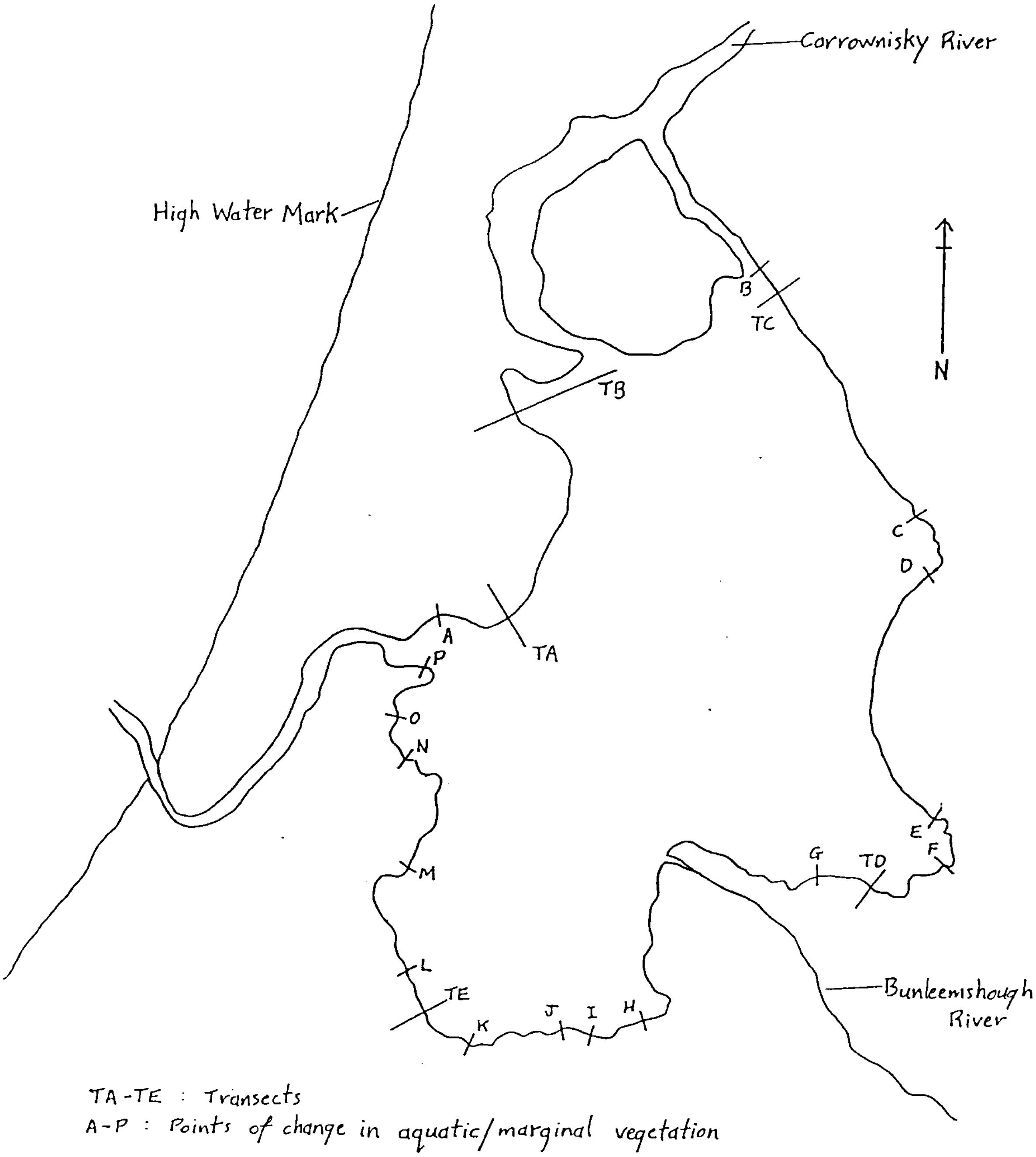


Fig. 18.3.2 Roonah Lough, Co.Mayo: Location of Transects and Shore-based Survey Sections

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

2. Shore-based survey:

The surveyor walked around the entire shore recording aquatic species, marginal communities and adjacent habitats and land use. The results are presented here as descriptive notes, divided into sections along the shore according to changes in floristics, substrate and/or adjacent habitat. These points of change are marked on the site maps.

Aquatic vegetation was surveyed by use of the grapnel and by means of wading where water and/or soft substrate depth allowed. The extent of aquatic survey was 10 metres out from the shore (i.e. the reach of the grapnel) except where otherwise stated in the descriptive notes.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A '*Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A '*Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

18.3.3 Results

1. Shore-based survey

Section A-B (Transects A and B)

Aquatic: Filamentous algae only - sparse

Sandy substrate

Marginal: Eleocharis palustris - Agrostis stolonifera dominated community. 10-c.80m

Adjacent: Dune grassland dominated by Festuca rubra, Trifolium repens, Plantago lanceolata, Lotus corniculatus

Section B-C (Transect C)

Aquatic: Ruppia maritima - sparse
Chara globularis var. virgata - sparse
Filamentous algae - sparse

Marginal: 50cm earth cliff

Adjacent: Agrostis stolonifera - Potentilla anserina grassland. 10m
Grading to Lolium perenne - Holcus lanatus - Cynosaurus cristatus pasture

Section C-D

Aquatic: Unchanged

Marginal: Eleocharis palustris - Agrostis stolonifera dominated community. 5-10m

Adjacent: Iris psuedacorus - Juncus effusus dominant with frequent Filipendula ulmaria, Rorippa nasturtium-aquaticum, Hydrocotyle vulgaris
Grading to pasture as B-C

Section D-E

Aquatic: Ruppia maritima
Chara globularis var. virgata
Chara globularis var. annulata
Filamentous algae - all sparse

Marginal: 50cm earth cliff

Adjacent: Agrostis stolonifera - Potentilla anserina grassland. 3-5m
Grading to Iris community and pasture as C-D

Section E-F

Aquatic: Ruppia maritima - sparse
Filamentous algae - sparse

Gravel and cobble substrate

Marginal: Scirpus maritimus single species swamp. 20x15m
Backing Eleocharis palustris swamp. 20x5m.

Adjacent: Agrostis stolonifera - Potentilla anserina grassland with Juncus effusus
Grading as D-E

Section F-G

Aquatic: Species unchanged

Silt substrate

Marginal: Schoenoplectus lacustris ssp tabernaemontani and Eleocharis palustris
swamps.
Maximum area c.200m2
50cm earth cliff

Adjacent: Agrostis stolonifera - Potentilla anserina grassland
Grading to pasture as B-C

Section G-H

Aquatic: Species unchanged
Sand substrate
Marginal: 50cm earth cliff
Occasional Schoenoplectus and Eleocharis palustris swamps
(maximum area c.25m2)
Adjacent: Agrostis stolonifera - Potentilla anserina grassland
Grading to Iris psuedacorus - Juncus effusus grassland
Grading to pasture as B-C

Section H-I

Aquatic: Unchanged

Marginal: Eleocharis swamp. 25x10m

Adjacent: Unchanged

Section I-J

Aquatic: Unchanged

Marginal: Schoenoplectus single species swamp. 25x15m

Adjacent: Unchanged

Section J-K

Aquatic: Unchanged

Marginal: 50cm earth cliff

Adjacent: Unchanged

Section K-L

Aquatic: Ruppia maritima
Enteromorpha
Filamentous algae

Marginal: Scirpus maritimus and Schoenoplectus lacustris ssp tabernaemontani single species swamps. Average 30m
Backing low peat cliff (average c.30cm)

Adjacent: Holcus lanatus - Cynosaurus cristatus - Potentilla anserina - Juncus effusus grassland. Average 8m
Grading to Molinia caerulea - Nardus stricta grassland

Section L-M

Aquatic: Unchanged

Marginal: 70cm earth cliff

Adjacent: Agrostis stolonifera - Potentilla anserina grassland

Section M-N

Aquatic: Filamentous algae only

Marginal: Eleocharis palustris - Agrostis stolonifera community almost continuous. 1-5m

Backing 50cm earth cliff

Adjacent: Unchanged

Section N-O

Aquatic: Unchanged

Marginal: As M-N with occasional_Scirpus maritimus shoots. 5-30m

Adjacent: Dune grassland dominated by Festuca rubra, Trifolium repens, Plantago lanceolata, Lotus corniculatus

Section O-P

Aquatic: Unchanged

Marginal: Open Agrostis stolonifera - Glaux maritima community. 2-5m

Adjacent: Unchanged

2. Transects

Site: Roonah Lough	Transect code: A	
Location: Outlet to sea	Sample point: 1 Aquatic - grapnel from shore	
Sample area: Grapnel only	Substrate: Sand	
Depth: 50 cm +	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Filamentous algae		
Description: Filamentous algae only.		

Site: Roonah Lough	Transect code: A	
Location: Outlet to sea	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand and silt	
Depth: 20 cm	Salinity: 2 parts per thousand	
NVC community: S19 Eleocharis palustris swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Eleocharis palustris	30	40
Agrostis stolonifera	20	60
Glaux maritima	15	5
Juncus articulatus	35	< 1
Description: Species-poor community with Eleocharis and Agrostis co-dominant. Dense		
cover. 10m. Flooded at time of survey.		
Grading to dune grassland with Festuca rubra, Trifolium repens, Plantago		
lanceolata, Lotus corniculatus dominant (barrier).		

Site: Roonah Lough	Transect code: B	
Location: Freshwater inflow	Sample point: 1 Aquatic 0-30m out - grapnel	
Sample area: Grapnel only	Substrate: Silt	
Depth: 50 cm	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Filamentous algae		
Description: Sparse filamentous algae the only aquatic species from 0 - 30m out.		

Site: Roonah Lough	Transect code: B	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 20 cm	Salinity: 0 parts per thousand	
NVC community: S19 Eleocharis palustris swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Eleocharis palustris	40	50
Agrostis stolonifera	30	50
Glaux maritima	15	5
Juncus articulatus	30	< 1
Description: Dense cover of Eleocharis and Agrostis co-dominant in species-poor community.		
20m. Flooded at time of survey.		

Site: Roonah Lough	Transect code: B	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 0 cm	Salinity: -----	
NVC community: S19 Eleocharis palustris swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Eleocharis palustris	40	50
Agrostis stolonifera	30	25
Potentilla anserina	10	5
Trifolium repens	6	5
Scirpus maritimus	30	< 5
Glaux maritima	10	< 5
Ranunculus acris	10	< 5
Rorippa nasturtium-aquaticum	20	< 5
Hydrocotyle vulgaris	6	< 5
Galium palustre	15	< 5
Leontodon autumnalis	30	< 5
Juncus articulatus	30	< 5
Description: Eleocharis - Agrostis dominated community with occasional low growing Scirpus		
maritimus shoots. Complete ground cover. 50m.		
Grading to dune grassland with Festuca rubra, Trifolium repens, Plantago		
lanceolata, Lotus corniculatus dominant.		

Site: Roonah Lough	Transect code: C	
Location: Freshwater inflow - cliff shore	Sample point: 1 Aquatic - 10m out	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 50 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		< 1
Higher Plant		< 1
Ruppia maritima	8	< 1
Algae		< 1
Chara globularis var. virgata	7	< 1
Description: Very sparse cover of Ruppia and Chara globularis.		
Backing earth cliff - height 50 cm.		
Backing Agrostis stolonifera - Potentilla anserina - Juncus articulatus		
grassland. 10m.		
Grading to Lolium perenne - Holcus lanatus - Cynosaurus cristatus pasture.		

Site: Roonah Lough	Transect code: D	
Location: Marginal swamps	Sample point: 1 Aquatic - 5m out - grapnel	
Sample area: Grapnel only	Substrate: Silt	
Depth: 80 cm	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia maritima		
Filamentous algae		
Description:		

Site: Roonah Lough	Transect code: D	
Location: Marginal swamps	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 70 cm	Salinity: 2 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		25
Schoenoplectus lacustris ssp tabernaemontani	130	25
Description: Open single species Schoenoplectus lacustris swamp. 10m.		

Site: Roonah Lough	Transect code: D	
Location: Marginal swamps	Sample point: 3 Marginal	
Sample area: 60m2 (20x3 - whole stand)	Substrate: Silt	
Depth: 50 cm	Salinity: 2 parts per thousand	
NVC community: S19 Eleocharis palustris swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		30
Eleocharis palustris	70	30
Agrostis stolonifera	40	< 1
Juncus articulatus	60	< 1
Description: Open cover of tall Eleocharis dominated species-poor vegetation. 3m.		
Backing earth cliff - height 50 cm.		
Backing Agrostis stolonifera - Potentilla anserina - Juncus articulatus		
community. 3m.		
Grading to Lolium perenne - Holcus lanatus - Cynosuarus cristatus pasture.		

Site: Roonah Lough	Transect code: E	
Location: Marginal swamp	Sample point: 1 Aquatic - 1m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: 80 cm +	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia maritima		
Enteromorpha		
Filamentous algae		
Description:		

Site: Roonah Lough	Transect code: E	
Location: Marginal swamp	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peaty silt	
Depth: 50 cm	Salinity: 0 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Scirpus maritimus sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Scirpus maritimus	130	100
Description: Dense single species Scirpus maritimus swamp. 30m.		

Site: Roonah Lough	Transect code: E	
Location: Marginal swamp	Sample point: 3 Marginal	
Sample area: 40m2 (40x1 - whole stand)	Substrate: Peaty silt	
Depth: 30 cm	Salinity: 0 parts per thousand	
NVC community: S21 Scirpus maritimus swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Scirpus maritimus	100	60
Agrostis stolonifera	30	20
Description: 1m strip Scirpus maritimus swamp with more open cover and Agrostis stolonifera now present.		
Backing 30cm peat cliff.		
Backing Holcus lanatus - Cynosaurus cristatus - Potentilla anserina - Juncus effusus grassland. 7m.		
Grading to Nardus stricta grassland with Molinia caerulea, Eriophorum angustifolium, Succisa pratensis, Mentha aquatica, Hydrocotyle vulgaris, Narthecium ossifragum.		

18.3.4 Evaluation

'Potentially Valuable'

This is a shallow sandy lagoon of low salinity at time of survey (0-2 parts per thousand) with a fairly large freshwater input.

Ruppia maritima was the only aquatic higher plant species found at this site. It has a wide distribution but is low-growing and was not found in dense beds.

Two charophytes, Chara globularis var. virgata and C.globularis var. annulata, occur close to the north eastern shore, where both species grow at sparse cover with equally sparse Ruppia.

Marginal communities show some diversity. Both mixed and single species Scirpus maritimus and Schoenoplectus swamps are found along parts of the south eastern and southern shores. Eleocharis palustris dominated swamp also occurs here and along the western shore. Much of the eastern shore is low earth cliff backing to wet grassland.

Ruppia has a wide distribution here and may occur at higher cover in deeper areas. The presence of two charophyte varieties is notable. This site is considered worthy of further survey as this may prove it to be a good representative of a low salinity sandy lagoon.

Full aquatic survey is recommended.

18.4 ECOTONAL COLEOPTERA

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18.4.1 Site Description

Coastal brackish lake with natural sand and shingle barrier, with outflow stream through shingle barrier. Inflow river into lake with large catchment, and outflow shingle probably regularly disturbed after heavy rain events. Barrier shore of shingle and sand, with small internal sandflat. Lake shore including marsh and grassland above sand and peaty soil cliff margins, with fringing emergents (*Schoenoplectus lacustris*, *Scirpus maritimus*) in water.

Subsites (see Fig 18.4.1)

1. *Potentilla/* grass margin (L 749760)

Grass, *Potentilla anserina*, *Trifolium* sp., *Triglochin maritima* sward above cliff to *Scirpus maritimus* in standing water. Not recently or heavily grazed. Salinity of offshore water (13 viii 1996) was 0‰.

2. Sandbank (L 748764)

Short-turf grass on sloping sandy bank to shingle/sandy beach with standing water (after water level rise in lake, 27 ix 1996). Ground cover complete to poor.

3. Sandflat (L 749765)

Aerobic sand on upper part of unvegetated sandflat, flooded during high water levels. Salinity offshore of sandflat (14 viii 1996) was 1‰.

18.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

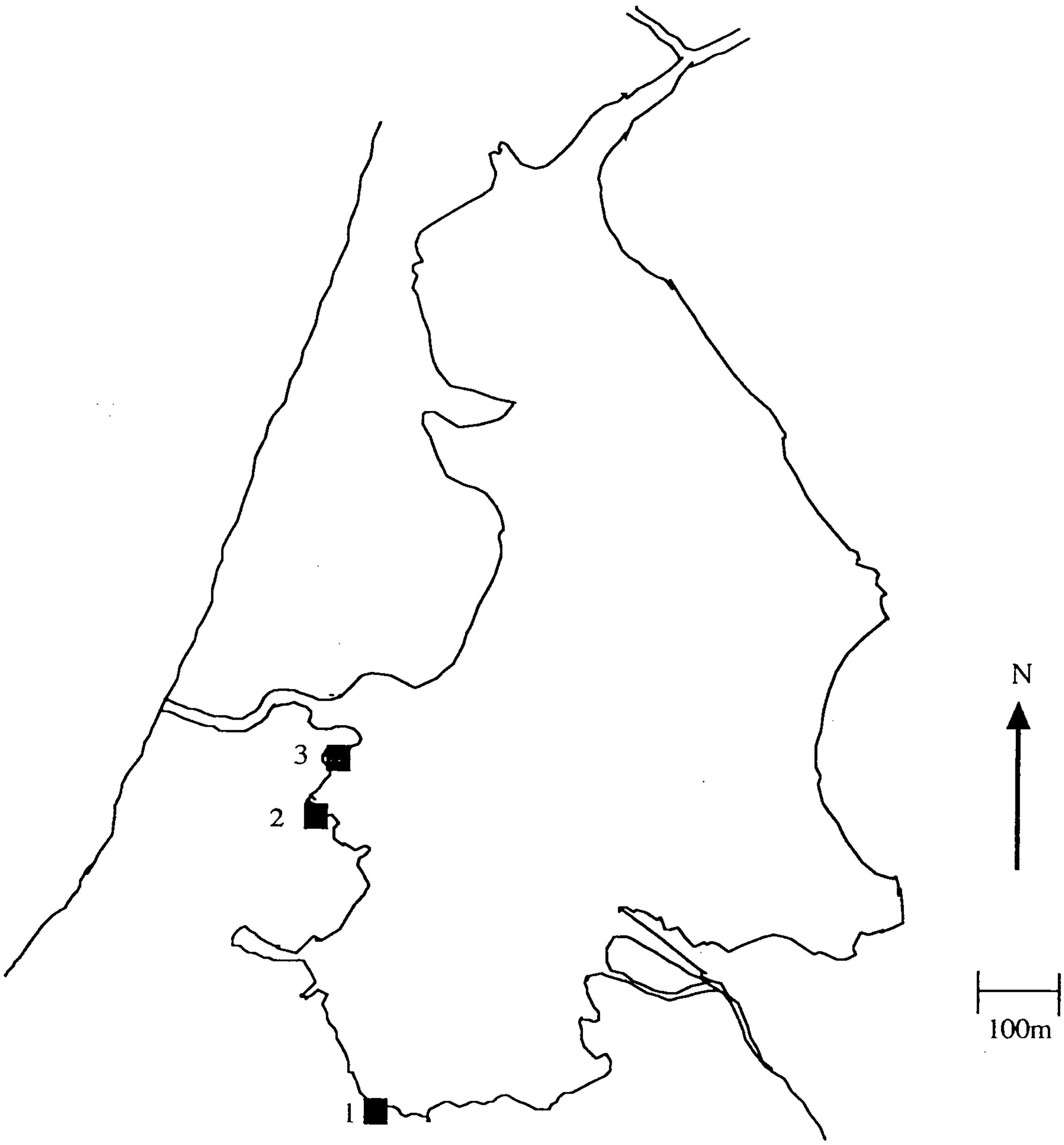

Fig. 18.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Roonah Lough, Co. Mayo.

1 - Pitfall traps, S-vac
2 - Pitfall traps
3 - Ground search, Flotation

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 18.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held

pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 18.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity.

That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Potentilla anserina* margin - S-vac suction sampler (13 viii 1996), c. 2 m^2;
(2) *Potentilla anserina* margin - 6 plastic pitfall traps with funnels and ethylene glycol preservative (13 viii - 27 ix 1996);
(3) Grass sandbank - 6 pitfall traps (27 ix - 17 x 1996);
(4) Sandflat - flotation samples (c. 0.17 m^2 x 5 cm depth) and 0.5 h ground search (13 viii 1996).

The shingle cobble/sand margins of the outflow channel were cobble-searched, with no carabids or staphylinids (or amphipods) found.

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

18.4.3 Results

Nine species of carabid and fifteen species of staphylinid were recorded, one species of which is regarded as an indicator species (Table 18.4.2).

TABLE 18.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Roonah Lough. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), with the exception of Booth (1988) for *Tachyporus dispar*.

	Species	No. individuals	
Carabidae			
	Agonum pelidnum (Payk.)	2	
*	*Bembidion bipunctatum* (L.)	1	**Indicator species**
	Bembidion pallidipenne (Ill.)	2	
	Calathus fuscipes (Goeze)	87	
	Calathus melanocephalus (L.)	7	
	Calathus micropterus (Duft.)	1	
	Calathus ochropterus (Duft.)	1	
	Dyschirius politus (Dej.)	1	
	Pterostichus niger (Schall.)	1	
Staphylinidae			
	Atheta elongatula (Grav.)	3	
	Atheta graminicola (Grav.)	8	
	Atheta melanocera (Thoms.)	3	
	Atheta volans (Scriba)	3	
	Bledius fergussoni Joy	15	
	Bledius longulus Er.	14	
	Euaesthetus laeviusculus Mannh.	1	
	Gabrius subnigritulus (Reitt.)	1	
	Ischnopoda atra (Grav.)	1	
	Ocypus aeneocephalus (Geer)	5	
	Othius melanocephalus (Grav.)	2	
	Quedius semiaeneus (Steph.)	14	
	Tachyporus dispar (Payk.)	6	
	Tachyporus pusillus Grav.	2	
	Xantholinus linearis (Ol.)	1	

Bembidion bipunctatum is a halotolerant shore species, occurring inland and in coastal shingle and brackish water pools (Koch 1989, Hyman and Parsons 1992). It is widespread but local in Great Britain (Hyman and Parsons 1992), and recorded from Ireland (Speight *et al.* 1982). It occurs from North Africa to west Siberia, and is common at least in northern Germany, although rarer further west (Freude 1976).

An assemblage of five halotolerant species occurred on the sandflats and sand banks, all associated with coastal sand or shingle (Table 18.4.3). All these species occur on beaches or intertidal sandflats. *Bembidion pallidipenne* was found at most coastal lake sandy shores during the initial phase of this survey, and is not considered local in Connemara, although it is listed as local in Great Britain by Hyman and Parsons (1992).

TABLE 18.4.3. Halotolerant staphylinid and carabid assemblage from sandflat and sandbank, Roonah Lough (flotation sample, ground search and pitfall traps combined).

Species	No.	Main biotope
Bembidion bipunctatum	1	Coastal, shingle
Bembidion pallidipenne	2	Coastal, sand
Bledius fergussoni	15	Intertidal sand
Bledius longulus	14	Foredunes
Dyschirius politus	1	Eurytopic, incl. dunes

18.4.4 Evaluation

Of <u>no</u> recorded conservation interest for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

Only one indicator species was found at this site, a single species represented by a single individual. Although an assemblage of halotolerant species occurred (Table 18.4.3), these are also beach, dune and intertidal species and are not associated with lagoonal conditions so the site cannot be rated of value.

18.4.5 References

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18.5 SUMMARY AND EVALUATION

Roonah Lough is a large (50 ha), **natural sedimentary lagoon** with a cobble barrier and a modified natural outlet. These features qualify it as a site of international importance based the Habitats Directive.

The lough is of interest as two rivers in which salmon spawn run through it and it also attracts small numbers of waterfowl and waders.

It is part of a proposed NHA (Site 1529).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion

Geomorphology	Moderate/High
Aquatic Fauna	Moderate/High
Vegetation	Potentially High
Ecotonal Coleoptera	None

Geomorphology

Roonah Lough is a natural sedimentary lagoon impounded by a low cobble barrier. A natural outlet has been relocated as a result of road construction. The lough lies in an area of coastline subject to dynamic changes in sedimentation patterns. It is shallow and the bed is mostly composed of sand.

Seawater enters through the inlet on spring tides only and is soon flushed from the lagoon by the large volume of freshwater entering from two rivers. Tidal variation in water level and salinity are low.

As a natural sedimentary lagoon with a cobble barrier, the lake is rated as of moderate to high conservation value

Aquatic Fauna

Among 31 taxa recorded, 29 were identified to species but only one is a lagoonal specialist. The majority (21 spp.) are limnic taxa.

The assemblage typifies a slightly saline lake receiving occasional small incursions of seawater. Oligohaline and freshwater species predominated. Corixids and beetles were common and diverse. Crabs and flounder were the only species present which can be assumed to have colonised diectly from the sea. Salinity readings of 0‰ were recorded on both visits, and it is evident that the brackishwater species present are capable of surviving in freshwater for long periods.

This was the only site at which *Cymatia bonsdorffi, Sigara semistriata, Agabus montanus* and *Laccobius minutus* were recorded. The only other species of interest is the bryozoan, which needs to be confirmed. None of the species identified can be described as rare in Ireland.

Despite the low number of lagoonal specialists, is rated as of moderate to high conservation value for its typical low salinity communitylow salinity

Vegetation

Ruppia maritima was the only aquatic higher plant species found. It had a wide distribution but was low-growing and was not found in dense beds although it may do so in deeper water.

Two charophytes, *Chara globularis* var. *virgata* and *C.globularis* var. *annulata*, occurred close to the north eastern shore, where both species grew at sparse cover with equally sparse *Ruppia*.

Marginal communities showed some diversity. Both mixed and single species *Scirpus maritimus* and *Schoenoplectus* swamps are found along parts of the south eastern and southern shores. *Eleocharis palustris* dominated swamp also occurred here and along the western shore. Much of the eastern shore is low earth cliff backing to wet grassland.

This site is considered worthy of further survey as this may prove it to be a good representative of a low salinity sandy lagoon. It is therefore rated as of potentially high conservation value.

Ecotonal Coleoptera

Nine species of carabid and fifteen species of staphylinid were recorded, one species of which is regarded as an indicator species and was represented by a single individual.

Bembidion bipunctatum is a halotolerant shore species, occurring inland and in coastal shingle and brackish water pools. It is widespread but local in Great Britain. and recorded from Ireland. It occurs from North Africa to west Siberia, and is common at least in northern Germany, although rarer further west.

An assemblage of five halotolerant species occurred on the sandflats and sand banks, all associated with coastal sand or shingle. All these species occur on beaches or intertidal sandflats. *Bembidion pallidipenne* was found at most coastal lake sandy shores during the initial phase of this survey, and is not considered local in Connemara, although it is listed as local in Great Britain.

Although an assemblage of halotolerant species occurred, these are also beach, dune and intertidal species and are not associated with lagoonal conditions so the site cannot be rated of value. It is rated as of no recorded conservation interest for terrestrial ecotonal community.

Summary

Roonah Lough is a large, natural sedimentary lagoon impounded by a low cobble barrier, with a natural, but partly altered, sea inlet. It is one of a number of lagoons, and "former lagoons" on the south Mayo coast which vary in their geomorphology and degree of marine influence. Some are entirely fresh, others saline, while barriers may be of sand or cobbles or both. Roonah Lough is the only one of this series with an apparently persistent low salinity, rather than being completely fresh or tidal.

The post-glacial history of parts of this coastline has been studied in detail and continues to be of great interest to geomorphologists.

The aquatic fauna and vegetation characterised a slightly saline lake in which freshwater and oligohaline species predominated. The lake has scientific value as an example of a lagoon evolving into a freshwater lake.

The lake has little conservation value on its own on the basis of its aquatic fauna and flora but as one of a series it sheds light on the history and geomorphological processes of this section of the coastline. Roonah is the best true lagoon of the series

Overall, the lake on its own is rated as of moderate conservation value. It is recommended that the complete series of lakes, from L. Polimore in the north to L. Doovilra in the south be designated as a proposed SAC and that further studies of the entire series be undertaken.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

(VOLUME III)

19. FURNACE LOUGH

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February 1997

Prepared for the National Parks and Wildlife Service

(BioMar/Life)

19. FURNACE LOUGH

CONTENTS

19. FURNACE LOUGH, Co. Mayo.

OS Grid Reference: L 965 975, 1:50,000 Sheet No. 31
Alternative names:

19.1 STUDY AREA

General features
Furnace Lough is situated in the northeast corner of Clew Bay, 2 km northwest of Newport. (Fig. 19.1.1). The lake forms the lower part of the Burrishoole valley, separated from the larger Lough Feeagh to the north by a terminal moraine. The two lakes together comprise the Burrishoole Fishery, a fully dedicated research fishery monitored by the Salmon Research Agency of Ireland (Poole 1994). Lough Furnace is a large, deep oligotrophic lake with a large catchment area. Seawater enters the lake on every tide but the large size of the lake and the volume of water passing through it ensure relatively low salinities at the surface throughout the year.

Parker (1977) described the lake in reference to the biology of *Neomysis integer*, De Burgh & Smart (1969) reported on the hydrography of the lake and its planktonic and littoral organisms, and Poole (1994) studied the European eel (*Anguilla anguilla*) in the Burrishoole system.

Climate and oceanographic influences
(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 5.5-6.0°C in January and 14.5-15.0°C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8.5 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is 1200-1600 mm, and the number of rain days (1 mm or more) is approx. 200. Winds are mainly from the southwest. Mean annual hourly wind speeds are between 6-7 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages 3.5-4.0 hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1983). Tides are semi-diurnal and the tidal range (MHWS-MLWS) for the area is not listed (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

Landscape and Geology The valley lies in the heart of the Nephin Beg mountain range, which is composed primarily of Dalradian schists, gneiss and quartzites. As the range descends towards Clew bay, the schists and quartzites dip under Old Red

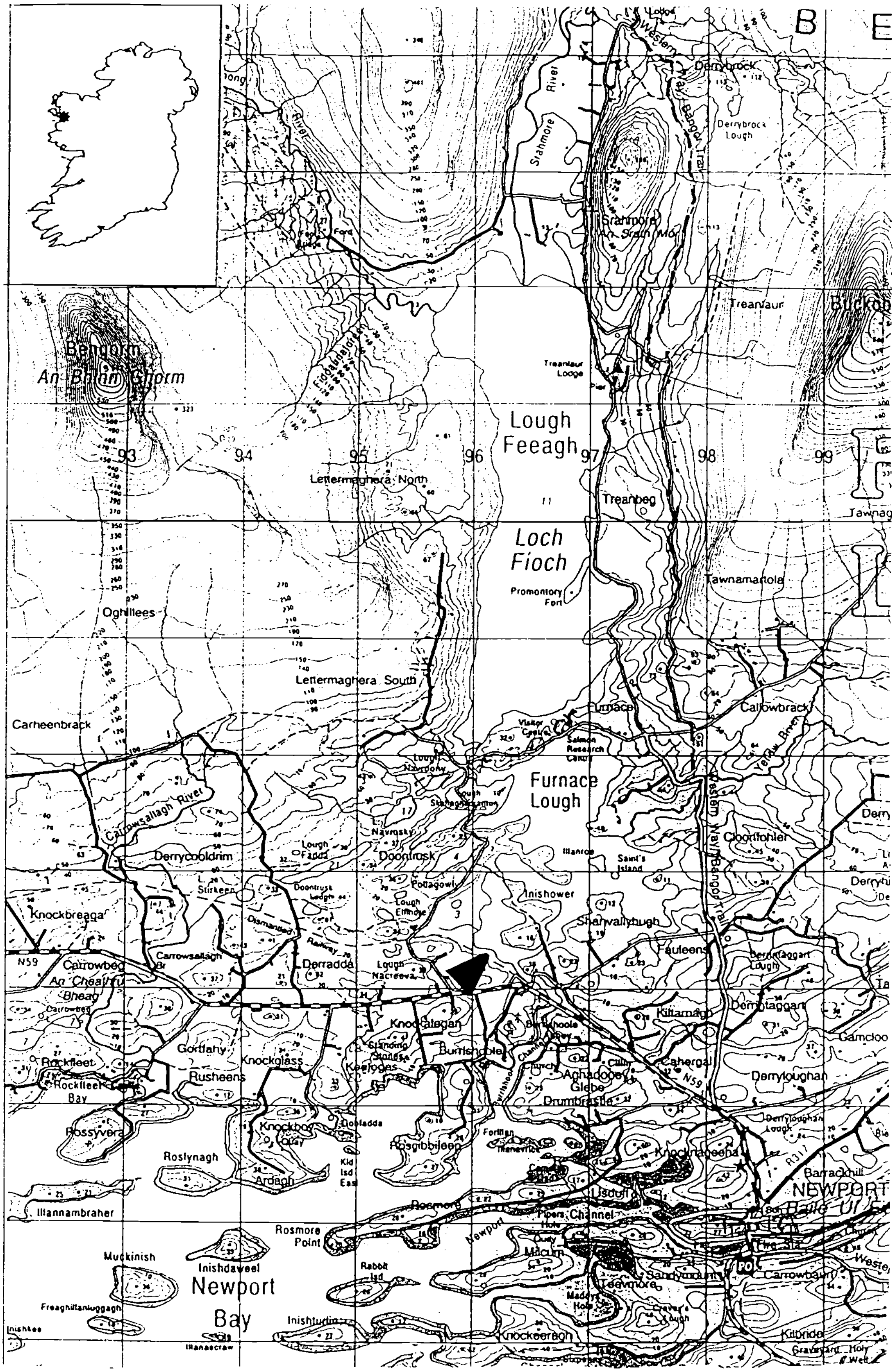

Fig. 19.1.1 Section of 1:50 000 map showing locality of Furnace Lough

Sandstone, and then Carboniferous sandstone and limestone. The area was heavily glaciated. Traces of moraine can be seen at the north and north east end of Furnace, and the retreating ice left the area blanketed with a sandstone bearing till, the Newport till. The overlying soils are mainly gleys, with peaty gleys and blanket peatlands dominating the mountain slopes to the north (Poole 1994).

Main land uses in the area are sheep and cattle grazing and forestry. The area is currently undergoing severe hillside erosion due to overgrazing, contributing to acidification and peat siltation of the streams and lakes (Poole 1994).

Lake Topography The lagoon is approximately 2 km from north to south, 2 km at its widest point. Two weirs have been constructed at the southern end of the lake between the mainland on each side and Nixon's Island in the middle. The lake covers approximately 125 ha north of the weirs. Water depth is mostly between 1 and 9 metres but with a deep area of 21 metres in the north in front of the Salmon Research Station.

Hydrology The hydrology of the lake was studied by Parker (1977). The lough is usually affected by tides greater than MHWN which flood into it from Clew Bay through the short Burrishoole Estuary. Maximum spring tide rise and fall in the lough is ordinarily about 50 cm. The waters are sharply stratified; a permanent halocline runs from 1-3 m depth down to 8 m, below which the water is of constant salinity (about 20‰), anaerobic and stagnant. Plankton and fish are therefore confined to the aerated surface layers, in which the salinity is generally in the range 0-2 ‰ (Parker and West 1978).

Salinity and water quality Despite the fact that seawater enters at regular intervals, the lake is also likely to receive large volumes of freshwater runoff from the surrounding land. Salinity levels are likely to vary considerably, both spatially and temporally, depending on precipitation and tides. Generally salinity levels are likely to be relatively low throughout the year with a tendency to increase during the summer. However, the peaty soils of the surrounding land would affect the delivery time of both surface- and ground-water flows to the lake through absorption and slow release of water. The prolonged flow of freshwater to the lagoon during the "dry" months may result in lower salinities than might be expected. On the other hand, winter storms may result in a higher volume of seawater entering the lake and raising salinity levels at a time when they might be expected to fall.

The waters are sharply stratified; a permanent halocline runs from 1-3 m depth down to 8 m, below which the water is of constant salinity (about 20‰), anaerobic and stagnant. Plankton and fish are therefore confined to the aerated surface layers, in which the salinity is generally in the range 0-2 ‰
The lough has suffered recent problems of deoxygenation and large-scale fish kills. The area is currently undergoing severe hillside erosion due to overgrazing, contributing to acidification and peat siltation of the streams and lakes (Poole, 1994).

19.2. AQUATIC FAUNA

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19.2.1 Methods

Environmental variables

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰ precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A, B, E and F in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (e.g. *Jaera*, hydrobiids). Finally, some soft-bodied groups were particularly difficult to identify when preserved (turbellarians, leeches).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

19.2.2 Results

Furnace Lough was sampled on 16.vi.96 during the first part of the survey, and from 20-23.ix.96 during the more intensive survey.

Nine sampling stations were selected in the lake to reflect the influences of substrate, and freshwater/seawater inflows. Fig. 19.2.1 shows the position of these sampling stations in the lagoon.

Environmental Variables

Station A (OS 9603 9748) was located in Bay na William on the west side of the lake (Plate 19.2.3). Water depth varied from 0 - 1 m, substrate was mostly rocks, large cobbles and coarse sand. Salinity of the outflowing water measured 0 - 10‰.

Station B (OS 9615 9780) was located in a relatively isolated pool in the northwest where water from Lough Feeagh enters Furnace (the Salmon Leap). Substrate consisted of stones and sand and fine organic silts in the deeper or more sheltered areas., water depth varied from 0 - 2 m in the area sampled and salinity measured 0 - 10‰.

Station C (OS 9683 9820) was located immediately in front of the Salmon Research station at the north end of the lake, approximately 100 m. offshore. Light-traps were hung from the mooring line of a salmon cage at 1.5 m and 5 m depths but no other sampling method was used at this station. Salinity measured 1.8 and 17.3‰, respectively, at these depths on the 12th September.

Station D (OS 9719 9813) was located in the northeast corner of the lake. Substrate consisted of large rocks (20 cm - 1 m diam.) with pockets of coarse sand and gravel. Water depth varied from 0 - 1 m, and salinity measured 15‰.

Station E (OS 9731 9659) was located in Black Sod Bay, an area of drowned lowland with boggy banks, and peat substrate with stumps of submerged woodland. Water depth varied from 0 - 1.25 m and salinity measured 0 - 10‰.

Station F (OS 9669 9556) was located near the weir and outlet to the lake east of Nixon's Island. Water depth varied from 0 - 2 m, substrate consisted largely of peat along the bank of the river, with stones and sand further out in the channel. Salinity measured 10 - 22‰.

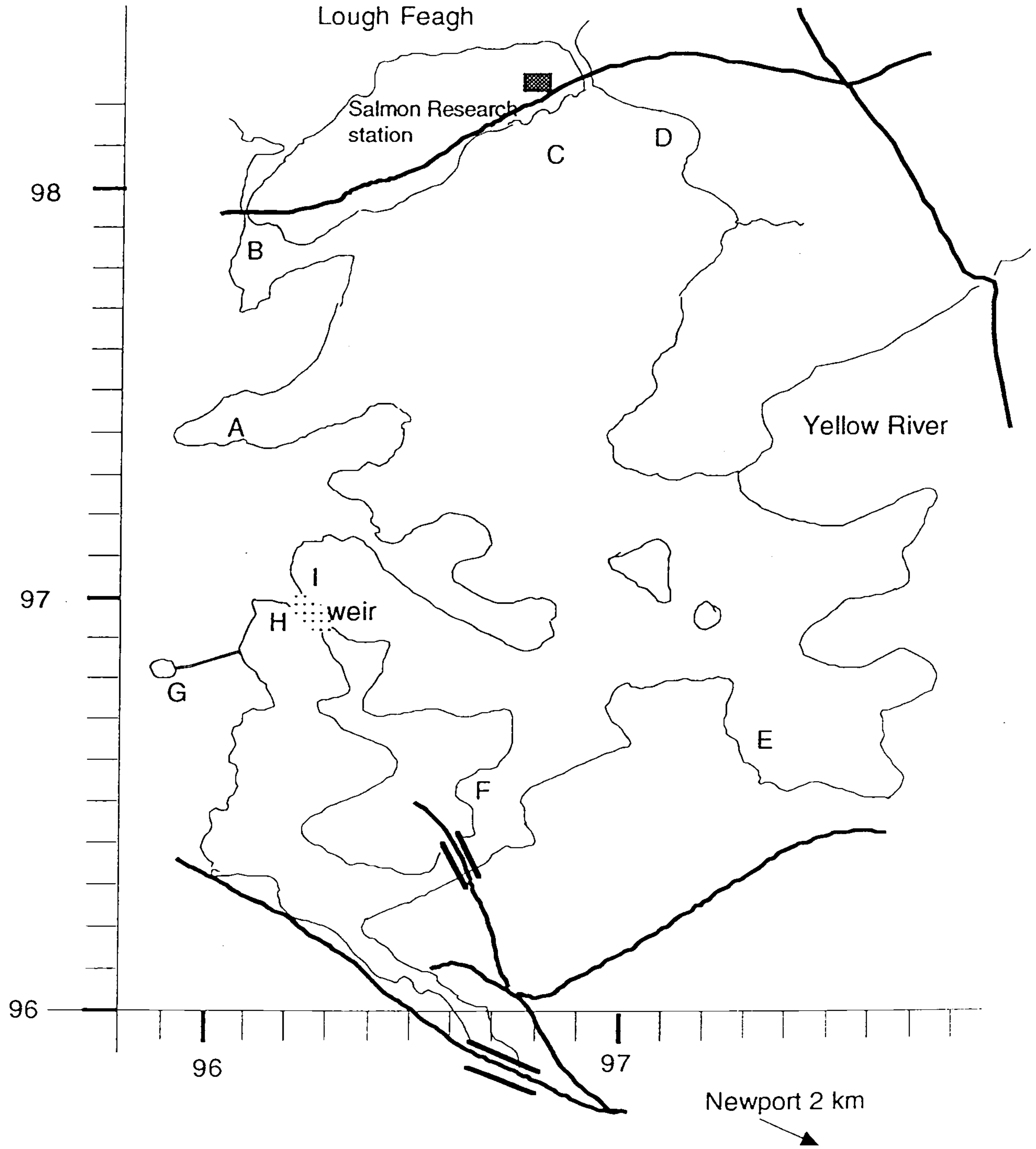

Fig. 19.2.1 Location Map of Sampling Stations in Furnace Lough, Co. Mayo.

Table 19.2.1. Fauna Recorded in Furnace Lough, Co. Mayo. June and September, 1996.

Fauna		Sampling Stations (L.T. = light-trap)																
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	L.T.E	F	L.T.F	G	L.T.G	H	L.T.H	I
Porifera																		
Cnidaria	*Aurelia aurita*							+				+				+		+
Turbellaria		o						a				o				+		+
Nemertea																		
Annelida																		
Crustacea																		
Ostracoda																		
Copepoda																		
Cirripedia																		
Mysidacea	*Neomysis integer*	c	c100	c	c100			c	c100	o	60	+	4	o		+	c.500	+
Isopoda	*Jaera albifrons*											o						
	J. ischiosetosa							o				c						
	J. nordmanni	+						o				c						
	Lekanesphaera hookeri	c	c75	c	c.75			a	>1000	c	30	c	45	o	50	+	c.100	+
Amphipoda		o		o				o		c		a		+		+		+
	Allomelita pellucida			+						+						+	+	
	Corophium volutator	+		+						o								
	G. duebeni	+										+					+	+
	G. zaddachi		+	+				+				+		+			+	
	**Lembos longipes*																	
	Leptocheirus pilosus											+						
Tanaidacea																		
Decapoda	*Crangon crangon*	1																
	Carcinus maenas	F, 1										F, 26						
	Palaemon elegans											c	3					
	Palaemonetes varians														1			
Arachnida																		

+ = present; o = occasional; c = common; a = abundant; F = fyke net
* = Station not known

Table 19.2.1. cont.. Fauna Recorded in Furnace Lough, Co. Mayo. June and September, 1996.

Fauna		Sampling Stations (L.T. = light-trap)																
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	L.T.E	F	L.T.F	G	L.T.G	H	L.T.H	I
Insecta																		
Ephemeroptera																		
Odonata	*Ischnura elegans*			2								(+)		+	3			
	Sp. 2			+														
Plecoptera																		
Trichoptera																		
Hemiptera	Corixidae											1		o				
	Notonecta glaucum													1				
	Hydrometra stagnorum	+																
	Gerris lacustris			+														
Coleoptera				2						o		+				+		
	Haliplus ruficollis			+														+
	**Hygroporus memnonius*																	
	**Megasternum obscurum*																	
	Nebrioporus depressus									+								
Diptera	Chironomidae			+				+				+				+		+
Mollusca																		
Prosobranchia	Hydrobiidae	c	12	a				a		a	75	a	3	+		+		+
	Potamopyrgus antipodarum	+	+	+				+		+	+	+	+	+		+		+
Pulmonata																		
Opisthobranchia																		
Bivalvia	*Mytilus edulis*															+		+
	Abra sp.													+				
Bryozoa	*Conopeum seurati*	+						+				+				+		+
Echinodermata																		
Tunicata																		
Teleostei	*Anguilla anguilla*	+		F, 2								F, 1	1	+				
	Gasterosteus aculeatus	+		+	3	+	8	+		+		c		+	2	+	1	+
	Platichthys flesus	F, 6		F, 2				+				F, 3						
	Pomatoschistus microps	+	1	+				+		+		+					1	

+ = present; o = occasional; c = common; a = abundant; F = fyke net
* = Station not known

Station G (OS 9588 9683) was located in a small circular pool southwest of the western weir (Plate 19.2.4). It actually lies outside the main area of the lake and a channel runs from the pool to what is locally referred to as the estuary. However, the weir separating the "estuary" from the main body of the lake is artificial and there is only a limited restriction in the flow of water in either direction. For the purposes of this study the pool is regarded as an integral part of the system.

Station H (OS 9624 9670) was located on the south side of the western weir. Substrate consisted of rocks and stones of various sizes with patches of coarse sand and reedbeds of *Phragmites.* Water depth varied from 0 - 1 m along the shore and salinity measured 10 - 12‰.

Station I (OS 9634 9689) was located on the north side of the western weir. Substrate consisted of rocks and stones of various sizes with patches of coarse sand and reedbeds of *Phragmites.* Water depth varied from 0 - 1 m along the shore and salinity measured 10 - 12‰.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 19.2.1. Among 35 taxa listed, 32 are identified to species. The list comprises 5 marine species, 5 poly-mesohaline, 12 euryhaline, 2 oligo-mesohaline and 6 limnic species (Table 19.2.2). Three of the species are listed as a lagoonal specialists in Britain (Davidson *et al.* 1991).

Table 19.2.2 Ecological categories of the recorded taxa in Furnace Lough L = lagoonal specialist according to Davidson *et al.* (1991).

Marine	*Aurelia aurita*	
	Jaera albifrons	
	Lembos longipes	
	Palaemon elegans	
	Mytilus edulis	
Poly-mesohaline	*Jaera ischiosetosa*	
	Allomelita pellucida	
	Leptocheirus pilosus	
	Corophium volutator	
	Crangon crangon	
Euryhaline	*Neomysis integer*	
	Jaera nordmanni	
	Lekanesphaera hookeri	L
	Gammarus duebeni	
	G. zaddachi	
	Palaemonetes varians	L
	Carcinus maenas	
	Conopeum seurati	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Pomatoschistus microps	
	Platichthys flesus	

Furnace Lough

Oligo-mesohaline	*Ischnura elegans* *Potamopyrgus antipodarum*
Limnic	*Notonecta glaucum* *Hydrometra stagnorum* *Gerris lacustris* *Haliplus ruficollis* *Megasternum obscurum* *Nebrioporus depressus*

Most of the common species were widely distributed in the lake with *Neomysis, Lekanesphaera, Gammarus zaddachi* and *Potamopyrgus* being common or abundant everywhere. The semi-isolated pool G, where the salinity was lower than in the main body of the lake, contained a somewhat different fauna. This was the only station where *Hydrometra,* and *Abra* were present and the single specimen of *Palaemonetes* taken there was the only one recorded for the entire lake.

One species of Turbellarian was particularly common at some stations but was not identified.

This is the only site at which *Megasternum obscurum, Sigara falleni*, and *Jaera albifrons* were recorded.

19.2.3 Discussion

The species assemblage typifies a lagoon with some direct contact with the sea allowing entry of jellyfish, prawns, shrimps, crabs and flatfish. Most of the species are characteristic of brackishwaters in the middle salinity range and those associated with higher or lower salinities were mostly present in low numbers only. Potential colonists from the sea or the mouth of the outlet may be inhibited from entering the lake by the two weirs. The relatively low number of oligohaline and freshwater species in such a large system, into which flow a number of streams, is surprising and indicates that tidal waters reach to all parts of the lake. The semi-isolated pool, in which the salinity was lower than the main body of the lake, may act as a refuge for species less tolerant of high salinity from which they can recolonise the lake when conditions become tolerable.

The essentially brackish nature of the system as a whole, and the relatively high faunal diversity, were unexpected because previous studies (Parker 1977, Parker and West 1979) had described a highly stratified lake containing a poor fauna dominated by a few abundant species with *Neomysis integer* and *Palaemonetes varians* dominant.

The most interesting features of the fauna were the diversity of *Jaera* and amphipod species, and the near absence of the normally ubiquitous euryhaline species *Palaemonetes varians*. The only previous records of *Leptocheirus pilosus* in Ireland are from Wexford Harbour (Costello *et al.* 1990) and brackishwater channels on the North Slob, Co. Wexford (Devlin 1992). There are only three Irish records for *Lembos longipes* (Costello *et al.* 1990).

19.2.4 Threats

Peat erosion due to overgrazing by sheep on surrounding hills is said to be the cause of recent fish kills due to a rise in the level of the oxycline.

It is assumed that any pollution from fish cages would sink into the deep, stratified lake.

19.2.5 Evaluation

Furnace Lough is a large, **natural saline lake** with a natural but modified tidal inlet.

The hydrology of the lough is of interest for the presence of a permanent stratification

It is of great importance as a salmon fishery and its environment and fish populations are closely monitored by the Salmon Research Agency. Little was known about the invertebrate fauna, however, or the effects on invertebrates of the recent deterioration in environmental conditions.

The aquatic fauna comprised marine, euryhaline, oligohaline and freshwater species. It was more diverse than had been expected from results of a previous survey in 1977, when only one species was in any way abundant. In 1996 there was a particularly high diversity of small crustaceans including two rather rare amphipods,

Management of the lake as a fishery is not incompatible with a thriving invertebrate fauna.

The lake is part of a proposed NHA (Site Code No. 1482).

Furnace Lough is of high conservation value as a unique geomorphological type in Ireland. The presence of a research station on its shores ensures continuous monitoring of environmental conditions. It would be worthwhile taking advantage of this facility to carry out simple monitoring of the invertebrates. Its designation as a proposed SAC is recommended.

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Plate 19.2.1 View of northern end of Furnace Lough showing the Salmon Research Station.

Plate 19.2.2 View of Furnace Lough looking southwest.

Plate 19.2.3 View of northwestern area of Furnace Lough. Station A.

Plate 19.2.4 View of the small pool west of Furnace Lough, Station G

19. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims
The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

19.3.1 Site Description (Fig. 19.3.1)

This is a large lagoon situated at the lower end of a valley which runs down through the Nephin Beg mountain range. The surrounding landscape is rocky with numerous smaller valleys and ridges coming down to the lough shores.

Heath and bog is the dominant vegetation of the area and borders the lough shores to the east and west. Lower-lying pasture occurs on Inishower and borders the lough to the south. Small patches of broad-leaved woodland occur along the northern and southern shores and at the end of a long promontory to the north of Inishower.

An inflow channel at the north western corner brings water into the lough from the larger Lough Feeagh which lies to the north. Several small loughs to the west also supply freshwater to the lagoon. The main inflowing river is the Yellow River, which discharges into the lagoon about half way along its eastern shore.

Shores are generally open and rocky and marginal areas narrow. Phragmites swamp occurs in sheltered areas and as a fringe around two small islands in the south.

The outlet to the sea joins the lough at its southern extremity.

19.3.2 Methods

This site was surveyd by means of transects only. The locality of these is shown in Fig. 19.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

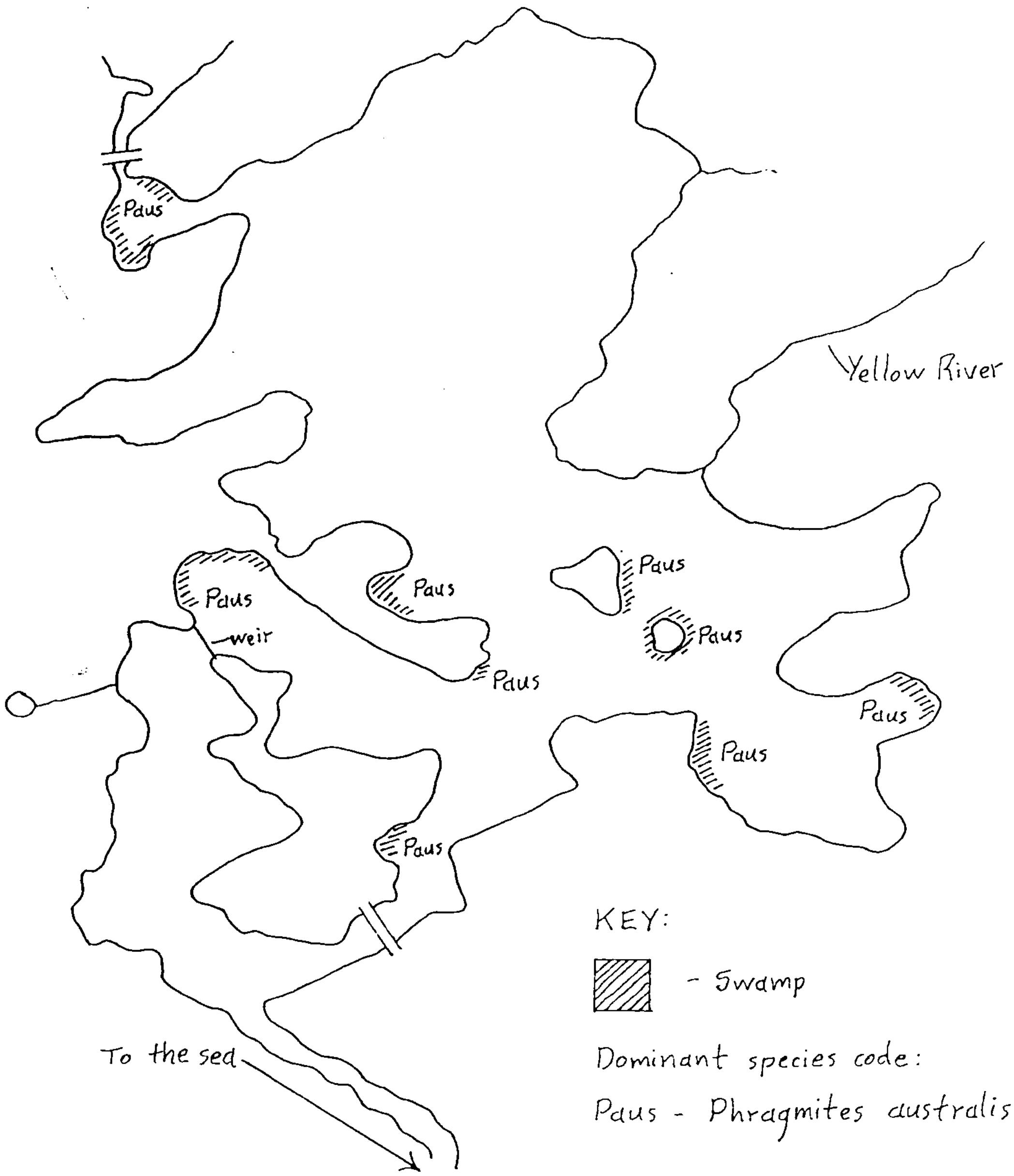

Fig. 19.3.1 Furnace Lough, Co. Mayo - Swamp Vegetation

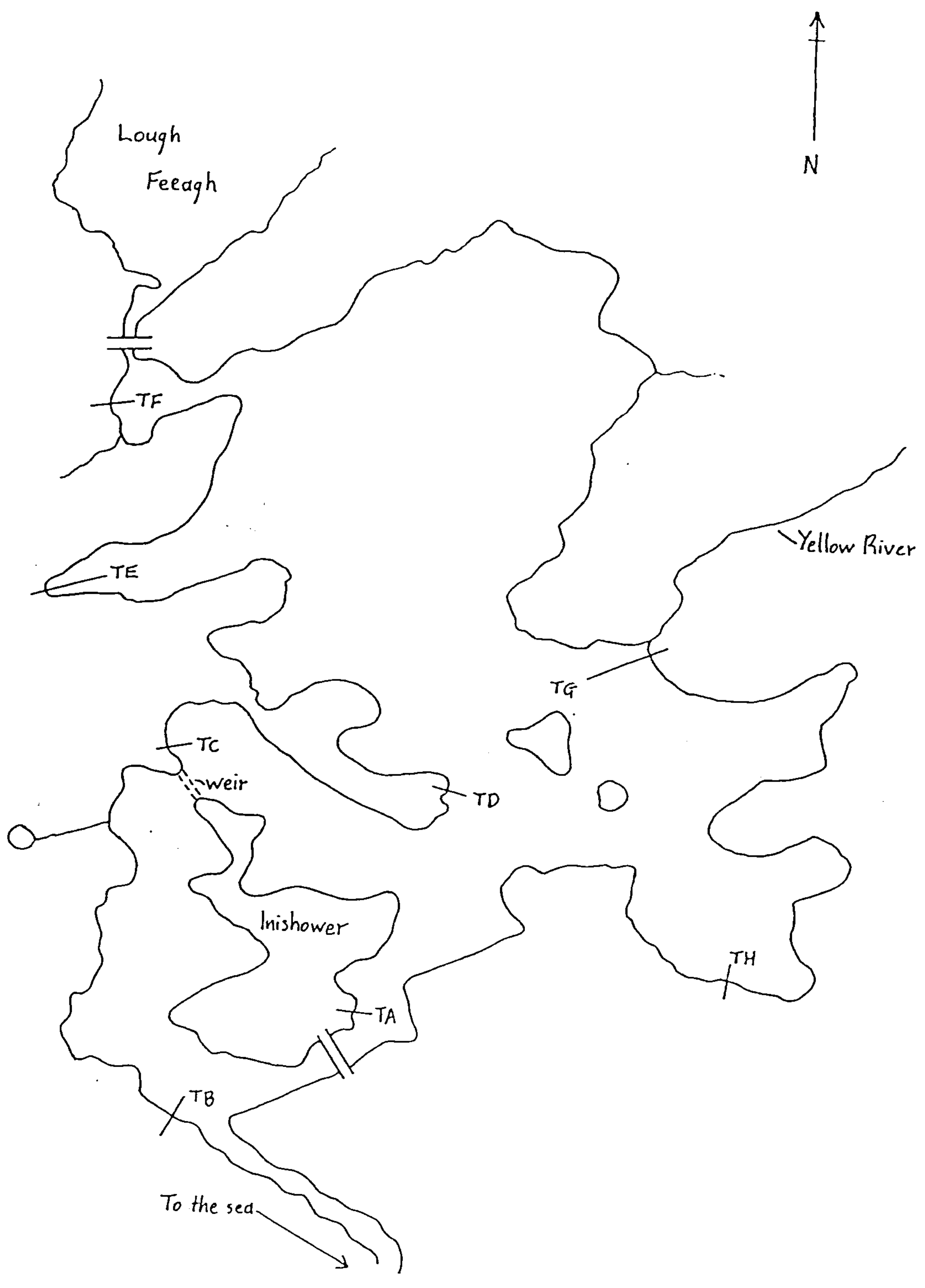

Fig. 19.3.2 Furnace Lough, Co.Mayo: Location of Transects

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values
Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency V	81-100 %
IV	61-80 %
III	41-60 %
II	21-40 %
I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.

Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:

a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;

b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications

Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

19.3.3 Results

Site: **Furnace Lough**	Transect code: A	
Location: Narrow channel near outlet to sea	Sample point: 1 Aquatic - grapnel from shore	
Sample area: Grapnel only	Substrate: Not known	
Depth: 70 cm +	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Potamogeton pectinatus		
Enteromorpha		
Filamentous algae		
Description: Narrow channel (c. 50m wide). No emergent or other marginal vegetation.		
Shore = earth cliff, 80 cm.		
Backing Molinia caerulea - Juncus acutiflorus - Juncus effusus community.		

Site: Furnace Lough	Transect code: B	
Location: Outlet to sea	Sample point: 1 Aquatic - 10m out - grapnel	
Sample area: Grapnel only	Substrate: Boulders, cobbles, gravel	
Depth: 80 cm +	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Fucus sp.		
Enteromorpha		
Filamentous algae		
Description:		

Site: Furnace Lough	Transect code: B	
Location: Outlet to sea	Sample point: 2 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Boulders, cobbles, gravel	
Depth: 20 - 40 cm	Salinity: 20 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Fucus sp.	30	50
Enteromorpha	10	5
Filamentous algae		5
Description: Fairly high algal cover on stony substrate with Fucus dominant. No higher plants present.		

Site: Furnace Lough	Transect code: B	
Location: Outlet to sea	Sample point: 3 Marginal	
Sample area: 10m2 (10x1)	Substrate; Boulders, cobbles, gravel	
Depth: 0 - 20 cm	Salinity: 17 parts per thousand	
NVC community: S19 Eleocharis palustris swamp - Litorella uniflora sub-community		
	Height (cm)	Cover (%)
Total Plant		80
Eleocharis palustris	15	60
Glaux maritima	10	10
Juncus maritimus	50	5
Cochlearia anglica	4	< 1
Litorella uniflora	5	< 1
Description: 1m wide strip species-poor salt tolerant community dominated by Eleocharis palustris with occasional Juncus maritimus tussocks.		

Site: Furnace Lough	Transect code: B	
Location: Outlet to sea	Sample point: 4 Marginal	
Sample area: 16m2 (8x2)	Substrate: Cobbles, clay	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		95
Juncus maritimus	60	30
Juncus gerardii	15	20
Festuca rubra	20	20
Triglochin maritima	10	20
Glaux maritima	10	10
Agrostis stolonifera	15	10
Cochlearia anglica	5	< 1
Description: 2m strip of species-poor salt tolerant vegetation dominated by Juncus gerardii and Festuca rubra with frequent Juncus maritimus tussocks.		
Backing c.75 degree slope up to 1m bank height and grading to Lolium perenne - Holcus lanatus pasture.		

Site: Furnace Lough	Transect code: C	
Location: Weir	Sample point: 1 Aquatic - 1m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: 1m +	Salinity: 17 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Enteromorpha		
Filamentous algae		
Description:		

Site: Furnace Lough	Transect code: C	
Location: Weir	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Boulders, cobbles	
Depth: 50 cm	Salinity: 17 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		90
Phragmites australis	220	90
Description: Dense single species Phragmites swamp forming 10m wide strip on rocky substrate, standing c.2m out from the shoreline. Substrate falls away sharply on loughward side of stand.		

Site: Furnace Lough	Transect code: C	
Location: Weir	Sample point: 3 Marginal	
Sample area: 16m2 (8x2)	Substrate: Boulders, cobbles	
Depth: 0 - 10 cm	Salinity: 17 parts per thousand	
NVC community: S19 Eleocharis palustris swamp - sub-community undetermined		
	Height (cm)	Cover (%)
Total Plant		10
Eleocharis palustris	50	5
Glaux maritima	10	< 5
Triglochin maritima	30	< 1
Juncus articulatus	30	< 1
Samolus valerandi	20	< 1
Description: Sparse Eleocharis dominated community forming 2m wide strip along rocky shore.		
Backing to wet heath vegetation with Sphagnum spp., Molinia caerulea, Calluna vulgaris, Erica tetralix, Trichophorum cespitosum.		

Site: Furnace Lough	Transect code: D	
Location: Exposed promontory head	Sample point: 1 Aquatic - 2m out - grapnel	
Sample area: Grapnel only	Substrate: Cobbles, gravel	
Depth: 70 cm +	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Chara aspera var. aspera		
Enteromorpha		
Filamentous algae		
Description:		

Site: Furnace Lough	Transect code: D	
Location: Exposed promontory head	Sample point: 2 Marginal	
Sample area: 10m2 (10x1)	Substrate: Boulders, cobbles, gravel	
Depth: 0 - 25 cm	Salinity: 4 parts per thousand	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		30
Litorella uniflora	5	25
Isolepes cernua	6	< 5
Agrostis stolonifera	20	< 5
Bare substrate		
Cobbles		60
Boulders		5
Gravel		5
Description: Sparse Litorella dominated shore community forming 1m wide strip, flooded at time of survey.		
Backing steep earth bank (c. 80 degrees to 2.5m height) and Alnus glutinosa - Fraxinus excelsior woodland.		

Site: Furnace Lough	Transect code: E	
Location: Sheltered bay	Sample point: 1 Aquatic - 40m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: 1m +	Salinity: Not known	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Potamogeton pectinatus		
Filamentous algae		
Description:		

Site: Furnace Lough	Transect code: E	
Location: Sheltered bay	Sample point: 2 Aquatic - 20m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: c. 1m	Salinity: Not known	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Enteromorpha		
Filamentous algae		
Description: Same species found by grapnel survey from 10m out and from shore		

Site: Furnace Lough	Transect code: E	
Location: Sheltered bay	Sample point: 3 Marginal	
Sample area: 10m2 (10x1)	Substrate: Sand, boulders	
Depth: 20 cm	Salinity: 5 parts per thousand	
NVC community: S19 Eleocharis palustris swamp - Litorella uniflora sub-community		
	Height (cm)	Cover (%)
Total Plant		50
Eleocharis palustris	25	40
Agrostis stolonifera	15	10
Samolus valerandi	15	< 1
Litorella uniflora	5	< 1
Isolepes cernua	6	< 1
Juncus articulatus	30	< 1
Bare substrate		50
Sand		40
Boulders		10
Description: Eleocharis dominated shore community forming 1m strip around bayhead. Backing 45 degree bank of peat and boulders, backing to wet heath vegetation - dominant species - Calluna vulgaris, Molinia caerulea, Potentilla erecta, Erica tetralix, Sphagnum spp..		

Site: Furnace Lough	Transect code: F	
Location: Inflow from Lough Feagh	Sample point: 1 Aquatic - 7m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: 1m +	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Filamentous algae		
Description:		

Site: Furnace Lough	Transect code: F	
Location: Inflow from Lough Feagh	Sample point: 2 Marginal	
Sample area: 50m2 (10 x 5)	Substrate: Peat	
Depth: 30 cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - sub-community undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	230	100
Agrostis stolonifera	40	< 1
Lythrum salicaria	60	< 1
Mentha aquatica	40	< 1
Hydrocotyle vulgaris	30	< 1
Description: Dense species-poor Phragmites swamp with sparse freshwater associates. 7m.		
Substrate dropping away steeply at loughward edge of swamp.		

Site: **Furnace Lough**	Transect code: F	
Location: Inflow from Lough Feagh	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Peat	
Depth: 0 cm	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	200	80
Molinia caerulea	80	95
Erica erigena	140	5
Myrica gale	100	5
Angelica sylvestris	120	5
Lythrum salicaria	50	< 1
Mentha aquatica	40	< 1
Hydrocotyle vulgaris	30	< 1
Filipendula ulmaria	120	< 1
Potentilla palustris	30	< 1
Osmunda regalis	100	< 1
Description: Dense Phragmites and Molinia co-dominant with sparse fen vegetation		
including shrubby understorey which increases its cover to landward. Extending about 100m		
back from the lough.		
Grading to wet heath vegetation with Molinia, Trichophorum cespitosum,		
Calluna vulgaris, Erica tetralix, Eriophorum angustifolium, Sphagnum spp..		

Site: Furnace Lough	Transect code: G	
Location: Freshwater inflow	Sample point: 1 Aquatic - 100m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: 1m +	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Ruppia sp.		
Chara aspera var. aspera		
Description:		

Site: Furnace Lough	Transect code: G	
Location: Freshwater inflow	Sample point: 3 Aquatic - 25m out	
Sample area: 16m2 (4x4)	Substrate: Gravel	
Depth: 50 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		< 1
Higher Plant		< 1
Ruppia sp.	8	< 1
Algae		< 1
Chara aspera var. aspera	6	< 1
Enteromorpha		< 1
Filamentous algae		< 1
Description: Very sparse low growing Ruppia and algal species. More or less unchanging to about 5m out.		
(No aquatic species found 40-c.80m out)		

Site: Furnace Lough	Transect code: G	
Location: Freshwater inflow	Sample point: 4 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Gravel	
Depth: 40 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Chara aspera var. aspera	6	< 1
Description: Sparse Chara only from 5m out to shore.		

Site: Furnace Lough	Transect code: G	
Location: Freshwater inflow	Sample point: 5 Marginal	
Sample area: 10m2 (10x1)	Substrate: Sandy clay	
Depth: 20 cm	Salinity: 4 parts per thousand	
NVC community: S19 Eleocharis palustris swamp - Litorella uniflora sub-communtiy		
	Height (cm)	Cover (%)
Total Plant		100
Eleocharis palustris	30	50
Agrostis stolonifera	20	40
Litorella uniflora	6	10
Juncus articulatus	30	5
Triglochin palustris	15	< 1
Description: Dense cover of species-poor shoreline vegetation forming 1m wide strip, with		
Eleocharis and Agrostis co-dominant.		
Backing 50cm earth cliff.		
Backing Juncus effusus - Agrostis stolonifera - Potentilla anserina community.		

Site: Furnace Lough	Transect code: H	
Location: Sheltered bay	Sample point: 1 Aquatic - 5m out - grapnel	
Sample area: Grapnel only	Substrate: Boulders, cobbles, gravel	
Depth: 80 cm +	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Potamogeton pectinatus		
Ruppia sp.		
Enteromorpha		
Filamentous algae		
Description:		

Site: Furnace Lough	Transect code: H	
Location: Sheltered bay	Sample point: 2 Marginal	
Sample area: 10m2 (5x2)	Substrate: Boulders, cobbles, gravel	
Depth: 0 - 20 cm	Salinity: 5 parts per thousand	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		25
Agrostis stolonifera	20	15
Eleocharis palustris	40	10
Glaux maritima	10	5
Triglochin maritima	20	< 1
Juncus articulatus	30	< 1
Description: Fairly sparse, open cover of species-poor Eleocharis - Agrostis dominated shoreline community forming strip of 2m width.		
Backing to wet heath vegetation with Molinia caerulea, Calluna vulgaris, Erica tetralix, Myrica gale and Sphagnum spp..		

19.3.4 Evaluation

'Potentially Valuable'

This large, deep lagoon was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared to most other sites.

Ruppia has a wide distribution, being found at all transect sites but that at the mouth of the outlet to the sea. Ruppia maritima occurs here and one sample has been determined as Ruppia c.f. cirrhosa.

Potamogeton pectinatus occurred at two transect sites, one in a sheltered south eastern bay and the other in the narrow channel south of Inishower.

Litorella uniflora occurred at three sites and was associated with an Eleocharis palustris swamp community.

Chara aspera var. aspera was found in two places, an exposed promontory head and the nearby mouth of the Yellow River.

A Fucus species occurred at the mouth of the outlet channel. No aquatic higher plants were found here.

There is little variation in marginal vegetation. Marginal areas are typically narrow and rocky. Phragmites swamp occurs at the inflow from Lough Feeagh, in sheltered bays and fringing the two small southern islands. These are typically of open cover.

Furnace Lough is a site of notable environmental variation. Salinity levels at time of survey were 0-5 parts per thousand in the main body of the lough but rose to 17-20 parts per thousand in the more enclosed south west quarter around the weir north of Inishowen and the outlet channel. This is also a relatively deep lagoon. This survey indicates an interesting species composition. For these reasons, a more thorough survey of its aquatic plant life is desirable.

Full aquatic survey is recommended.

19.4 ECOTONAL COLEOPTERA

J.A. Good Ph.D MIEEM FRES
Terrascope Environmental Consultancy, Riverstick, Co. Cork

19.4.1 Site Description

Large complex brackish low-tidal amplitude lake with modern bridge barrier on one inlet (Plate 1) and abandoned stone trackway with narrow cut channel barriers at another inlet, in drumlin landscape. Lake shore mostly with boulder/cobble/pebble margin or soil cliff and *Schoenoplectus lacustris* and *Phragmites communis* in sheltered shores. One area (Nixon's Is.) with *Alnus glutinosa* carr at shore.

Subsites (Fig 19.4.1)

1. *Alnus glutinosa* foreshore (L 966965) Plates 2 & 3

Sheltered cove backed by *Alnus glutinosa* carr, with *Schoenoplectus lacustris* in offshore standing water, and with grass, *Eleocharis* sp., etc. ground cover. Also area of cobbles covered with bleached filamentous algae.

2. Grass bank (L 966964)

Bank c. 0.7 m above cliff to open standing water with grasses incl. *Molinia carulea*, *Juncus* sp., etc. Surface water-table at high spring tide. Subsite close to inlet bridge (Plate 1).

3. Exposed shore (L 965967)

Cobbles on sandy exposed shore, with pasture bank behind. Flooded during periods of high water. Salinity offshore (14 viii 1996) of 6‰.

19.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

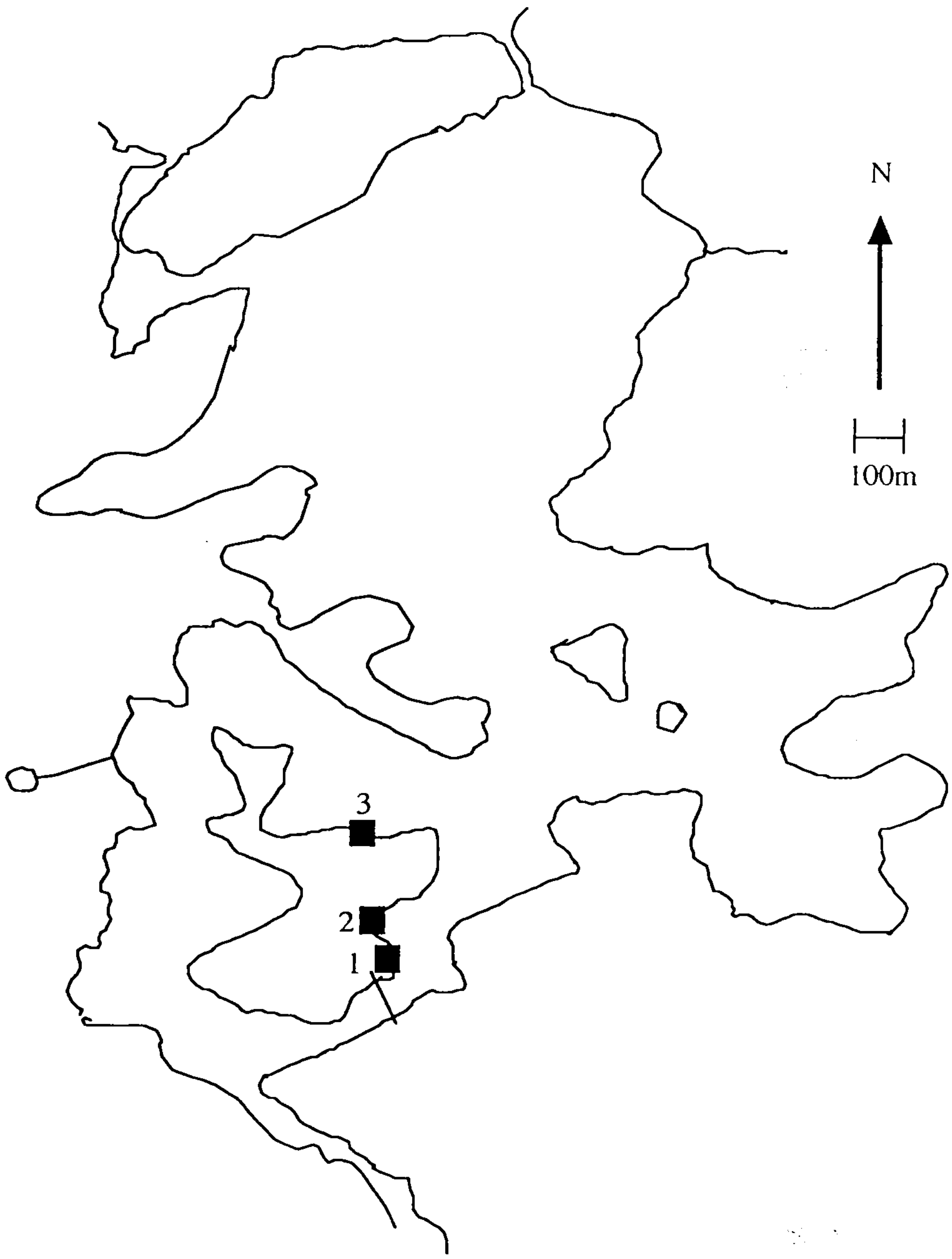

Fig.19.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Furnace Lough, Co. Mayo.

1 - Pitfall traps
2 - Pitfall traps, S-vac, Cobble search
3 - Cobble search

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 19.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held

pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 19.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm depth
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water. Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques
Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is

not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

References
Foster, G.N., Nelson, B.H., Bilton, D.T., Lott, D.A., Merritt, R., Weyl, R.S. and Eyre, M.D. (1992) A classification and evaluation of Irish water beetle assemblages. *Aquat. Conserv. : Mar. Freshw. Ecosyst.* **2**: 185-208.

Good, J.A. and Speight, M.C.D. (1991) Sites of international and national importance for invertebrate fauna - a definition proposed for use in site surveys. *Bull. Ir. biogeog. Soc.* **14**: 48-53.

Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :

(1) *Alnus glutinosa* area - S-vac suction sampler (14 viii 1996), c. 2 m^2;
(2) *Alnus glutinosa* area - 6 plastic pitfall traps with funnels and ethylene glycol preservative (14 viii - 27 ix 1996);
(3) Unvegetated shore near *Scirpus maritimus* area - cobble search (30 cobbles, 14 viii 1996);
(4) Grass bank - 6 plastic pitfall traps (27 ix - 17 x 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins; <u>and</u>, (2) they

are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

19.4.3 Survey Results

Twelve species of carabid and twenty-one species of staphylinid were recorded, none of which are regarded as indicator species (Table 19.4.2).

TABLE 19.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Furnace Lough. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), and Booth (1988) for *Tachyporus dispar*.

Species	No. individuals
Carabidae	
Agonum fuliginosum (Panz.)	1
Agonum gracile (Gyll.)	5
Agonum pelidnum (Payk.)	14
Agonum viduum (Panz.)	1
Elaphrus cupreus Duft.	7
Loricera pilicornis (F.)	3
Nebria brevicollis (F.)	4
Platynus albipes (F.)	14
Pterostichus diligens (Sturm)	2
Pterostichus melanarius (Ill.)	5
Pterostichus niger (Schall.)	16
Pterostichus nigrita (Payk.)	2
Staphylinidae	
Anotylus rugosus (F.)	1
Atheta elongatula (Grav.)	1
Atheta volans (Scriba)	2
Deubelia picina (Aubé)	2
Lesteva sicula Er.	1
Ocypus olens (Müll.)	1
Oxypoda elongatula Aubé	3
Philonthus carbonarius (Grav.)	1
Philonthus cognatus (Steph.)	3
Quedius fuliginosus (Grav.)	1
Quedius molochinus (Grav.)	1
Stenus bifoveolatus Gyll.	15
Stenus brunnipes Steph.	1
Stenus canaliculatus Gyll.	1
Stenus fulvicornis Steph.	1
Stenus juno (Payk.)	10
Stenus nitidiusculus Steph.	13
Stenus similis (Hbst.)	3
Stenus tarsalis Ljungh	1
Tachinus signatus Grav.	6
Tachyporus dispar (Payk.)	1

19.4.4 Evaluation

Of no recorded conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

Indicator species were absent.

19.4.5 References

Booth, R.G. (1988) The identity of *Tachyporus chrysomelinus* (Linnaeus) and the separation of *T. dispar* (Paykull) (Coleoptera; Staphylinidae). *Entomologist* **107**: 127-133.
Lohse, G.A. and Lucht, W.H. (1989) *Die Käfer Mitteleuropas*. **12**. *1. Supplementband mit Katalogteil.* Goecke & Evers, Krefeld.
Lucht, W.H. (1987) *Die Käfer Mitteleuropas. Katalog*. Goecke & Evers, Krefeld.

Plate 1 Bridge over inlet at Furnace Lough, Co. Mayo

Plate 2 Subsite 1 - sheltered cove at Furnace Lough, Co. Mayo

Plate 3 Cobbles covered with algae at Furnace Lough, Co. Mayo

19.5 SUMMARY AND EVALUATION

Furnace Lough is a large (approx. 125 ha), **natural saline lake** with a natural but modified tidal inlet.

It is of great importance as a salmon fishery and its environment and fish populations are closely monitored by the Salmon Research Agency.

The lough is part of a proposed NHA (Site 1482).

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion

Geomorphology	High
Aquatic Fauna	Moderate
Vegetation	Potentially High
Ecotonal Coleoptera	None

Geomorphology

The lough lies in a heavily glaciated area. It is large and deep, reaching 21 m at its inland end, opening to the sea by a modified, shallow tidal inlet. The hydrology of the lough is of interest for the presence of a permanent stratification with a halocline at 1-8 m. It is affected by tides greater than MHWN which flood into it through the short Burrishoole Estuary but their effect is controlled by two weirs. The maximum tidal range is c.50cm. There are considerable variations in salinity both temporally and spatially.

The lough is a good example of a deep, stratified saline lake in a natural state and is therefore rated as of high conservation value.

Aquatic Fauna

Among 35 taxa recorded, 32 were identified to species and three are lagoonal specialists. The fauna comprised marine, euryhaline, oligohaline and freshwater species but only mysids, sphaeromids and flatworms were at all common. The fauna was, however, more diverse than had been expected from results of a previous survey in 1977, when only one species was in any way abundant.

The species assemblage typifies a lagoon with some direct contact with the sea allowing entry of jellyfish, prawns, shrimps, crabs and flatfish. Most of the species are characteristic of brackishwaters in the middle salinity range and those associated with higher or lower salinities were mostly present in low numbers only. Potential colonists from the sea may be inhibited from entering the lake by the two weirs. The relatively low number of oligohaline and freshwater species in such a large system, into which flow a number of streams, is surprising and indicates that tidal waters reach to all parts of the lake. A semi-isolated pool, in which the salinity was lower than the main body of the lake, may act as a refuge for species less tolerant of high salinity from which they can recolonise the lake when conditions become tolerable.

The most interesting features of the fauna were the diversity of *Jaera* and amphipod species. The only previous records of *Leptocheirus pilosus* in Ireland are from Wexford Harbour and brackishwater channels on the North Slob, Co. Wexford. There are only three Irish records for *Lembos longipes*. However, these interesting crustaceans were all confined to the southern end near the sea inlet.

The aquatic fauna is rated as of moderate conservation value based on its relatively high diversity in certain areas and the presence of rare and unexpected crustaceans.

Vegetation

The lake was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared with most other sites.

Ruppia had a wide distribution, being found in all areas except the mouth of the outlet to the sea. *Ruppia maritima* occurred here and one sample has been determined as *Ruppia* c.f. *cirrhosa*. *Potamogeton pectinatus* occurred at two sites. *Chara aspera* var. *aspera* was found in two places. A *Fucus* species was present at the mouth of the outlet channel but no aquatic higher plants were found here.

Marginal areas are typically narrow and rocky and there was little variation in marginal vegetation. *Litorella uniflora* occurred at three sites and was associated with an *Eleocharis palustris* swamp community. *Phragmites* swamp occurred at the inflow from Lough Feeagh, in sheltered bays and fringing the two small southern islands. These are typically of open cover.

This survey indicates an interesting species composition and a more thorough survey of its aquatic plant life is desirable. It is therefore rated as of potentially high conservation value.

Ecotonal Coleoptera

Twelve species of carabid and twenty-one species of staphylinid were recorded, none of which are regarded as indicator species.

The lake is therefore rated as of no conservation value for ecotonal Coleoptera.

Summary

Furnace Lough is a large, **natural saline lake** with a natural but modified tidal inlet. It resembles a sea lough but is unusual in being permanently stratified.

The aquatic fauna was poor throughout the main body of the lake but more diverse than indicated by previous studies with a high diversity of crustaceans near the inlet.

The vegetation survey indicated an interesting species composition but further study of the aquatics is needed.

The lake is of great importance as a salmon fishery and its environment and fish populations are closely monitored by the Salmon Research Agency. It would be worthwhile taking advantage of this facility to carry out simple monitoring of the invertebrates and further investigations of the aquatic flora. Management of the lake as a fishery is not incompatible with a thriving invertebrate fauna.

The lake is of high conservation value as a unique geomorphological type in Ireland and the presence of a research station on its shores ensures continuous monitoring of environmental conditions Overall it is rated as of high conservation value and its designation as a proposed SAC is recommended.

COASTAL LAGOONS IN THE REPUBLIC OF IRELAND

VOLUME III

20. DURNESH LOUGH

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20. DURNESH LOUGH

CONTENTS

20. DURNESH LOUGH, Co. Donegal.

20.1 STUDY AREA

OS Grid Reference: G 878 695 1:50,000 Sheet No.11
Alternative names:

General features

Durnesh Lough is located in the eastern part of Donegal Bay, 10 km north of Ballyshannon and 5 km east of Ballintra (Fig. 20.1.1). The lake is impounded by a barrier of high sand-dunes which have filled the gap between two drumlins. A channel and then a pipe runs through the dunes which allows water to drain from the lake and for seawater to enter at least during spring tides and storms. The surrounding area consists of sandhills, sand covered drumlins, extensive reedbeds and large areas of wet grassland. Main activities affecting the lake are wildfowling, some reed cutting for thatch, cattle grazing on the wet grasslands and some angling.

The lagoon is regarded as one of the most important wildfowl sites in Donegal and at times holds internationally important numbers of Scaup (*Aythya marila*) and Greenland White-fronted Goose (*Anser albifrons flavirostris*) and regionally or locally important numbers of all three species of swans and several other species of waterfowl. Bewick's swans (*Cygnus bewickii*), Whooper swans (*Cygnus cygnus*) and Greenland White-fronted geese are all Annex I species of the Birds Directive.

The lake is a proposed NHA (Site Code No. 000138).

Climate and oceanographic influences

(Climatic data are taken from Rohan 1986 and The Royal Irish Academy Atlas of Ireland 1979)

The region experiences a mild oceanic climate with a small annual temperature range of only 8°C and frequent cyclonic depressions accompanied by rain and strong winds. The mean daily air temperature is 5.5 °C in January and 14.5 °C in July. The growing season (the period of mean daily air temperatures above 6 °C) is 8 months and as snow and frosts are rare, some plant growth is possible in winter months. Annual rainfall is approximately 1200 mm, and the number of rain days (1 mm or more) is 175-200. Winds are mainly from the SW. Mean annual hourly wind speeds are between 7-8 m/s and a maximum wind speed of 50 m/s is estimated to occur once in 50 years. The daily duration of bright sunshine averages hours. Mean relative humidity is around 85% as on all Irish coasts.

Marine processes in the area are dominated by long period Atlantic swell waves with median wave heights of 1.5-3.0 m and frequent cyclonic depressions which produce large waves, inshore breakers commonly exceeding 8 m (Carter 1992). Maximum wave heights (averaging once in 50 years) are 30-35 m (Couper 1984). Tides are semi-diurnal and the tidal range (MHWS-MLWS) Donegal Bay is 3.0 m (Admiralty Tide Tables). Sea temperatures are lowest in February and highest in August.

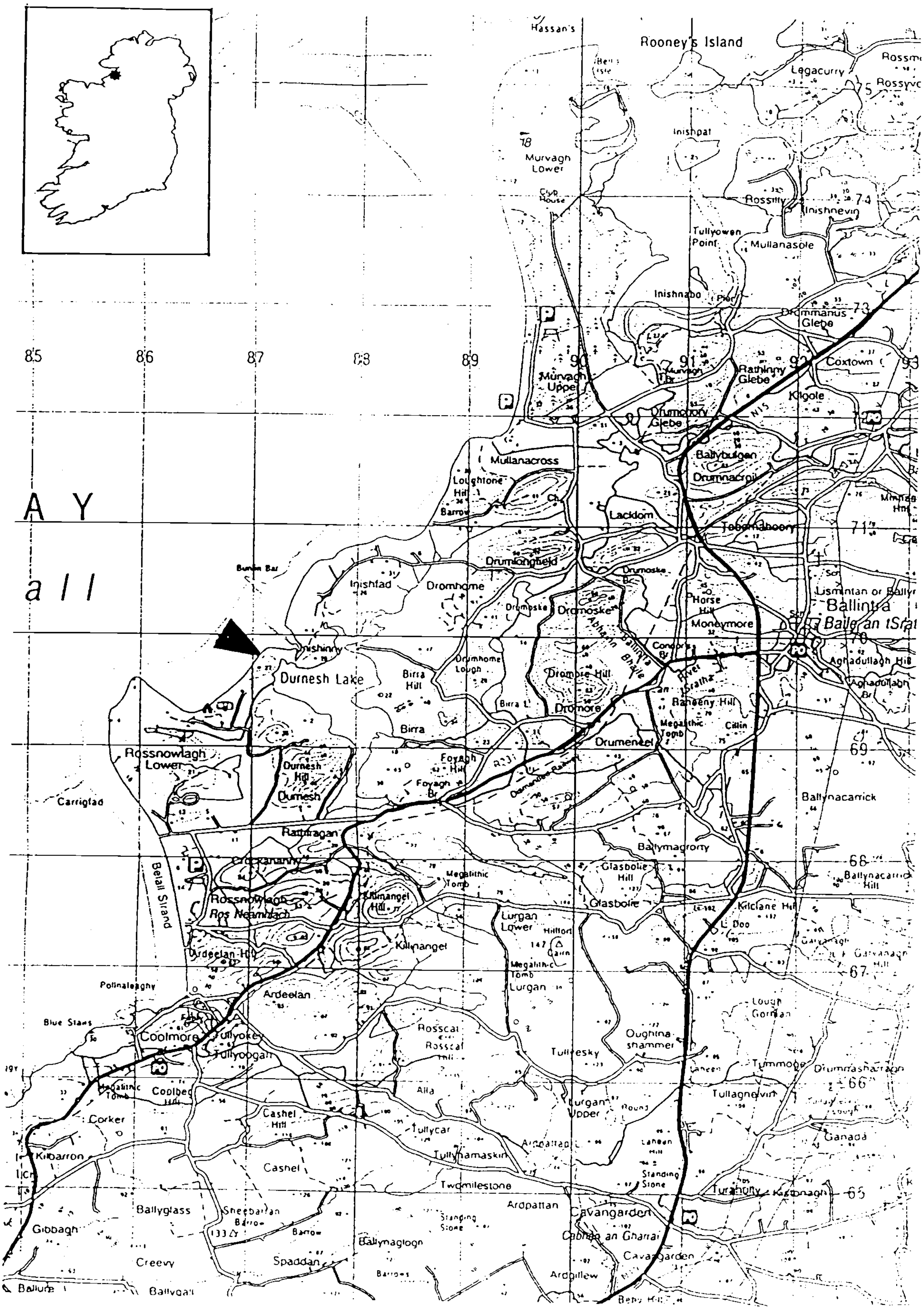

Fig. 20.1.1 Section of 1:50 000 map showing locality of Durnesh Lake

Landscape and Geology The underlying geology is limestone but this is covered by a thick layer of heavy clay drift. The area contains numerous drumlins, parent material is shale and Old Red Sandstone, and soils are mostly gleys, peaty gleys, inter-drumlin peat and acid brown earths (Royal Irish Academy, 1979)

Lake Topography The lagoon is almost 2 km from north to south, approximately 1 km at its widest point and covers approximately 70 ha. The lake is shallow with both stony and muddy shores but most of the bed of the lake is sand with occasional patches of stone.

Hydrology Small rivers enter the lake at several points along the shoreline of the lake related to the valleys formed between drumlins. The lake was apparently tidal in the past, but is now impounded by sandhills. A sophisticated channel and pipe with flap sluice through the dunes has been constructed. The most recent construction is said to date from the 1920s. Seawater flows through the channel to the lake, at least during spring tides.

Salinity and water quality Despite the fact that seawater enters at regular intervals, the lake is also likely to receive large volumes of freshwater runoff from the surrounding land. Salinity levels are likely to vary considerably, both spatially and temporally, depending on precipitation and tides. Generally salinity levels are likely to be relatively low throughout the year with a tendency to increase during the summer.

The lake is shallow and the surrounding land is heavily grazed in places. Farm effluents could cause problems of eutrophication, especially at the southern end.

20.2 AQUATIC FAUNA

Brenda Healy, Geoff Oliver. Dept. of Zoology, University College Dublin

20.2.1 Methods

Environmental variables

Water depths were measured using a plumbline from an inflatable dinghy.

The position of each sample area was determined using a GPS Personal Navigator (Global Positioning Satellite, Garmin GPS 45). Manufacturers of the GPS state that positions can be determined to within 15 meters. It is therefore possible not only to mark the position of sample areas but also to record changes in the extent of vegetation and in the morphometry of the barrier and inlets. Names and spellings used are taken from the Discovery Series 1:50,000 O.S. map and grid references refer to the centre of the site.

At each sampling station the depth of water and substrate type were recorded, and salinity was measured using a salinity refractometer (No. 1270, Chemlab, U.K., 1‰ precision). A photographic record was made of the site and local information sought concerning the background and recent history.

Faunal Sampling

Faunal samples were collected by a combination of sweepnetting (mesh size 0.5 mm), sieving of sediment (1 mm mesh) and close inspection of stones and vegetation for one hour at each station. Perspex light-traps were left overnight at certain stations. These consisted of a perspex box (25x25x25 cm) containing a chemical light which glowed for 8 hours. The boxes were constructed in the Zoology Dept. at U.C.D. according to the model described by Holmes & O'Connor (1988). Faunal samples were preserved in 70% alcohol and stored for subsequent sorting and identification.

Fyke nets were used at stations A, B, C and F in order to gain additional information concerning larger fish species which would not be recorded using the above methods. Standard procedure was that followed by Moriarty (1975) and Poole (1994). The nets used are referred to as summer fyke nets and consist of two traps, facing each other, joined by a leader net, mesh size 16 mm. The trap at each end consists of two chambers and a cod end with knot to knot mesh sizes of 16, 12 and 10 mm., respectively. Nets were generally placed at right angles to freshwater inflows or tidal inlets in order to trap fish swimming from either direction. All fish were recorded and returned alive whenever possible.

Limitations of Sampling Methods and Species Determination

All sampling methods used in the survey are affected by many environmental and biotic variables including season, state of the tide, weather, nature of the habitat and life cycles of the species involved. It is therefore difficult to make quantitative comparisons between lagoons, or even between stations within the same lagoon, as they are sampled at different times and often with a different sampling method. The

Table 20.2.1. Fauna Recorded at Durnesh Lake, Co. Donegal. June and September 1996.

Fauna		Sampling Stations (L.T. = light-trap)												
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	L.T.E	F	L.T.F	G
Porifera														
Cnidaria	*Cordylophora caspia*	a		c		c		+						c
Turbellaria														
Nemertea														
Annelida														
Crustacea														
Ostracoda												a		
Copepoda	*Eurytemora sp.*											a		
Cirripedia														
Mysidacea	*Neomysis integer*	o	18	o		o	?	o	3	c	>100	+		+
Isopoda	*Idotea baltica*		1											
	Jaera nordmanni	c		c		c								
Amphipoda	*Gammarus chevreuxi*	a	a	a	a	a	a	a	c	c	c	c	c	c
Tanaidacea														
Decapoda	*Carcinus maenas*	F, 2		F, 2		F, 1								
	Crangon crangon	1	1											
	Palaemonetes varians	o		c		c	75	c	4	o	5	+	1	c
Arachnida														
Insecta														
Thysanura														
Ephemeroptera												2		
Odonata	*Ischnura elegans*	+		c		o		c		o		c	1	
Plecoptera		+												
Trichoptera	(cases)					c								
Hemiptera	Corixidae	+		c		c	c	+	1	a	a	a	+	
	Callicorixa praeusta			+		c		+	+	c	c	c	+	
	Corixa panzeri	c				c	c	+	+	+	c	+	+	
	Hesperocorixa linnaei					c								
	Arctocorisa germari									+				
	Sigara dorsalis			+					+	+	+	+	+	
	S. falleni										+	+	+	
	S. stagnalis	c		+		+		c		+	+	+		
Coleoptera				1		1		c		c		+		
	Anacaena globulus	+												
	Graptodytes granularis	+												
	Gyrinus aeratus									+				
	**Helophorus brevipalpis*													
	**Hydroporus angustatus*													
	**H. gyllenhalli*													
	**H. incognitus*													
	H. memnonius	+												
	H. palustris							+		+				
	H. planus									+				
	H. pubescens									+				
	H. striola							+						
	H. umbrosus	+												

+ = present; o = occasional; c = common; a = abundant; F = fyke net
* = Station not known

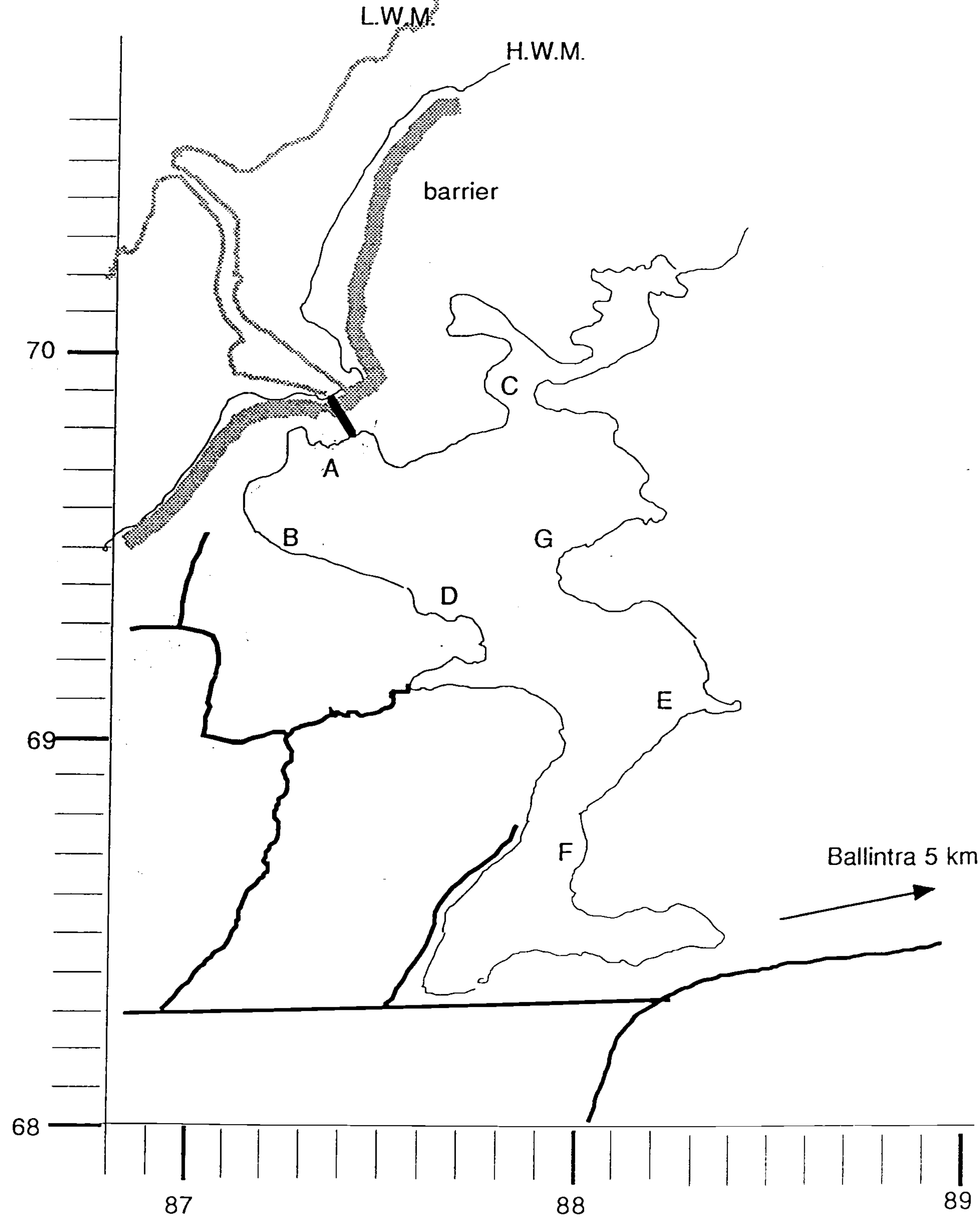

Fig 20.2.1 Location Map of Sampling Stations in Durnesh Lake, Co. Donegal.

Table 20.2.1. cont.. Fauna Recorded at Durnesh Lake, Co. Donegal. June and September 1996.

Fauna	Sampling Stations (L.T. = light-trap)													
		A	L.T.A	B	L.T.B	C	L.T.C	D	L.T.D	E	L.T.E	F	L.T.F	G
Coleoptera cont.	*Hygrotus impressopunctatus*								+	+				
	H. inaequalis	+						+		+				
	**Laccophilus minutus*													
	Noterus clavicornis									+				
Diptera	Chironomidae	c		o		+		a		?		a	>1000	
Mollusca														
Prosobranchia	*Potamopyrgus antipodarum*	c		a		a		c		c		c		o
Pulmonata	*Lymnaea peregra*	+		1				o		3		o		
	Planorbis corneus							1						
	Sementina complanata											+		
Opisthobranchia														
Bivalvia														
Bryozoa														
Echinodermata														
Tunicata														
Teleostei	*Anguilla anguilla*	+				F, 9						F, 6		
	Gasterosteus aculeatus	+		+		+	2	+	3	0				
	Mugilidae	F, 1												
	Platichthys flesus	F, 21		F, 18		F, 20						F, 1		
	Salmo trutta					F, 1								

+ = present; o = occasional; c = common; a = abundant; F = fyke net
* = Station not known

results of the light-traps come closest to quantitative sampling, but even these are affected by inter- and intra-specific relationships of the fauna and the non-random distribution within the water column. Abundance categories of present, common and abundant are purely subjective, and absolute numbers vary between taxa.

Several faunal groups were sorted and distributed to specialists. Standard keys were used to identify remaining specimens, but many of these were larval or juvenile stages and difficult to identify with certainty. Some groups require adult males for identification and these were often not available due to low population density and the limited number of individuals collected in the time available (eg *Jaera*, hydrobiids).

All Diptera are identified to family level. All Odonata positively identified were *Ischnura elegans* and it is assumed that early instars of this group were of the same species.

20.2.2 Results

Durnesh Lough was sampled on 18.vi.96 during the first part of the survey, and from 24-26.ix.96 during the more intensive survey. Positions of the sampling stations are shown in Fig. 20.2.1.

Environmental Variables

Station A (OS 8741 6975) was located in the northwest corner near the outlet from the lake (Plate 20.2.3). Water depth varied from 0 - 60 cm, substrate was mostly sand with stones along the shoreline. Salinity of the outflowing water measured 0 - 2‰ at the time of sampling, but up to 19 ‰ was recorded by J. Good on 26 ix 96 following a spring tide.

Station B (OS 8723 6950) was located on the southern shore where freshwater discharges into the lake (Plate 20.2.4). Substrate consisted of sand, water depth varied from 30 - 60 cm and salinity measured 0 ‰.

Station C (OS 8781 6988) was located in the northern corner of the lake (Plate 20.2.5). Water depth varied from 25 - 50 cm, substrate was a mixture of sand, peat, silt and stones, and salinity measured 0 ‰.

Station D (OS 8767 6930) was located on the southwestern shoreline. Depth varied from 15 - 35 cms, substrate was sand and cobbles and salinity measured 0‰

Station E (OS 8837 6920) was located on the eastern shore bordered by wet grassland (Plate 20.2.6). Substrate consisted of sand, silt and peat with occasional stones. Cattle use this area and the ground was heavily poached and manured. Water depth varied from 10 - 30 cms and salinity measured 0‰

Station F (OS 8805 6873) was located at the southern end in an arm of the lake choked with pondweed. Water depth varied from 50 - 125 cms, substrate consisted of silty sand with soft organic mud and occasional large stones. Salinity measured 0‰.

Station G (OS G 8799 6944 was located on the northeastern shore where a point formed by a drumlin extends into the lake. Substrate consisted largely of cobbles of various sizes derived from the drumlin with pockets of sand and silt. Where depth varied from 0 - 50 cms and salinity measured 0 ‰.

Fauna

The species recorded at the different stations, using all sampling methods, are listed in Table 20.2.1. Among 46 taxa listed, 43 are identified to species. The list comprises 3 poly-mesohaline species, 10 euryhaline, 2 oligo-mesohaline, and 27 limnic species (Table 20.2.2). Two of the species are listed as a lagoonal specialists in Britain (Davidson et al. 1991).

Most species were widely distributed in the lake, reflected the absence of a salinity gradient and the similarity of habitats at the different stations. Beetles, however, are only recorded for A, D and E. Only *Crangon* and the cryptic species *Jaera nordmanni,* had a more restricted distribution, the latter being confined to the western stony shores. The most abundant species were *Gammarus chevreuxi* and *Potamopyrgus antipodarum.*
Ostracods, copepods and chironomids were extremely abundant in the light trap at F.

No details of site locations are at present available for beetle species marked with an asterisk.

Table 20.2.2 Ecological categories of the recorded taxa in Durnesh Lough. L = lagoonal specialist according to Davidson *et al.* (1991)

Marine	None	
Poly-mesohaline	*Idotea baltica*	
	Crangon crangon	
	Mugilidae	
Euryhaline	*Cordylophora caspia*	
	Neomysis integer	
	Jaera nordmanni	
	Gammarus chevreuxi	L
	Palaemonetes varians	L
	Carcinus maenas	
	Sigara stagnalis	L
	Anguilla anguilla	
	Gasterosteus aculeatus	
	Platichthys flesus	
Oligo-mesohaline	*Ischnura elegans*	
	Potamopyrgus antipodarum	

Cont....

Table 20.2.2 cont.

Limnic

Callicorixa praeusta
Corixa panzeri
Hesperocorixa linnaei
Arcocorisa germari
Sigara dorsalis
S. falleni
Anacaena globulus
Graptodytes granularis
Gyrinus aeratus
Helophorus brevipalpis
Hydroporus angustatus
H. gyllenhalli
H. incognitus
H. memnonius
H. palustris
H. planus
H. pubescens
H. striola
H. umbrosus
Hygrotus impressipunctatus
H. inaequalis
Laccophilus minutus
Noterus clavicornis
Lymnaea peregra
Planorbis corneus
Sementina complanata
Salmo trutta

20.2.3 Discussion

The assemblage typifies an isolated lagoon with restricted access for both sea water and colonists from the sea. The presence of a sluice and a long, narrow, artificial outlet to the sea, obviously restrict the entry of marine species but a few manage to gain access and juvenile flounder, which presumably entered in the current year, were quite plentiful. The majority of the recorded species are characteristic of medium to low salinities and a few are normally considered to be freshwater species.

The lake is notable for the abundance of *Gammarus chevreuxi* and the diversity of corixids (7 spp.) and beetles (13 spp.). Six of the beetles were not recorded at any other site during this survey. Trout *Salmo trutta* were only recorded at this site and at L. Gill during the survey.

This was the only lagoon visited in 1996 in which the brackishwater hydroid *Cordylophora caspia* was found although the species was reported from Lady's Island Lake, Co. Wexford by Healy *et al.* (1982) and was found during this survey at Rostellan Lake. There are only two previous records of *Gammarus chevreuxi* in Ireland: a report by Spooner in the Plymouth Marine Fauna (1957) giving the locality as "NE Ireland (rarely)", and a subsequent report by Pinkster (1978). The species is widespread in Europe in brackish habitats and is listed as a lagoonal specialist in Britain by Davidson *et al.* (1991), but it was abundant in 0‰ in this lake. Costello *et al.* (1990) list it as a species for which Irish records require confirmation.

20.2.4 Threats

Some parts of the surrounding land are heavily grazed and farm effluents could cause eutrophication.

There is a large camp site nearby and there may be plans to increase tourist amenities.

No other threats were apparent.

20.2.5 Evaluation

Durnesh Lough is **natural sedimentary lagoon** and is therefore of international importance based on geomorphology, although its outlet is artificial.

Ornithologically, the lake holds internationally important numbers of wintering Scaup and White-fronted Geese and nationally important numbers of swans.

The lake lies behind a natural sand dune barrier but its present brackish nature may be entirely due to the presence of the artificial outlet.

The aquatic faunal assemblage, which was diverse, with a high proportion of freahwater insect species but only 3 lagoonal specialists. It typified an isolated lagoon with persistently low salinity and restricted access for both seawater and colonists from the sea.

Seven species were not recorded at other sites. One of the lagoonal specialists, *Gammarus chevreuxi*, considered to be very rare in Ireland, was very abundant throughout the lake.

The surrounding land is a proposed NHA (Site Code No. 138).

In spite of the artificial nature of the outlet, the lake and its barrier are worth conserving on geomorphological grounds and for the presence of a healthy invertebrate community which includes an important population of a rare species. The outlet channel is of interest as an example of industrial archaeology.

Designation as a proposed SAC is recommended.

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20. 3 VEGETATION SURVEY

Pat Hatch, Sherkin Island Co. Cork

Aims

The aim of this survey is to describe the vegetation of each site in such a way as to facilitate its subsequent assessment and consideration for legal protection.

20.3.1 Site Description (Fig. 20.3.1)

This is a large lagoon set amongst pastoral farmland on low hills.

Swamp vegetation, often fairly extensive, is dominant in marginal areas in the southern half of the site and around freshwater inflows in the north east and north west corners. Elsewhere, shores are more open with short rock-strewn stretches and areas of low earth cliff along the eastern shore.

Shores are more or less shallowly sloping, but narrow, with adjacent land generally rising quickly to the surrounding hills.

Freshwater inflows join the lagoon from the north east, north west and south east. A pipe runs beneath the dunes to the north east and joins the lagoons waters with those of the sea beyond.

7.3.2 Methods

This site was surveyed by means of transects only. The locality of these is shown in Fig. 20.3.2.

Each transect ran from the aquatic zone, through adjacent marginal areas, to the adjacent habitat. Aquatic and marginal areas were sampled using quadrats or releves and the adjacent habitat described.

The position of aquatic samples, particularly their distance from the shore, was dependent on water depth and, in some cases, on the depth of soft substrates. A transect normally extended as far into the lagoon as depth would allow. Sample area was the area clearly visible from one point.

One sample was taken at each aquatic sampling point along the transect. All plant species present in the sample area were recorded. The average height and percentage cover of each species were estimated and recorded together with the total plant, higher plant and algal cover.

At the aquatic end of each transect a grapnel was used to attempt to locate additional species and these were recorded. Where no additional species were found the grapnel survey was not recorded. In some cases, the grapnel was the sole method of aquatic survey due to water depth or poor visibility. Here, of course, the results were a species list only with no cover data. The reach of the grapnel was 10 metres.

Plate 20.2.1 View of outlet channel and pipe through the barrier of Durnesh Lake.

Plate 20.2.2 View of Durnesh Lake looking south along outlet channel.

Plate 20.2.3 View of northern area of Durnesh Lake near outlet channel, Station A

Plate 20.2.4 View of Durnesh Lake looking southeast from barrier, Station B

Plate 20.2.5 View of northeast corner of Durnesh Lake , Station C

Plate 20.2.6 View of southeast area of Durnesh Lake, Station E

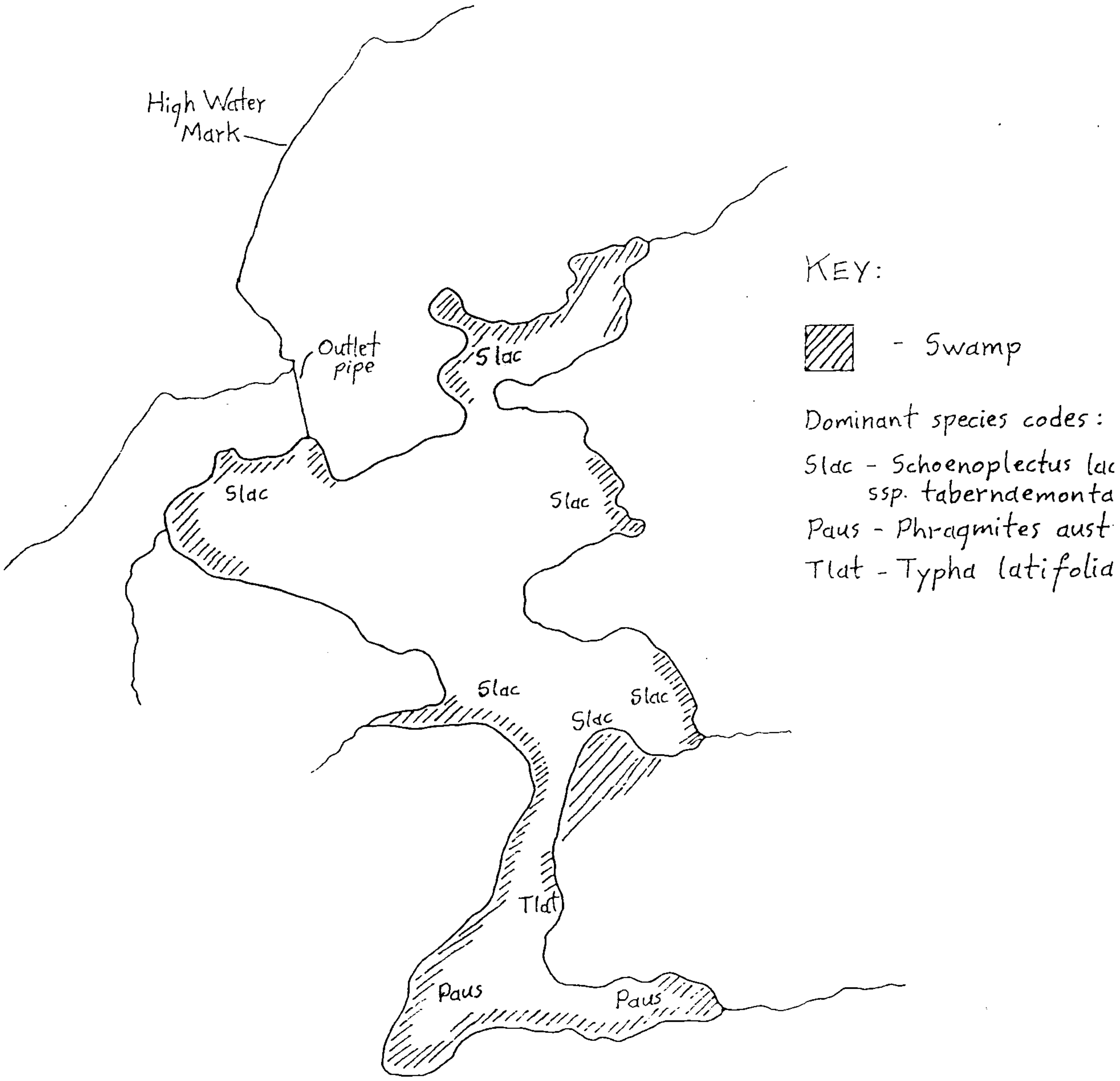

Fig. 20.3.1 Durnesh Lake, Co. Donegal - Swamp Vegetation

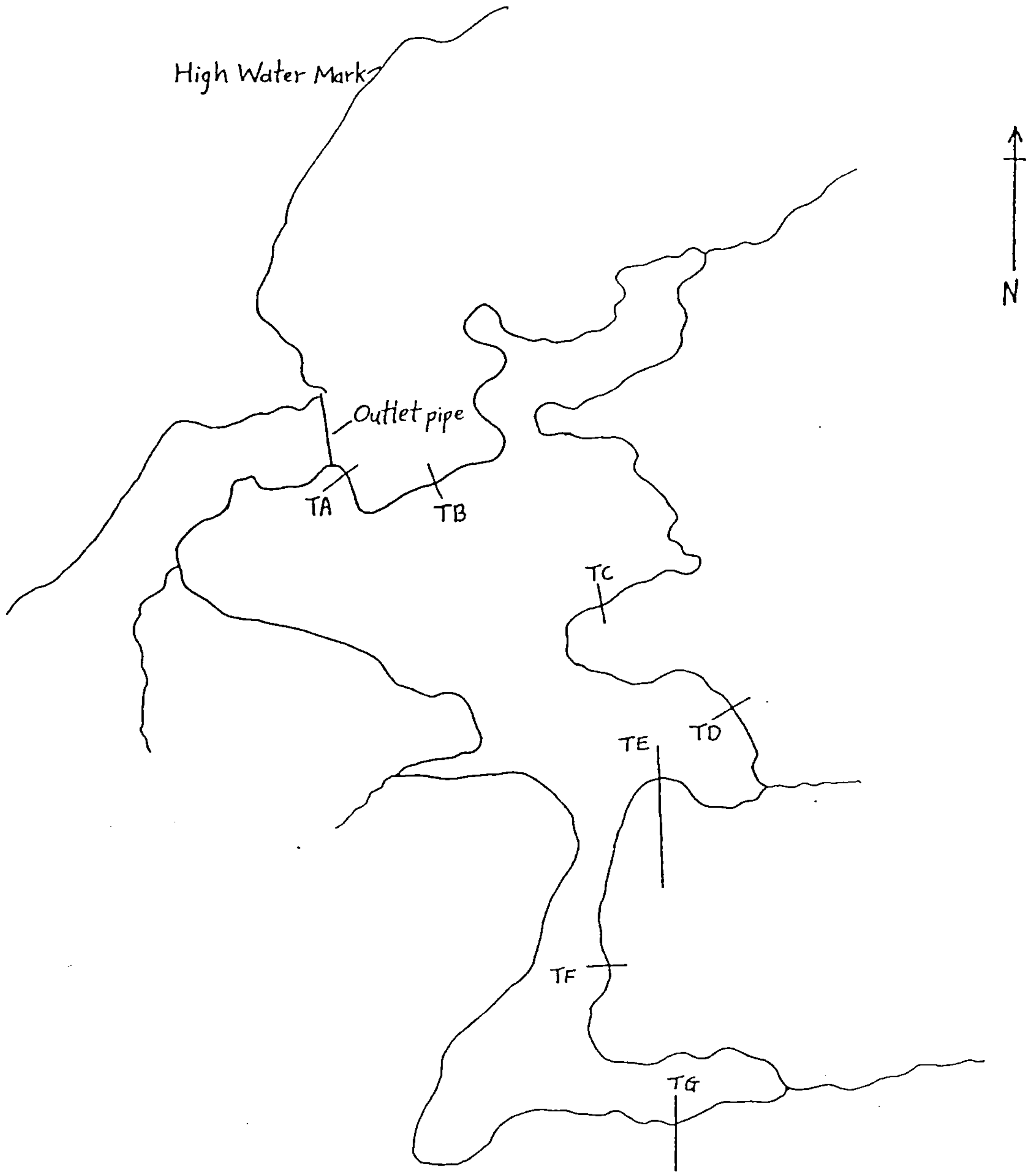

Fig. 20.3.2 Durnesh Lake, Co. Donegal: Location of Transects

At each aquatic sample point measurements were taken of salinity (using a hand refractometer) and water depth. The nature of the substrate was also recorded. The position of each aquatic sample was recorded as 'x metres out', meaning so many metres out from the shore. For the purposes of this survey, 'the shore' is defined as the marginal vegetation line. This can be both the loughward edge of a swamp and the loughward edge of saltmarsh vegetation with 50 metres of bare sand between it and the waters edge at time of survey. It was felt that this location method was more accurate and made sample areas more re-locatable than one related to, for instance, high water mark, as this is difficult to establish at many sites.

In the marginal areas through which each transect passed, homogeneous stands of vegetation were identified and sampled using quadrats or releves. Sample area was generally 100m2 for single species and particularly species-poor stands and 16m2 for other stands. Sample shape varied according to the shape and size of the stand. For example, many marginal stands were narrow strips. All plant species in the sample area, their average height and percentage cover were recorded.

Salinity and water depth were measured and recorded where appropriate. Salinity readings for marginal swamps were taken at the midway point along that part of the transect.

Representative examples of every marginal community encountered during the course of the survey were sampled using British National Vegetation Classification (NVC) methods for the purpose of subsequent classification. This involved the taking of five quadrats in each community and the recording of percentage cover (using the Domin scale) and the calculation of frequency for each species:

Cover/Abundance Values

Each species in a sample is given a percentage cover value according to the Domin scale as follows:

Domin . 10	91-100 %		
9	76-90 %		
8	51-75 %		
7	34-50 %		
6	26-33 %		
5	11-25 %		
4	4-10 %		
3	<4 %	-	many individuals
2	<4 %	-	several individuals
1	<4 %	-	few individuals

Frequency Values

Frequency of each species within the total number of samples is expressed as follows:

Frequency	V	81-100 %
	IV	61-80 %
	III	41-60 %
	II	21-40 %
	I	1-20 %

Note: The NVC volume covering saltmarsh communities was not available at the time of this survey. Therefore, these communities have not been determined.
Swamp communities were determined according to the NVC 'Swamps and Tall Herb Fen' volume.

Representative examples were used as there was insufficient time to sample each community at every site where it occurred in this way. The resulting data are presented in an appendix to this report.

Each aquatic and marginal transect sample is presented here in table form, with a brief description covering dominant species, stand structure and physiognomy.

The locations of transects within each site were selected to represent the degree of variation therein. Variation in marginal zone floristics, aquatic floristics and shore and aquatic substrate were taken into account. Transects were located at the outlet to the sea (where present) and the major freshwater inflow (where present) as a matter of course.

Adjacent habitat and land use was described in general terms and dominant species recorded.

A brief site description was written for each lagoon.

Constraints

Time. Restrictions on the time available in which to carry out this survey had the following consequences:
a). The five largest lagoons were surveyed using transects only as there was insufficient time to carry out a full shore-based survey;
b). Marginal NVC survey was carried out on representative stands only (see 'Methodology').

Resources. No boats were available for survey purposes. This is one reason why this is primarily a shore-based survey.

Safety. Considerations of personal safety, in view of the fact that the surveyor was working alone, meant that, with one exception, no dives were undertaken. This is the second reason for the restriction of this survey, in the main, to the lagoon shores.

Identifications
Ruppia species were identified by Pat Hatch and by Jim Ryan, National Parks & Wildlife Service

Charophytes were identified by Pat Hatch and by Jim Ryan, NPWS

Filamentous green algae: due to the difficulty in obtaining determinations, filamentous green algae is recorded in this report as 'filamentous algae'. Larger *Enteromorpha* is recorded simply as '*Enteromorpha*'.

Other algal species were identified by Helen Fazakerley, Phycology Dept., University College Galway and Michael Guiry, Professor of Botany, University College Galway

Nomenclature

Scientific names of vascular plants in this report are in accordance with Clapham, Tutin & Warburg, 'Excursion Flora of the British Isles' (Third Edition). Scientific names of charophytes are according to N.F. Stewart and J.M. Church, 'Red Data Books of Britain and Ireland: Stoneworts' (1992).

Evaluation

This section comprises a brief summary of the survey findings for each site, a grading of each site according to specified criteria and recommendations for further survey.

The criteria employed in the assessment and grading of each site are species composition, diversity and abundance, the presence of rare species and whether or not a site is representative of a certain 'type'. Both aquatic species and marginal communities are taken into account, though particular importance is put on aquatic macrophytes. Due to the difficulties in obtaining determinations for filamentous green algae, such species have not been taken into account here. Sites are graded as 'Valuable', 'Potentially Valuable' and 'Not Valuable'.

A *'Valuable' site* is one that is shown to be of particular interest and that is considered to be worthy of conservation/protection.

A *'Potentially Valuable' site* is one which this survey indicates may be of interest and which may prove to be valuable following further survey.

A *'Not Valuable' site* is one that is shown to be of little or no interest.

The fact that this is primarily a shore-based survey and not a full aquatic survey (see 'Constraints') makes a complete assessment of many sites impossible. Further aquatic survey of sites where recommended is to be encouraged.

20.3.3 Results

Site: **Durnesh Lake**	Transect code: A	
Location: Outlet to sea	Sample Point: 1 Aquatic - 50m out	
Sample area: 16m2 (4 x 4)	Substrate: Sand	
Depth: 60cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		80
Higher Plant		80
Ruppia sp.	6	80
Description: Fairly dense, low growing Ruppia.		

Site: **Durnesh Lake**	Transect code: A	
Location: Outlet to sea	Sample point: 2 Marginal	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 50cm	Salinity: 5 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		70
Higher Plant		70
Schoenoplectus lacustris ssp tabernaemontani	140	10
Ruppia sp.	10	60
Algae		1
Enteromorpha		1
Description: Sparse S. lacustris swamp extending from about 8 - 28m out from shoreline. Extensive low growing Ruppia, some in flower and in fruit. Enteromorpha restricted to free-floating Fucoid algae.		

Site: Durnesh Lake	Transect code: A	
Location: Outlet to sea	Sample point: 3 Marginal	
Sample area: 80m2 (10x8)	Substrate: Sand	
Depth: 0 - 30cm	Salinity: 5 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Higher Plant		100
Schoenoplectus lacustris ssp tabernaemontani	140	90
Potamogeton pectinatus	20	10
Ruppia sp.	15	1
Litorella uniflora	5	1
Algae		1
Chara canescens	6	1
Chara aspera var. aspera	6	< 1
Description: Tall, dense Schoenoplectus swamp with P. pectinatus occuring throughout, Ruppia restricted to small areas of more open cover (70 - 80 %), Litorella along shoreward edge only. Sparse Chara canescens and C. aspera		

Site: Durnesh Lake	Transect code: A	
Location: Outlet to sea	Sample point: 4 Marginal	
Sample area: 10m2 (10x1)	Substrate: Cobbles	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		5
Glaux maritima	10	5
Description: 0.5 - 1m wide strip of cobble shore with sparse Glaux.		

Site: Durnesh Lake	Transect code: A	
Location: Outlet to sea	Sample point: 5 Marginal	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Iris psuedocorus	170	80
Filipendula ulmaria	130	10
Agrostis stolonifera	30	10
Mentha aquatica	30	1
Potentilla anserina	10	1
Vicia cracca	40	1
Description: Tall, densely growing Iris dominant with species-poor understorey of freshwater		
associates on sandy bank, slope c. 30 degrees, height c. 3m..		
Grading to Marram dune grassland (barrier).		

Site: Durnesh Lake	Transect code: B	
Location: Open shore	Sample point: 1 Aquatic - 5m out - grapnel	
Sample area: Grapnel only	Substrate: Not known	
Depth: 80cm +	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Potamogeton pectinatus		
Ruppia sp.		
Chara aspera var. aspera		
Description:		

Site: Durnesh Lake	Transect code: B	
Location: Open shore	Sample point: 2 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Cobbles, gravel	
Depth: 15 - 50cm	Salinity: 5 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		1
Higher Plant		< 1
Potamogeton pectinatus	30	< 1
Algae		< 1
Chara aspera var. aspera	10	< 1
Description: Sparse plant cover on coarse , fairly steeply sloping substrate. More or less the same from 1-5m out.		

Site: Durnesh Lake	Transect code: B	
Location: Open shore	Sample point: 3 Marginal	
Sample area: 10m2 (10x1)	Substrate: Cobbles, gravel	
Depth: 0-15cm	Salinity: 5 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		5
Higher Plant		5
Schoenoplectus lacustris ssp tabernaemontani	60	< 5
Potamogeton pectinatus	30	< 1
Litorella uniflora	6	< 1
Algae		< 1
Chara aspera var. aspera		<1
Description: Very sparse, low growing Schoenoplectus in 1m strip along shore. Aquatic associates all sparse.		

Site: Durnesh Lake	Transect code: B	
Location: Open shore	Sample point: 4 Marginal	
Sample area: 10m2 (10x1)	Substrate: Boulders, cobbles, gravel	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		< 1
Glaux maritima	5	< 1
Potentilla anserina	4	< 1
Description: 1m strip rocky shore with sparse plant cover.		
Grading to Festuca rubra - Dactylis glomerata grassland on 60 degree slope to		
c. 5m height, with Schoenus nigricans, Rosa pimpinellifolia, R. canina.		
Backing to Holcus lanatus - Cynosaurus cristatus pasture.		

Site: Durnesh Lake	Transect code: C	
Location: Open shore	Sample point: 1 Aquatic - 12m out	
Sample area: 16m2 (4x4)	Substrate: Cobbles, coarse gravel	
Depth: 90cm	Salinity: 3 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		100
Potamogeton pectinatus	80	100
Description: Dense bed of tall Potamogeton pectinatus.		

Site: **Durnesh Lake**	Transect code: C	
Location: Open shore	Sample point: 2 Aquatic - 3m out	
Sample area: 25m2 (5x5)	Substrate: Cobbles, coarse gravel	
Depth: 0 - 45cm	Salinity: 3 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		5
Higher Plant		< 1
Potamogeton pectinatus	40	< 1
Algae		5
Chara aspera var. aspera	8	5
Description: Sparse charophyte cover on stony substrate with scattered P. pectinatus.		

Site: **Durnesh Lake**	Transect code: C	
Location: Open shore	Sample point: 3 Marginal	
Sample area: 10m2 (10x1)	Substrate: Boulders, cobbles, gravel	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		10
Juncus gerardii	12	5
Agrostis stolonifera	10	5
Potentilla anserina	3	1
Glaux maritima	10	< 1
Substrate		90
Boulders		5
Cobbles		75
Gravel		10
Description: Sparse cover of J. gerardii - A. stolonifera dominated community on stony		
substrate. 3m.		
Grading to Schoenus nigricans flush vegetation on c. 45 degree slope to c. 6m		
height, with Festuca rubra, Briza media, Succisa pratensis, Juncus articulatus.		
Backing to Lolium perenne - Holcus lanatus - Cynosaurus cristatus pasture.		

Site: Durnesh Lake	Transect code: D	
Location: Sparse emergent stand	Sample point: 1 Aquatic - 50m out	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 50 cm	Salinity: 3 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		15
Higher Plant		10
Potamogeton pectinatus	30	10
Ruppia sp.	15	< 1
Algae		5
Chara aspera var. aspera	5	5
Description: Sparse cover of fairly low growing aquatics.		

Site: Durnesh Lake	Transect code: D	
Location: Sparse emergent stand	Sample point: 2 Aquatic - 25m out	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 40 cm	Salinity: 3 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		50
Potamogeton pectinatus	15	50
Ruppia sp.	10	< 1
Algae		10
Chara aspera var. aspera	5	10
Description: Fairly high cover of low growing Potamogeton pectinatus with frequent charophyte and very sparse low growing Ruppia.		

Site: Durnesh Lake	Transcect code: D	
Location: Sparse emergent stand	Sample point: 3 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 30 cm	Salinity: 3 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		50
Potamogeton pectinatus	20	50
Myriophyllum spicatum	10	< 1
Algae		10
Chara aspera var. aspera	6	10
Description: Fairly high cover of low growing Potamogeton pectinatus with frequent charophyte and very sparse low growing Myriophyllum.		

Site: Durnesh Lake	Transect code: D	
Location: Sparse emergent stand	Sample point: 4 Marginal	
Sample area: 25m2 (5x5)	Substrate: Sand	
Depth: 0 - 20cm	Salinity: 3 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		20
Higher Plant		20
Schoenoplectus lacustris ssp tabernaemontani	80	15
Potamogeton pectinatus	30	5
Myriophyllum spicatum	10	< 1
Algae		< 1
Chara aspera var. aspera	6	< 1
Description: Open Schoenoplectus swamp with sparse aquatic associates. Grazed. 8m		

Site: Durnesh Lake	Transect code: D	
Location: Sparse emergent stand	Sample point: 5 Marginal	
Sample area: 16m2 (4x4)	Substrate: Not known	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus gerardii	15	60
Agrostis stolonifera	15	50
Scirpus maritimus	25	10
Potentilla anserina	6	5
Leontodon autumnalis	15	< 1

Description: Species-poor J. gerardii - A. stolonifera community with occasional young
S. maritimus shoots.
Grading to Iris psuedacorus - Juncus effusus freshwater flush community, 30m.
Backing c.45 degree slope to c.6m height with Schoenus nigricans flush
vegetation (as Transect C).
Backing Lolium perenne - Holcus lanatus - Cynosaurus cristatus pasture.

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 1 Aquatic - 50m out	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 50 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		35
Higher Plant		30
Potamogeton pectinatus	25	25
Ruppia sp.	10	5
Myriophyllum spicatum	10	< 1
Algae		5
Chara aspera var. aspera	6	5
Description: Patchy cover of dominant Potamogeton pectinatus with low growing associates.		

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 2 Aquatic - 25m out	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 50 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		60
Higher Plant		50
Potamogeton pectinatus	30	50
Ruppia sp.	10	< 1
Algae		10
Chara aspera var. aspera	6	10
Description: Potamogeton pectinatus dominant, its cover increasing as Ruppia cover		
decreases.		

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 3 Aquatic - 5m out	
Sample area: 16m2 (4x4)	Substrate: Sand	
Depth: 50 cm	Salinity: 4 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Total Plant		75
Higher Plant		70
Potamogeton pectinatus	30	70
Algae		5
Chara aspera var. aspera	6	5
Description: Potamogeton cover increasing. Ruppia now absent. Charophyte cover more or less constant.		

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand	
Depth: 50 cm	Salinity: 4 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	180	90
Potamogeton pectinatus	50	30
Description: Tall dense single species S. lacustris swamp for 30m, with frequent Potamogeton pectinatus the only aquatic associate.		

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 5 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand	
Depth: 50 cm	Salinity: 4 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		30
Higher Plant		25
Schoenoplectus lacustris ssp tabernaemontani	180	10
Potamogeton pectinatus	60	15
Algae		5
Chara aspera var. aspera	6	< 5
Chara hispida var. major	30	< 5
Description: Open Schoenoplectus swamp for 20m, with P. pectinatus sparse but dominant in aquatic zone over associated charophytes.		

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 6 Marginal	
Sample area: 100m2 (10x10)	Substrate: Sand	
Depth: 50 cm	Salinity: 4 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - S.lacustris ssp tabernaemontani sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	180	90
Potamogeton pectinatus	50	30
Description: Tall dense single species Schoenoplectus swamp for 10m with P. pectinatus the only aquatic associate.		

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 7 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt (de-oxygenated)	
Depth: 20 cm	Salinity: 3 parts per thousand	
NVC community: S20 Schoenoplectus lacustris ssp tabernaemontani swamp - Agrostis stolonifera sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Schoenoplectus lacustris ssp tabernaemontani	180	100
Agrostis stolonifera	30	20
Description: Tall dense S. lacustris swamp for 50m with frequent Agrostis.		

Site: Durnesh Lake	Transect code: E	
Location: Schoenoplectus swamp	Sample point: 8 Marginal	
Sample area: 16m2 (8x2)	Substrate: Not known	
Depth: -----	Salinity: -----	
NVC community: Undetermined		
	Height (cm)	Cover (%)
Total Plant		100
Juncus gerardii	15	50
Agrostis stolonifera	15	50
Potentilla anserina	6	10
Description: Dense cover of species-poor Juncus gerardii - A. stolonifera community. 3m.		
Grading to Schoenus nigricans flush vegetation (as Transect C), 10m on		
c.15 degree slope.		
Backing to line of trees 10m width on c.40 degree slope to c.5m bank height -		
Prunus spinosa, Crataegus monogyna, Salix cinerea.		
Backing Lolium perenne - Holcus lanatus - Cynosaurus cristatus pasture.		

Site: Durnesh Lake	Transect code: F	
Location: Typha swamp	Sample point: 1 Aquatic - 2m out - grapnel	
Sample area: Grapnel only	Substrate: Silt	
Depth: 80 cm +	Salinity: 2 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Potamogeton pectinatus		
Ruppia sp.		
Enteromorpha		
Description:		

Site: Durnesh	Transect code: F	
Location: Typha swamp	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt (de-oxygenated)	
Depth: 80 cm	Salinity: 2 parts per thousand	
NVC community: S12 Typha latifolia swamp - Typha latifolia sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Typha latifolia	200	100
Description: Tall dense single species Typha swamp. 20m.		

Site: Durnesh Lake	Transect code: F	
Location: Typha swamp	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt (de-oxygenated)	
Depth: 0 - 50 cm	Salinity: 0 parts per thousand	
NVC community: S12 Typha latifolia swamp - Alisma plantago-aquatica sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Typha latifolia	200	100
Alisma plantago-aquatica	70	< 1
Lemna minor		< 1
Description: Tall dense Typha swamp with sparse freshwater associates. 10m		
Backing to Lolium perenne - Holcus lanatus - Cynosaurus cristatus grassland,		
15m on c.15 degree slope. Grazed.		
Backing line of trees, 10m on c.35 degree slope to c.6m height - Corylus avellana		
Prunus spinosa, Crataegus monogyna.		
Backing Lolium - Holcus - Cynosaurus pasture.		

Site: Durnesh Lake	Transect code: G	
Location: Freshwater inflow	Sample point: 1 Aquatic - 2m out - grapnel	
Sample area: Grapnel only	Substrate: Silt	
Depth: 70 cm +	Salinity: 0 parts per thousand	
NVC community: -----		
	Height (cm)	Cover (%)
Potamogeton pectinatus		
Potamogeton c.f. obtusifolius		
Myriophyllum spicatum		
Callitriche stagnalis		
Enteromorpha		
Description:		

Site: Durnesh Lake	Transect code: G	
Location: Freshwater inflow	Sample point: 2 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 30 - 70 cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - Phragmites australis sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	270	100
Lemna minor		30
Description: Dense Phragmites swamp for 30m with Lemna cover increasing to landward.		

Site: Durnesh Lake	Transect code: G	
Location: Freshwater inflow	Sample point: 3 Marginal	
Sample area: 100m2 (10x10)	Substrate: Silt	
Depth: 0 - 20cm	Salinity: 0 parts per thousand	
NVC community: S4 Phragmites australis swamp - Galium palustre sub-community		
	Height (cm)	Cover (%)
Total Plant		
Phragmites australis	270	100
Nasturtium officinale	15	60
Lemna minor		30
Myosotis scorpioides	10	5
Galium palustre	20	< 1
Equisetum fluviatile	50	< 1
Description: Dense Phragmites swamp with Rorippa dominant amongst species-		
poor understorey of freshwater species. 15m.		

Site: Durnesh Lake	Transect code: G	
Location: Freshwater inflow	Sample point: 4 Marginal	
Sample area: 100m2 (10x10)	Substrate:	
Depth: 0 cm	Salinity: -----	
NVC community: S4 Phragmites australis swamp - Galium palustre sub-community		
	Height (cm)	Cover (%)
Total Plant		100
Phragmites australis	180	80
Equisetum fluviatile	40	75
Nasturtium officinale	15	5
Filipendula ulmaria	120	5
Galium palustre	30	< 1
Lythrum salicaria	60	< 1
Mentha aquatica	20	< 1
Agrostis stolonifera	20	< 1
Description: Reduced Phragmites cover with Equisetum dominant amongst species-poor fen vegetation. 20m.		
Grading to willow carr strip 30m width - Salix cinerea dominant, average height c. 5m, with epiphytic mosses and lichens. Equisetum fluviatile dominant below.		
Backing to public road.		

20.3. 4 Evaluation

'Valuable'

This large site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared to most other sites. Seven transects were carried out.

Chara canescens was found growing fairly sparsely in the vicinity of the outlet pipe. This rare charophyte was previously recorded from six Irish sites since 1970. Its presence at Durnesh is reason enough to regard the site as valuable.

Chara aspera var. aspera was found at five transect sites, indicating a wide distribution.

Chara hispida var. major was found growing with C.aspera var. aspera in an area of open water in a Schoenoplectus swamp.

Ruppia was found at five transect sites, which indicates a wide distribution here. Dense patches occur near the outlet pipe. Elsewhere Ruppia was sparse or found by grapnel survey only. It is notable that both R.cirrhosa and R.maritima occur here.

Potamogeton pectinatus occurred in all seven transects. Dense stands of this species were found at two of these sites.

Litorella uniflora was found at the two northernmost transect sites. Myriophyllum spicatum occurred at two sites in the southern half of the lake.

Potamogeton c.f. obtusifolius and Callitriche stagnalis occurred with P.pectinatus and Myriophyllum spicatum at the major freshwater inflow.

Marginal vegetation shows little variation. Phragmites and Schoenoplectus swamps are extensive in places and Typha latifolia is locally dominant in the southern half of the site, indicating the lower salinities here. The surveyed open shores were dominated by a Juncus gerardii - Agrostis stolonifera community.

Salinity levels were low at time of survey, varying from 0 parts per thousand at the freshwater inflow in the south to 5 parts per thousand around the outlet pipe in the north.

Durnesh Lake is regarded as a good representative of a low salinity lagoon, with high species diversity and a species composition and distribution which reflect the spatial variation in conditions from freshwater to brackish.

Further survey is recommended.

20.4 ECOTONAL COLEOPTERA

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20.4.1 Site Description

Large coastal brackish lake in drumlin landscape, with sand dune barrier with artificial outflow/inflow channel, and small sandflat between beach and dunes. Extensive *Schoenoplectus lacustris* stands (Plate 1) and large areas of marsh and reedbeds on lakeshore.

Subsites (see 20.4.1)

1. *Schoenus* margin (G 871696)

Due to high water levels at the time of sampling, an upper shore zone above the flooded area was sampled, characterised by *Schoenus nigricans, Filipendula ulmeria, Parnassius palustris, Briza media, Centuarea nigra,* etc. It is assumed that water margin species migrated into this flooded grassland zone with rising water. Salinity of flood water was 5‰ (15 viii 1996).

2. *Iris*/grass margin (G 872697)

Iris/grass on sandy loam grading into *Schoenoplectus lacustris* in flooded standing water (similar to above), behind dune barrier. After spring tide, salinity was 19‰ (26 ix 1996).

3. Sandflat (M 254117)

Unvegetated aerobic sandflat beside outflow pool on beachside of sand dune barrier.

20.4.2 Methods

Site Rating using Indicator Species

Species rarity or community typicality are the most frequently used criteria for rating sites for their biological conservation value. The approach in this Coleoptera survey is to use selected species to indicate that sites are ecologically well-developed with relatively undisturbed natural processes still operating. In particular, it is assumed that this is shown by the presence of assemblages of species which have specialised habitat requirements for habitat features created by physical processes (e.g. aerobic sandflat, washed peat slopes) or biotic responses (algal growth, *Scirpus* monoculture) to these processes.

As a consequence, the rating is intended to be of more general ecological value (i.e. indicating ecotonal soil biota), than purely indicating the presence of rare beetles. Indeed, in one case, a rare species has been excluded as an indicator because it lacks a specific requirement for habitats created in the lagoon sites.

Therefore, species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon

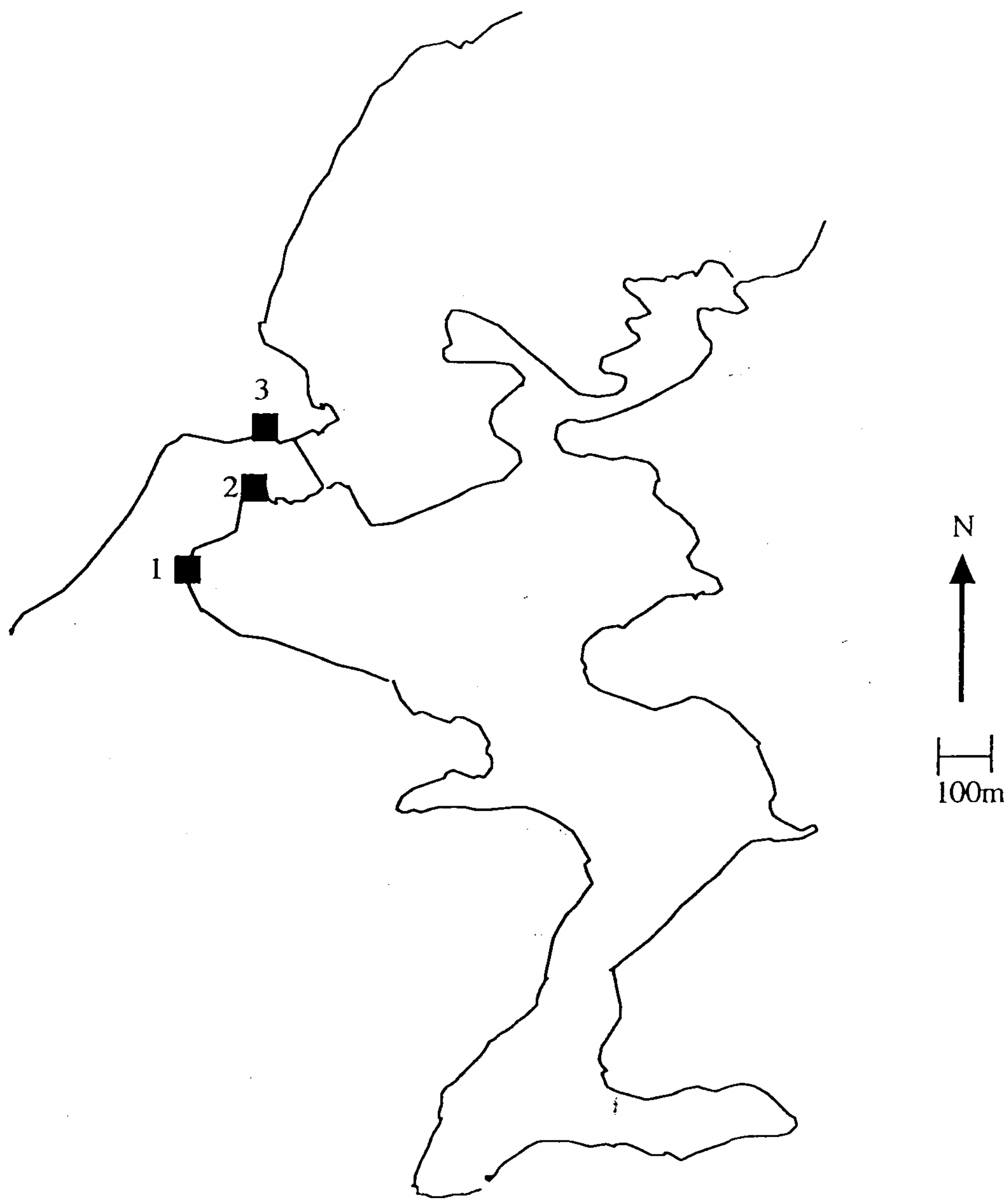

Fig. 20.4.1 Map of sampling sites (Carabidae and Staphylinidae) at Durnesh Lake, Co. Donegal.

1 - Pitfall traps, S-vac
2 - Pitfall traps
3 - Ground search

margins; and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

Interpretation of Indicator Species

Sites were not rated simply on the number of indicator species, but the following considerations were also taken into account: (1) Whether the indicator species was likely to originate from the habitat associated with the lagoon or a surrounding habitat (see Lough Aconeera, for instance), taking into account the number of individuals of the species present (singletons are often vagrant); (2) The habitat requirements of the non-indicator species, if they indicated an anthropogenically disturbed habitat (see Bridge Lough, for instance) ; (3) Whether the habitat feature might be uniquely created by the lagoonal conditions (see Lough Tanaí, Section 14, for instance).

Sites were rated into four categories of conservation value: (1) No recorded value; (2) low value; (3) average value; (4) exceptional value. It would be difficult to defend a categorization of sites into any finer categories than this (see Foster et al. (1992), for instance). Sites were not rated of average value if there were less than two indicator species present (see argument in Good and Speight 1992).

Limitations of Ratings

The site ratings are based on recorded data using standardised sampling methods. The ratings refer to the terrestrial/ecotonal soil assemblages, and do not represent the aquatic/ecotonal assemblages (e.g. aquatic Coleoptera, etc.) or herbivorous assemblages (e.g. Lepidoptera). Different indicator species are likely to occur in spring, but it is assumed that the relative number of indicator species would not differ significantly. The number of indicator species and their relative interpretation is based on a reasonably standard sampling effort at each site. Greater sampling effort will probably result in higher numbers of indicator species, but it is assumed that this will not affect the relative rating of sites.

Sampling Strategy

At each site representative marginal areas were sampled, including vegetation dominated by *Scirpus maritimus, Juncus maritimus, Juncus gerardi* and grasses, as well as bare or poorly-vegetated areas of sand, silt or peat. Particular emphasis was given to habitat associated with the sedimentary barrier and areas of highest salinity, since much of the habitat associated with freshwater inflows to the interior of the lagoons would contain a soil fauna not dependent on coastal lagoons.

Sampling Techniques

The sampling methods used are listed in Table 20.4.1. For each site, a Stihl® BR 400 suction apparatus, mounted on the operator's back, was used. This machine (referred to hereafter as 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58 mm diameter (0.0026 m^2 surface area). Six subsamples (transects) of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56 m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2 m^2) was effectively sampled. Sets of six pitfall traps with undiluted ethylene glycol (commercial anti-freeze) preservative were also dug into the soil at each site. Because many of the species expected to occur in such a habitat are adapted to climbing during flooding, these traps were fitted with funnels cut and shaped (with tape) from the same type of plastic cups that were used for the traps themselves.

TABLE 20.4.1. Details of sampling methods.

Method	Details	No. replicates per unit sample	Sampling period, etc.
Suction sampler	Stihl suction sampler	6	100 x 1.5 sec 0.026 m^2
Pitfall traps	Plastic cups with ethylene glycol preservative and plastic funnels; collars used where cattle/horses occur	6	30 days
Cobble samples	Cobbles turned 0.5 - 2 m from water margin	30	
Flotation depth	Samples taken where burrow casts observed; agitated soil floated in water	24	5 cm x 10 cm x 5 cm
Ground search	Search of bare soil (< 50% vegetation cover) during warm weather without rain	1	1 hour

Habitat features associated with the sedimentary barrier, such as shingle cobbles on finer substrate, bare or poorly vegetated sand, and peat cliffs, were also sampled if they occurred to a sufficient extent (> several m^2) at the site. Sampling involved a fixed time ground search (1 hour) during warm dry weather, or a fixed number of cobbles turned (n = 30) or cliff sods (8 subsamples of 5 x 5 x 10 cm) extracted by flotation in a bucket of sea or brackish water.

Sampling was carried out during late summer and early autumn (late July to early October), with some sites visited in June. This was unavoidable, and due to time constraints associated with the survey, but it is assumed that the species occurring during this period are representative of the sites, even if spring species may be absent.

Variety of sampling techniques

Several techniques will always give a more robust picture of the fauna of a site, because any weather- or site-affected bias in one technique will be compensated by other sampling methods. Some sites did not possess suitable habitat (peat cliffs, bare sand, cobbles on sediment, etc.) for flotation, ground search or cobble search. This is regarded as an absence of habitat, rather than an unavailable sampling opportunity. That some sites, therefore, had more sampling effort using these additional methods is not regarded as sampling bias, but a genuine reflection of the habitat diversity of the site.

Flooding of pitfall traps
Flooding is a problem for sampling lagoon sites using pitfall traps, especially as it is difficult to visit sites twice between spring tides to place and lift traps. Altogether, about 80 traps were flooded due to water level changes; these were not included in the survey. However, this was planned for, and three sets (6 traps each) were placed at all sites (four sets at some sites), of which two were sorted. There was only one site (Aughinish which has a spring/neap water level variation of >1m) where flooding limited trap results to only one set.

Weather conditions and sampling
The suction sampler is very efficient in grass, rush and sedge swards which are dry, but useless if they are even slightly wet, because the sampling pipe and net becomes wet. The priority for sampling therefore was to visit sites in response to dry weather forecasts, thus all sites were successfully sampled using this technique. However, as a result of this strategy, the period that pitfall traps were placed varied from site to site. This is not regarded as biasing results to any great extent, however, as much of the trap sample appears to be obtained in the first two weeks.

Quality control: identification
Voucher specimens of indicator species have been retained and will be deposited in the National Museum of Ireland, and specimens of many of the other species have been retained in the author's collection.

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Methods used at this site

Carabidae and Staphylinidae (Coleoptera) were recorded from :
(1) *Schoenus* margin - S-vac suction sampler (26 ix 1996), c. 2 m^2;
(2) *Schoenus* margin - 6 plastic pitfall traps with funnels and ethylene glycol preservative (15 viii - 26 ix 1996);
(3) Sandflat - flotation (c. 0.09 m^2 x 5 cm depth, 15 vi 1996);
(4) Sandflat - 1h ground search (15 vi 1996);
(4) *Iris* /grass margin - 6 pitfall traps (26 ix - 17 x 1996).

Species were selected as indicators of conservation value if : (1) they have a restricted habitat preference to a specific type of microhabitat associated with the lagoon margins;

and, (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems.

20.4.3 Results

Eight species of carabid and twenty-nine species of staphylinid were recorded, three species of which are regarded as indicator species (Table 20.4.2).

The separation of the two species of *Diglotta* has heretofore been confused by incorrect species concepts (J.A. Good, in preparation). *Diglotta submarina* may yet prove to be an indicator species for this site, but its distributional status is not clear, so it has been omitted.

Myllaena infuscata is generally local in Europe and occurs in marshy meadows, ditches, alder carr, etc. (Horion 1967), rather than on lake shores. While it can be regarded as stenotopic (e.g. Koch 1989), it could occur inland of Durnesh Lake, and is not likely to be dependant on shore habitats created by coastal processes. It has not therefore been selected as an indicator species.

There are few Irish records of *Philonthus furcifer*, a species not recorded from Great Britain (Lott and Foster 1990, Lott and Bilton 1991). It is rare in Europe, and occurs on marshy shores including those on sea coasts (Horion 1967).

There are three pevious Irish records of *Stenus lustrator* (Anderson 1984), which appears to be local in Europe (Horion 1963). The species is tyrphophilous (associated with peat), but also occurs on marshy shores and flood meadows, according to Koch (1989). The Irish records are from bogs (Anderson 1984), and the species was also recorded at Faranamanagh Lake and Lough Aconeera in this survey, both of which posess peat margins or adjacent bog.

Schistoglossa gemina is widespread but local in Great Britain (Hyman and Parsons 1994), and widespread but rare in Central Europe and Scandanavia (Benick and Lohse 1974, Palm 1970). It has been recorded previously from Ireland (O'Mahony 1929). The habitat of the species is marshy lake shores, wet meadows and marshes including wet ditches in sand dunes (Koch 1989, Hyman and Parsons 1994).

TABLE 20.4.2. Carabidae and Staphylinidae (Coleoptera) recorded from Durnesh Lake. Nomenclature follows Lucht (1987) and Lohse & Lucht (1989), with the exception of *Diglotta* which follows Good (in preparation).

	Species	No. individuals	
	Carabidae		
	Agonum fuliginosum (Panz.)	4	
	Agonum pelidnum (Payk.)	7	
	Bembidion mannerheimi Sahlb.	8	
	Bembidion pallidipenne (Ill.)	11	
	Dromius linearis (Ol.)	2	
	Leistus terminatus (Hellw.)	1	
	Pterostichus niger (Schall.)	11	
	Pterostichus nigrita (Payk.)	1	
	Staphylinidae		
	Anotylus maritimus Thoms.	1	
	Anotylus rugosus (F.)	1	
	Atheta amplicollis (Muls. Rey)	1	
	Atheta vestita (Grav.)	3	
	Bledius fergussoni Joy	18	
	Bledius subniger Schneid.	3	
	Carpelimus corticinus (Grav.)	1	
	Cypha laeviuscula (Mannh.)	4	
	Diglotta submarina (Fairm. Lab.)	1	
	Drusilla canaliculata (F.)	2	
	Euaesthetus ruficapillus Bois. Lac.	1	
	Gyrohypnus angustatus (Steph.)	2	
	Myllaena infuscata Kr.	1	
	Ocypus olens (Müll.)	8	
	Oxypoda elongatula Aubé	2	
*	*Philonthus furcifer* Renk.	2	**Indicator species**
	Phytosus balticus Kr.	1	
	Quedius fuliginosus (Grav.)	1	
	Quedius nigriceps Kr.	1	
*	*Schistoglossa gemina* (Er.)	1	**Indicator species**
	Sepedophilus nigripennis (Steph.)	1	
	Staphylinus dimidiaticornis Gemm.	1	
	Stenus brunnipes Steph.	2	
	Stenus fuscipes Grav.	6	
	Stenus juno (Payk.)	2	
*	*Stenus lustrator* Er.	2	**Indicator species**
	Stenus nitens Steph.	4	
	Stenus ossium Steph.	1	
	Tachinus signatus Grav.	3	

20.4.4 Evaluation

Of average conservation value for terrestrial ecotonal community.
(Rating categories : None, low, average, exceptional]

Scientific Argument for Rating

The presence of three indicator species (Table 20.4.2) indicates an ecologically well-developed system. However, all indicator species plus a further one which was excluded as inappropriate can breed in freshwater wetlands, and their occurrence at this site may be due to the large acreage of reedbeds and marshes adjoining the lake (e.g. towards Rossnowlagh).

20.4.5 References

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Plate 1 *Schoenoplectus lacustris* stands at Durnesh Lake, Co. Donegal

20.5 SUMMARY AND EVALUATION

Durnesh Lough is a large (c. 70 ha), **natural sedimentary lagoon** and is therefore of international importance based the Habitats Directive although its outlet is artificial.

The lough lies within a proposed NHA (Site 138).

Ornithologically, the lake at times holds internationally important numbers of wintering Scaup and White-fronted Geese and nationally important numbers of swans.

The following table shows the conservation value of the lake based on the four main criteria of the survey. The values given are modified from the original rating system which varied for each criterion

Geomorphology	High
Aquatic Fauna	High
Vegetation	High
Ecotonal Coleoptera	Average

Geomorphology

Durnesh Lough is a large natural sedimentary lagoon, separated from the sea by a sand dune barrier and by poorly drained farmland fronted by cobble barriers. It lies in an area of drumlins which underlie the barrier. Seawater enters the lough through an artificial sluiced channel, mainly during spring tides, but the salinity in the lough did not exceed 5‰ during the survey except near the outlet. The lake is shallow and the bed mainly sandy.

As a good example of a natural sedimentary lagoon with a dune barrier, the lake is rated as of <u>high</u> conservation value in spite of its artificial outlet.

Aquatic Fauna

Among 46 taxa recorded, 43 were identified to species and three are lagoonal specialists. The aquatic faunal assemblage included a high proportion of freshwater insect species. Corixids (7 spp.) and beetles (13 spp.) were particularly diverse. The fauna typified an isolated lagoon with persistently low salinity and restricted access for both seawater and colonists from the sea.

The lough is notable for the abundance of *Gammarus chevreuxi* for which there are only two previous records in Ireland. The species is widespread in Europe in brackish habitats and is listed as a lagoonal specialist in Britain, but it was abundant in 0‰ in this lake. Trout, *Salmo trutta,* were only recorded at this site and at L.

Gill during the survey. This was also the only lagoon visited in 1996 in which the brackishwater hydroid *Cordylophora caspia* was found although the species has been reported from Lady's Island Lake and was found during this survey at Rostellan Lake.

The aquatic fauna is rated as of high conservation value for its high diversity of insects, the presence of seven species not recorded elsewhere, and the abundance of *Gammarus chevreuxi*.

Vegetation

This large site was surveyed by transects only. Therefore, the information available upon which to make this assessment is limited compared with most other sites.

Ruppia was widely distributed but sparse with dense patches near the outlet pipe only. It is notable that both *R.. cirrhosa* and *R.. maritima* occurred here. *Potamogeton pectinatus* also occurred widely, sometimes in dense stands.

Chara canescens was found growing fairly sparsely in the vicinity of the outlet pipe. This rare charophyte was previously recorded from six Irish sites since 1970. Its presence at Durnesh is reason enough to regard the site as valuable. *Chara aspera* var. *aspera* was found at five transect sites, indicating a wide distribution. *Chara hispida* var. *major* was found growing with *C.aspera* var. *aspera* in an area of open water in a *Schoenoplectus* swamp.

Potamogeton c.f. *obtusifolius* and *Callitriche stagnalis* occurred with *P. pectinatus* and *Myriophyllum spicatum* at the major freshwater inflow. *Litorella uniflora* was found at the two northernmost transect sites. *Myriophyllum spicatum* occurred at two sites in the southern half of the lake.

Marginal vegetation showed little variation. *Phragmites* and *Schoenoplectus* swamps were extensive in places and *Typha latifolia* was locally dominant in the southern half of the site, indicating the lower salinities here. The surveyed open shores were dominated by a *Juncus gerardii - Agrostis stolonifera* community.

Durnesh Lough is regarded as a good representative of a low salinity lagoon, with high species diversity and a species composition and distribution which reflect the spatial variation in conditions from freshwater to brackish. For these reasons, and the presence of *Chara canescens*, the site is rated as of high conservation value. Further survey is recommended.

Ecotonal Coleoptera

Eight species of carabid and twenty-nine species of staphylinid were recorded, three species of which are regarded as indicator species.

The separation of the two species of *Diglotta* has heretofore been confused by incorrect species concepts. *Diglotta submarina* may yet prove to be an indicator species for this site, but its distributional status is not clear, so it has been omitted.

Myllaena infuscata is generally local in Europe and occurs in marshy meadows, ditches, alder carr, etc. rather than on lake shores. While it can be regarded as stenotopic, it could occur inland of Durnesh Lake, and is not likely to be dependent on shore habitats created by coastal processes. It has not therefore been selected as an indicator species.

There are few Irish records of *Philonthus furcifer*, a species not recorded from Great Britain It is rare in Europe, and occurs on marshy shores including those on sea coasts.

There are three previous Irish records of *Stenus lustrator* which appears to be local in Europe. The species is tyrphophilous (associated with peat), but also occurs on marshy shores and flood meadows. The Irish records are from bogs and the species was also recorded at Faranamanagh Lake and Lough Aconeera in this survey, both of which possess peat margins or adjacent bog.

Schistoglossa gemina is widespread but local in Great Britain and widespread but rare in Central Europe and Scandinavia It has been recorded previously from Ireland The habitat of the species is marshy lake shores, wet meadows and marshes including wet ditches in sand dunes.

The presence of three indicator species indicates an ecologically well-developed system. However, all indicator species plus a further one which was excluded as inappropriate can breed in freshwater wetlands, and their occurrence at this site may be due to the large acreage of reedbeds and marshes adjoining the lake (e.g. towards Rossnowlagh). The site is therefore rated as of average conservation value for ectonal Coleoptera.

Summary

Durnesh Lough is a large, natural sedimentary lagoon, separated from the sea by a sand dune barrier, but its present brackish nature may be entirely due to the presence of the artificial outlet.

The aquatic fauna typified a low salinity lagoon with little contact with the sea. The assemblage is rated highly for its high diversity of insects, the presence of seven species not recorded elsewhere during the survey, and the abundance of the rare amphipod *Gammarus chevreuxi*.

The lake holds internationally important numbers of wintering Scaup and White-fronted Geese and nationally important numbers of swans.

The vegetation is regarded as being representative of a low salinity lagoon, with high species diversity and a species composition and distribution which reflect the spatial variation in conditions from freshwater to brackish. For these reasons, and the presence of *Chara canescens*, the site is rated highly.

The presence of three indicator species of ecotonal Coleoptera indicates an ecologically well-developed system. All can, however, breed in freshwater wetlands therefore the site is rated as of high, but not exceptional, conservation value.

Overall, Durnesh Lough is rated as of high conservation value as large sedimentary lagoon containing a high diversity of aquatic fauna and vegetation and some rare species. Its designation as a proposed SAC is recommended.