Marine communities of the Mulroy Bay and Lough Swilly area, north-west Ireland, with an assessment of their nature conservation importance

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Cover photograph: The bright red tentacles of the file shell *Limaria hians*. 'Nests' of this bivalve mollusc consolidate the gravel seabed and form areas of biogenic hard substrata.

Reference: Picton, B. E, Emblow, C. S., Morrow, C. C., Sides, E. M. & Costello, M. J., 1994. Marine communities of the Mulroy Bay and Lough Swilly area, north-west Ireland, with an assessment of their conservation importance. Field survey report, Environmental Sciences Unit, Trinity College, Dublin.

INTRODUCTION

There is little published work on the fauna, flora and biotopes of Mulroy Bay and Lough Swilly. A study of the intertidal algae exists (Parkes, 1958a, 1958b), otherwise there are only a few papers dealing with individual species of plants and animals of the area (Praeger, 1894; Morton, 1978; Minchin, 1981, 1987, 1988; Minchin, *et al*, 1987; Somerfield, 1985).

There are a number of areas of scientific interest (OPW, 1989) adjoining the sea within the area described here but none of these has been designated on the basis of marine life. Most are of ornithological or botanical interest.

This report presents the results of a survey undertaken between 9th and 23rd July 1993. Previous data on the area is reviewed and a conservation assessment of Mulroy Bay and Lough Swilly is provided. Site descriptions are given in Appendix 1 and an analysis of the biotopes present in the area is given in Appendix 2. A complete list of the species recorded with site numbers is given in Appendix 3. Species names throughout are taken from Howson (1987).

STUDY AREA

Physical conditions

Mulroy Bay (figures 1 and 2) is the most convoluted of the marine inlets in north-west Ireland. It is approximately 12m long in a north-south direction. The entrance to the bay is a narrow embayment leading to a winding entrance channel 10m long. This channel varies in width and depth, with three significant narrows only 100-150m across, where the current reaches maxima of 3-5 knots. It opens into the Broad Water, an open shallow sea lough 8m from north to south and 2.5m from east to west, generally less than 20m in depth and with many small rocky islands and islets. Leading back towards the north is another narrow channel which opens into a deep, extremely sheltered body of water known as the North Water. The North Water measures 3m north to south and 1.5m east to west, with a maximum depth of 51m, a considerable area deeper than 30m and a narrow rocky intertidal zone. The North Water is surrounded by hills and extremely sheltered with only a relatively small catchment area. It retains a high salinity and has a pronounced halocline in wet periods of weather. Bay is a strange term to use for this complex body of water, which would certainly be described as a sea loch in Scotland. Mulroy Bay is in fact a fiard, formed by glaciation. Rocks on both sides of the bay are ice-polished with striations indicating a south to north direction for the movement of ice (Hull *et al.*, 1895). The Moross peninsula, separating the North Water from the Broad Water, is a large glacial drumlin as is the area of boulders known as Scalpmore, to the south of where the main channel enters Broad Water (Charlesworth, 1924, 1953). The tidal regime within Mulroy Bay is affected by the narrows, which both delay the times of high and low water and reduce the tidal amplitude. Parkes (1958a) quotes a delay of 2 hours 33 minutes between Mulroy Bar (at the entrance) and the village of Cranford on Broad Water. She also reports a reduction of height of spring tides from 4.5m to 1.6m between the same places.

Lough Swilly (figures 1 and 3) is the longest marine inlet in north-west Ireland and is very different in character to Mulroy Bay, from which it is separated by the narrow Fanad peninsula. It is 7km wide at the entrance and approximately 38km in length, tapering gradually to the south-south-east and then turning south-south-west. There are extensive intertidal mud flats along the shores of the inner lough, and large banks of coarse sand and gravel in 10m or less in the middle portion, opposite the town of Buncrana. A channel in the centre of the inner arm of the lough reaches 19m depth. The river Swilly flows into the lough at its head and the river Leanan enters on the western side about one third of the way from the head. The lough has more of the qualities of an estuary than a sea lough.

Human impacts

The majority of the area is not densely populated. The largest centres are the towns of Buncrana (population 2800) on the east coast of Lough Swilly and Letterkenny (population 3500) at the head of Lough Swilly (1971 census, Royal Irish Academy 1979).

Mulroy Bay is used for aquaculture, particularly salmon farming and is important for scallop spat collection. One of the oldest salmon farms in Ireland, Fanad Fisheries, has its headquarters located on the northern shore of the North Water. Salmon cages are no longer located in the extremely sheltered North Water (apart from holding cages), but are now located in the Moross Channel and in Mill Bay in the main entrance channel as well as in Lough Swilly. Locations of aquaculture sites were taken from observations in the field (Figures 2 and 3).

The North Water of Mulroy Bay is a designated area for collection of *Pecten maximus* spat. Dredging for *Pecten maximus* is prohibited by a fisheries bye-law and to date the Department of the Marine has not permitted mussel culture in this area. A scallop fishery has existed within the Broad Water of Mulroy Bay for many years but is undertaken mostly from small local boats which have depleted the stocks less than in many other areas.

Tourism in the area is of minor importance, with no large tourist centres and accomodation in scattered hotels, bed and breakfast establishments and caravan sites. Holiday homes owned by residents of Northern Ireland account for much of the tourism. Popular beaches are situated on Lough Swilly but these are generally uncrowded.

Conservation areas

Within the survey area there are no sites that have been designated for conservation on the grounds of their direct marine biological interest but several have a maritime or coastal component (Table 1, Figure 1).

Table 1. Current nature conservation status of areas in the Mulroy Bay and Lough Swilly area, with a marine component.

No	Name	Importance	Area (ha)	Interest	Description	O.S. Grid reference
1.	Inch Lough and islet	International	320	Botanical, Ornithological	Shallow brackish lough with internationally important wildfowl	C3522
2.	Lough Nagreany dunes	National	30	Botanical	Grassland, heathland and dunes	C1341
3.	Blanket Nook	National	67	Botanical, Ornithological	Brackish lake	C3019
4.	Carradoan	Regional	200	Ecological	Oak woodland	C2830
5.	Mulroy Bay (Island Roy)	Regional	37	Botanical, Ornithological	Grassland, nesting terns, algae	C1338
6.	Tranarossan	National	30	Botanical	Grassland, machair	C1242
7.	Kindrum Lough	Local	78	Zoological	Lake with char	C1842
8.	Kinny Lough	Local	65	Botanical, Ornithological	Lake and fen	C2044
9.	Melmore Lough	Local	4	Botanical	Lagoonal lake	C1243
10.	Swilly Estuary	National, Regional	17400	Ornithological	Large composite coastal	C2416
11.	Leanan Estuary	National, Regional	N/A	Ornithological	Estuary	C2523

12.	Dunaff Head	National	N/A	Ornithological	Headland with breeding seabirds	C3048
13.	Naran & Magheradrumman machair	National	N/A	Botanical, Ornithological	Grassland, machair	C2145
14.	The Point, Mulroy	National, Regional	N/A		Brackish	C1836
15.	Greers Island, Mulroy Bay	N/A	N/A		Islet	C1840

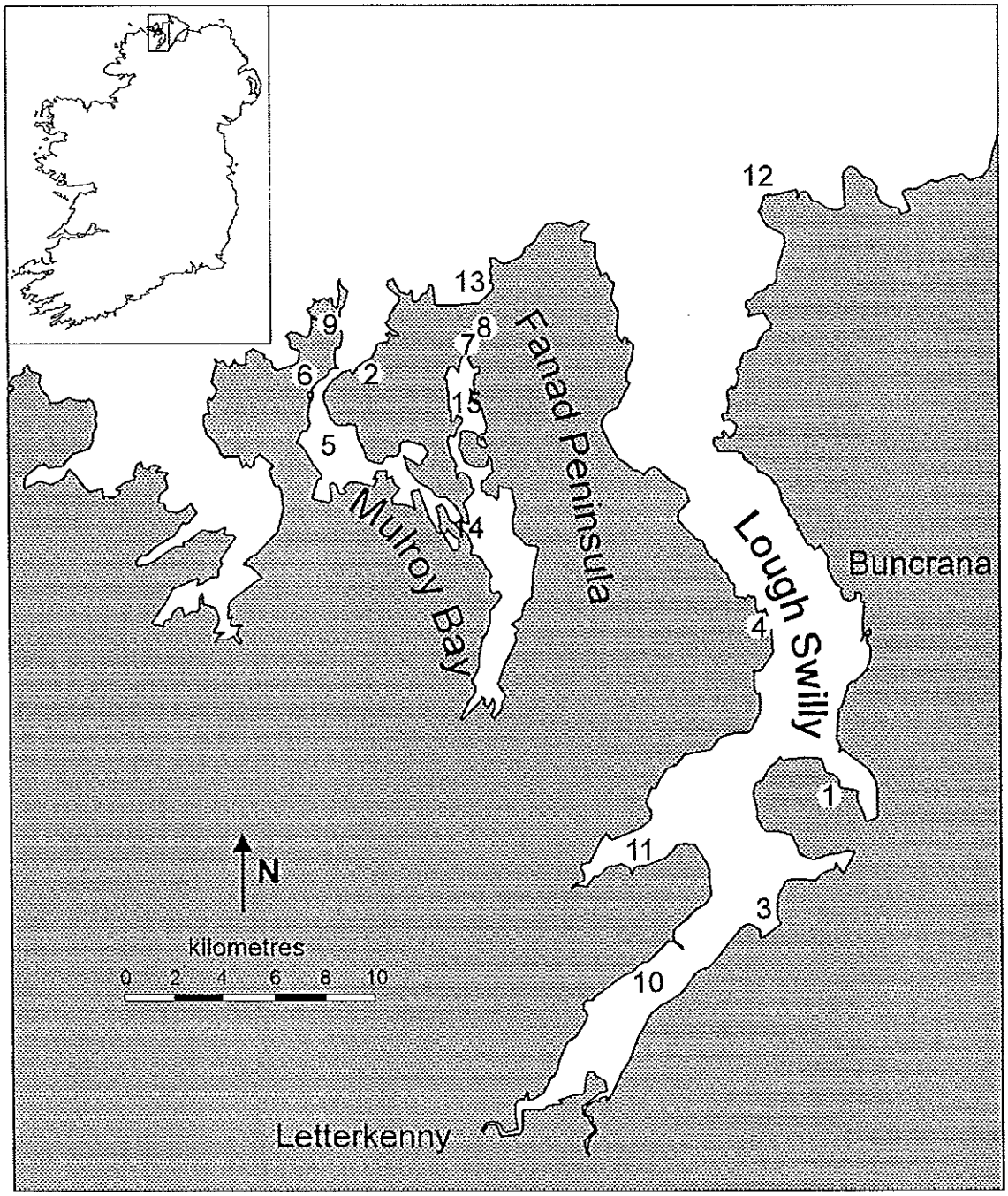

Figure 1. Map of area surveyed showing main features and areas of scientific interest (numbers refer to Table 1).

METHODS

Site selection

Sites were selected to cover the range of habitats and communities likely to occur in the area. Where possible the seabed topography, types of substrata and tidal currents were obtained from Admiralty charts and Ordnance Survey maps. The wave exposure was estimated from the fetch, aspect and offshore topography and a series of sites were chosen to cover as wide a variety of habitats as possible from a consideration of all these features.

Recording

Sublittoral sites were surveyed by scuba diving from a rigid-hulled inflatable boat and littoral sites by direct observation on the shore. Sites were surveyed following the procedures described by Hiscock (1990). Descriptions were compiled of the main physical and biological features of each site and the habitats within each site. Habitats were described from the main biological depth subzones (infralittoral, circalittoral) and range of substrata, wave exposure and tidal streams present.

Details of each site were recorded on a form designed to facilitate data collation and transfer to a database. Within each site records were compiled on separate forms for each habitat, detailing information on physical parameters and the species present. The relative abundance of all the conspicuous species was estimated using a six point abundance scale described in Hiscock (1990). Depth limits of each habitat were measured at the time and converted to chart datum using a correction taken from a tideclock. All depths referred to in the present report are relative to chart datum unless otherwise stated.

Photographs were taken to illustrate the range of habitats, communities and species present at as many of the sites as possible. Photographs were taken using two Nikon F4s cameras (in Aquatica underwater housings for underwater work). A 20 mm wide angle lens was used for sublittoral habitat pictures and a 60 mm macro lens for close-up photographs of individual species. Underwater lighting was provided by Ikelite Ai submersible flashguns. Kodachrome 64 slide film was used for underwater work and Kodachrome 200 film for terrestrial photography.

Specimens

Specimens were collected to improve *in situ* identification skills and to contribute to a voucher collection of the species present in the survey area. Specimens will be lodged in the National Museum, Dublin. A voucher collection was made of algae present in the area and sent to Prof. M. Guiry, University College, Galway for identification. This will be incorporated in a national collection at the end of the survey. All records of these specimens were added to the appropriate habitat forms and to the database to be included in the data analysis.

Data analysis

All data collected during the survey was entered onto the Trinity College copy of the Marine Nature Conservation Review (MNCR) database (Mills 1991), allowing the comparison of records according to biological and physical characteristics. The species data was analysed using TWINSPAN (Hill, 1979a) and DECORANA (Hill, 1979b) allowing the records to be separated into groupings. These groupings formed the basis for community descriptions from the survey area.

RESULTS

During the survey 40 sites were visited, 32 sublittoral and 8 littoral (Table 2, Figures 2, 3). A description of each of the sites is given in Appendix 1. From these sites 79 habitat records were completed and grouped into 43 communities by the computer analysis of the species present and their abundances (Appendix 2). In all 486 species of macrofauna and macro-algae were identified (Appendix 3).

Table 2. Survey site names, positions and other details.
No.: Report site number allocated to each site and stored in the BioMar database and given to the locations on Figure 1. Survey activities: L - littoral recording; S - sublittoral recording; P-photography.

No.	Site name	Grid ref.	Latitude & Longitude	Surveyors	Date	Survey activities
1	Outer Claddaghanillian Bay, Mulroy Bay.	C 118446	55°14.9'N 007°48.8'W	BEP,EMS	16.07.93	S,P
2	N of Frenchmans Rock, Mulroy Bay.	C 115455	55°15.4'N 007°49.1'W	CCM,CSE	16.07.93	S,P
3	Limeburner Rock, Mulroy Bay.	C 125502	55°17.9'N 007°48.1'W	EMS,CSE	14.07.93	S,P
4	S side of Limeburner Rock, Mulroy Bay.	C 126502	55°17.9'N 007°48.0'W	BEP,CCM	14.07.93	S,P
5	W of Melmore Head, Mulroy Bay.	C 134454	55°15.3'N 007°47.3'W	BEP,EMS	16.07.93	S,P
6	E of Melmore Head, Mulroy Bay.	C 135453	55°15.3'N 007°47.1'W	CCM,BEP	17.07.93	S,P
7	N of Ravedy Island, Mulroy Bay.	C 139451	55°15.2'N 007°46.8'W	CSE,EMS	10.07.93	S,P
8	W of Bar Rocks, Mulroy Bay.	C 138435	55°14.3'N 007°46.9'W	CSE,EMS	14.07.93	S,P
9	W of Knox's Hole, Mulroy Bay.	C 123406	55°12.7'N 007°48.3'W	BEP,CCM	17.07.93	S,P
10	Mark's Point, Mulroy Bay.	C 164369	55°10.8'N 007°44.5'W	CCM,EMS	22.07.93	L
11	Back Lough Narrows, Mulroy Bay.	C 174353	55°09.9'N 007°43.5'W	CSE,BEP	22.07.93	L,P
12	SE of Scalpmore, Broadwater, Mulroy Bay.	C 191350	55°09.7'N 007°41.9'W	EMS,BEP	12.07.93	S,P
13	N of Pan Bay, Mulroy Bay.	C 188347	55°09.6'N 007°42.2'W	EMS,CSE	17.07.93	S,P
14	SE of Deegagh Point, Mulroy Bay.	C 195340	55°09.2'N 007°41.5'W	CCM,BEP	13.07.93	S,P
15	E of Deegagh Point, Mulroy Bay.	C 195339	55°09.1'N 007°41.5'W	CCM,BEP	13.07.93	S,P
16	SW of Rough Island (Long Island group), Mulroy Bay.	C 195303	55°07.2'N 007°41.6'W	CCM,BEP	13.07.93	S,P
17	E of Gortnatraw Bay, Mulroy Bay.	C 211330	55°08.7'N 007°40.1'W	EMS,CSE	20.07.93	L
18	SW of Campbells Bed, Mulroy Bay.	C 204337	55°09.0'N 007°40.7'W	CSE,EMS	13.07.93	S,P
19	White Mares Bay, Broadwater, Mulroy Bay.	C 190360	55°10.3'N 007°42.0'W	CCM,CSE	12.07.93	S,P
20	SE of Mullaghanardy Point, Mulroy Bay.	C 188369	55°10.8'N 007°42.2'W	BEP,CCM	11.07.93	S,P
21	S of Mullaghanardy Point, Mulroy Bay.	C 189371	55°10.9'N 007°42.1'W	CSE,EMS	11.07.93	S,P
22	Moross Castle, Moross Channel, Mulroy Bay.	C 179388	55°11.8'N 007°43.1'W	CCM,BEP	11.07.93	S,P
23	Stookan Rocks, Mulroy Bay.	C 186401	55°12.5'N 007°42.3'W	BEP,CCM	10.07.93	S,P
24	S of Greers Island, Mulroy Bay.	C 182404	55°12.7'N 007°42.8'W	CSE,EMS	10.07.93	S,P
25	Outer Millstone Bay, Mulroy Bay.	C 152380	55°11.4'N 007°45.6'W	CCM,EMS	15.07.93	S,P
26	Mark's Point, Broadwater, Mulroy Bay.	C 185357	55°10.1'N 007°42.5'W	BEP,CCM	21.07.93	L

27	N of Tirloughan Bay, Mulroy Bay.	C 145378	55°11.2'N 007°46.2'W	BEP,CSE	15.07.93	S,P
28	Dundooan Rocks, Mulroy Bay.	C 128412	55°13.1'N 007°47.8'W	CCM,CSE	16.07.93	S,P
29	Off Doaghmore Strand, Mulroy Bay.	C 138421	55°13.6'N 007°46.9'W	BEP,CCM	14.07.93	S,P
30	W of Ballyhoorisky Island, Mulroy Bay.	C 151443	55°14.8'N 007°45.7'W	CCM,EMS	22.07.93	L,P
31	Portnagarribane, Fanad, Lough Swilly.	C 227477	55°16.6'N 007°38.5'W	BEP,CCM	21.07.93	L,P
32	Ballyhoorisky Point, Mulroy Bay.	C 154455	55°15.4'N 007°45.4'W	CSE,BEP	22.07.93	L,P
33	Great Pollet Arch, Lough Swilly.	C 242455	55°15.4'N 007°37.1'W	EMS,CSE	21.07.93	L,P
34	Knockalla Point, Lough Swilly.	C 272371	55°10.8'N 007°34.2'W	CCM,BEP	19.07.93	S,P
35	Bay S of Carnsore Point, Lough Swilly.	C 280349	55°09.7'N 007°33.5'W	CCM	20.07.93	S
36	S side of Anny Point, Lough Swilly.	C 287343	55°09.3'N 007°32.9'W	BEP,CCM	19.07.93	S,P
37	SE of Macamish Point, Lough Swilly.	C 307321	55°08.1'N 007°31.0'W	EMS	20.07.93	S
38	Saltpans Bank, Lough Swilly.	C 314318	55°08.0'N 007°30.4'W	BEP	20.07.93	S
39	W of White Sands Rocks, Lough Swilly.	C 318337	55°09.0'N 007°30.0'W	CSE,EMS	19.07.93	S
40	W of Dunree Head, Lough Swilly.	C 283408	55°12.8'N 007°33.2'W	CSE,EMS	19.07.93	S,P

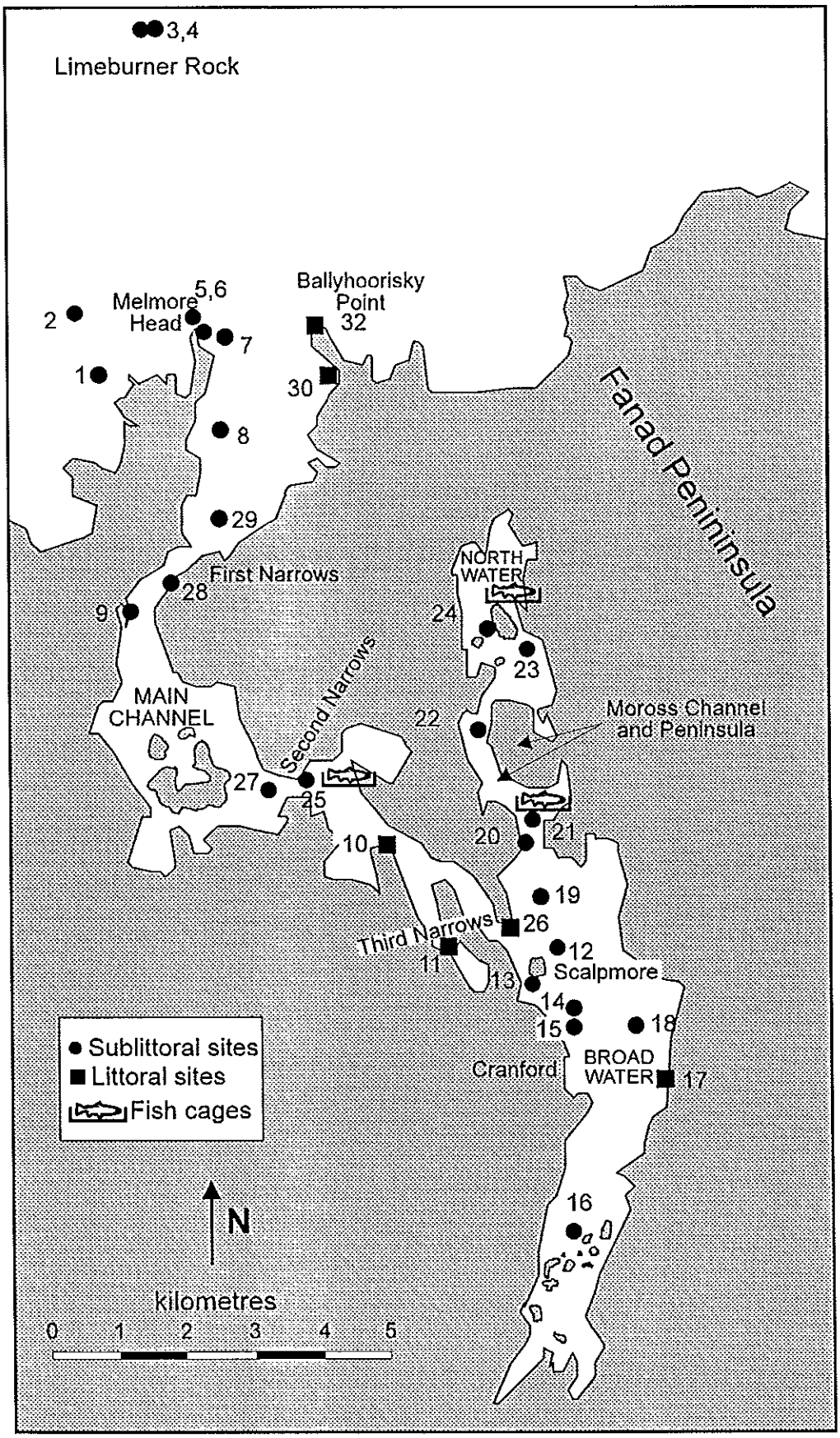

Figure 2. Map of sites surveyed in Mulroy Bay

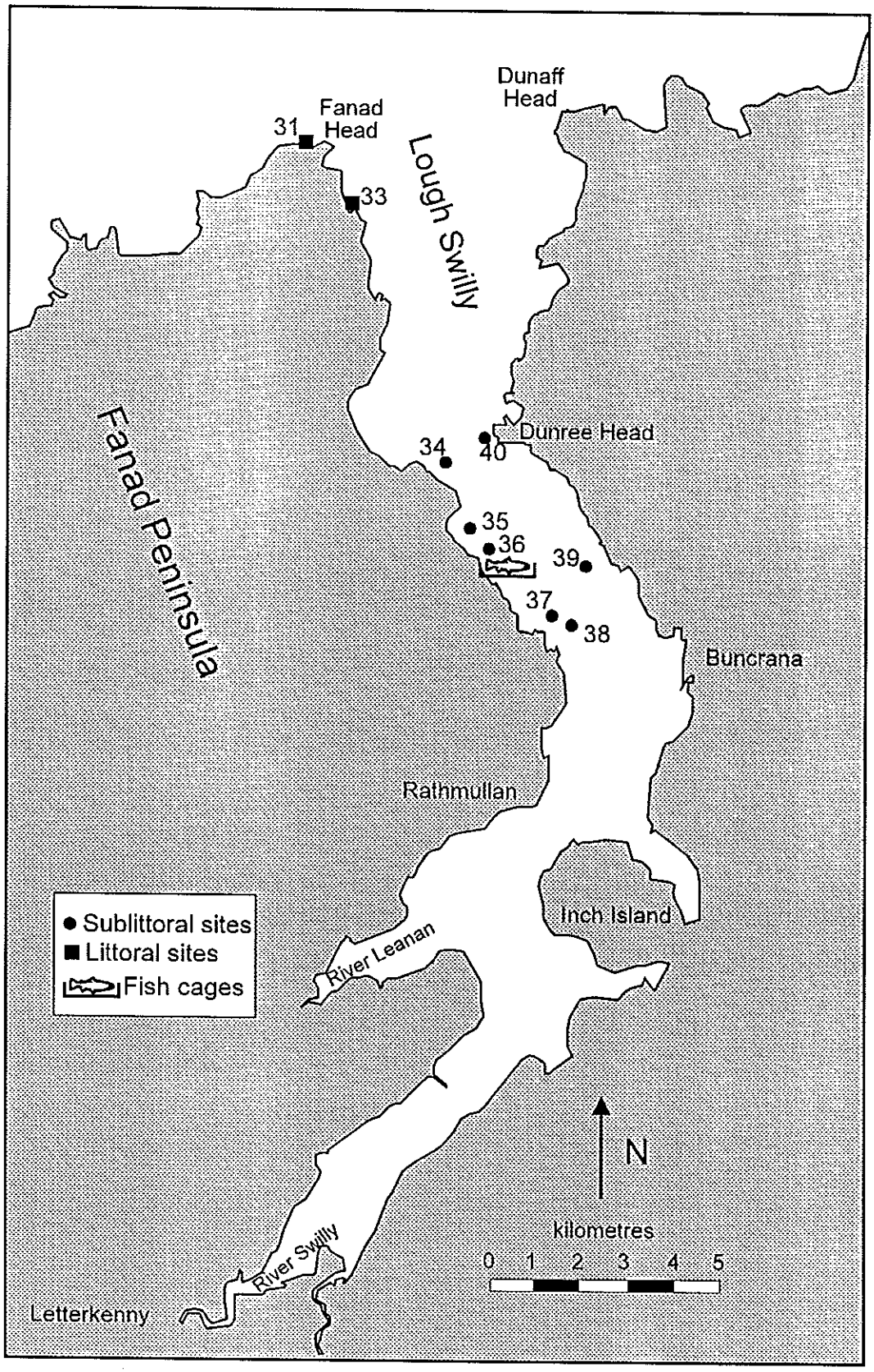

Figure 3. Map of sites surveyed in Lough Swilly

Communities

Analysis of the habitat records enabled the identification of 43 communities, 13 littoral and 30 sublittoral (Table 3). The dataset analysed was relatively small and the groupings TWINSPAN created were not always biologically meaningful as the range of biotopes under comparison was very wide. The DECORANA results indicated a considerable spread of points with few habitats falling in tight clusters, and suggested that the survey aim of sampling as wide a range of habitats as possible in the time available had been achieved. They further indicated that the main habitat parameters separating sublittoral biotopes were gross water movement, with wave sheltered sites on different substrata being closer to each other than to wave exposed sites on the same substrata. Sheltered sites subject to strong tidal streams were more similar to sites exposed to wave action than to sheltered sites without strong tidal streams. The coverage of the area was limited by the time available for survey and the analysis suggests that more habitats are likely to be present in addition to those sampled by this survey. Many of the habitats are described on the basis of one or two examples. In the following discussion the letters MS followed by a number refer to communities listed in Table 3 and described in Appendix 2.

Table 3. Communities and habitats identified in Mulroy Bay and Lough Swilly area.

	Community name	Habitat type	Site (habitat) numbers
MS1	Lichen zone	Supralittoral fringe bedrock	33(1); 30
MS2	*Pelvetia canaliculata* zone	Lower littoral fringe bedrock, boulders and cobbles	17(1); 33(2)
MS3	*Porphyra* zone	Exposed bedrock in Littoral fringe	30(1)
MS4	*Fucus vesiculosus* zone	Mid eulittoral bedrock and boulders, strong tidal streams	10(1); 26(1)
MS5	*Ascophyllum nodosum* zone	Mid eulittoral bedrock, boulders and cobbles	17(2);26(2); 31(1)
MS6	Barnacle and limpet dominated rock	Upper eulittoral bedrock	30(2); 32(2)
MS7	Barnacle and *Palmaria palmata* zone	Exposed bedrock in the mid-eulittoral	32(3); 33(3); 33(4)
MS8	*Fucus serratus* zone	Lower eulittoral bedrock and boulders	17(3); 31(2)
MS9	Mid shore pools with *Bunodactis verrucosa*	Mid shore open coast rockpools	30(3)
MS10	Upper shore pools with *Paracentrotus lividus*	Upper shore open coast rockpools	32(1)
MS11	Sublittoral fringe with *Alaria esculenta*	Exposed sublittoral fringe bedrock	30(4); 32(4); 33(5)
MS12	Sandy cove with *Zostera marina*	Open coast, sheltered sand and boulders	31(3)
MS13	Tide swept sublittoral fringe with *Cereus pedunculatus* and sponges	Sublittoral fringe tide swept boulders and gravel	10(2); 11(1); 26(3)
MS14	Shallow mud with *Anthopleura ballii*	Sheltered shallow mud	20(2)
MS15	Mud with *Zostera marina*	Very sheltered shallow mud	16(1)

	and *Leptosynapta inhaerens*		
MS16	*Zostera marina* bed with *Amphiura brachiata*	Sublittoral sand	35(1)
MS17	Mud with *Ciona intestinalis* and *Ascidia virginea*	Very sheltered mud	16(2)
MS18	Mud with *Ascidiella aspersa* clumps	Sheltered mud	12(1); 12(2); 15(1); 20(3)
MS19	Sand with *Gracilaria verrucosa*	Moderately exposed shallow sand with rocks	29(1)
MS20	Sand with *Spisula elliptica*	Moderately exposed medium sand	8(1); 6(2)
MS21	Sand with *Echinocardium cordatum* and *Amphiura brachiata*	Sublittoral sand	36(3)
MS22	Sand with *Ophiura albida and Echinocardium cordatum*	Sublittoral sand	37(1)
MS23	Sand with *Ophiura ophiura* and *Ophiura albida*	Duned mobile coarse sand with moderate tidal streams	38(1)
MS24	Sand with *Vesicularia spinosa*	Sand with moderate tidal streams	39(1)
MS25	Mud, sand and shells with *Limaria hians*	Lower infralittoral shelly sand	21(1); 22(1)
MS26	Coarse gravel & maerl with *Neopentadactyla mixta*	Coarse gravel	9(1); 13(1)
MS27	Cobbles with *Esperiopsis fucorum* and red algae	Infralittoral cobbles in strong tidal stream	25(1); 27(1)
MS28	Cobbles with *Hymedesmia brondstedi* and *Tridemnum cereum*	Circalittoral cobbles in tidal stream	27(2); 27(3)
MS29	Open coast kelp forest	Upper infralittoral exposed bedrock	3(1); 4(1)
MS30	Open coast kelp park with *Drachiella spectabilis*	Lower infralittoral exposed bedrock	1(1); 6(1); 7(1)
MS31	Open coast kelp park with *Halidrys siliquosa*	Lower infralittoral exposed bedrock with sand scour	5(1)
MS32	Cliff with *Rhodymenia pseudopalmata*	Upper infralittoral sheltered bedrock	9(3)
MS33	Shallow bedrock with *Hypoglossum hypoglossoides*	Upper infralittoral sheltered bedrock	40(1)
MS34	Sheltered rock with *Griffithsia corallinoides*	Extremely sheltered bedrock	24(1)
MS35	Boulders with *Plocamium cartilagineum* and other red algae	Upper infralittoral sheltered boulders	9(4); 36(1)
MS36	Sheltered rock with *Polymastia mamillaris*	Sheltered rock outcrops	20(1)
MS37	Sheltered rock with	Extremely sheltered rock outcrops	18(1); 19(1)

	Ascidiella aspersa		
MS38	Sheltered bedrock with *Ascidia virginea*	Steep very sheltered bedrock	14(1); 23(1); 23(2); 24(2)
MS39	Bedrock cliff with *Parerythropodium corallioides*	Sheltered circalittoral bedrock	18(2)
MS40	Bedrock with *Flustra foliacea* and *Trididemnum cereum*	Circalittoral tide-swept bedrock	34(1); 40(2)
MS41	*Ophiothrix fragilis* dominated bedrock	Circalittoral tide-swept bedrock	34(2)
MS42	Tide swept bedrock with *Sertularia argentea*	Steep bedrock in strong tidal stream, sheltered	9(2); 28(2)
MS43	Circalittoral bedrock with *Phorbas fictitius*	Open coast circalittoral bedrock with moderate tidal streams	2(1); 3(2); 4(2); 5(2)

Littoral soft substrata communities

Tide swept coarse gravel with small boulders was found on the lower shore at an unusual site in a channel leading to a shallow lough off the main channel into Mulroy Bay (Back Lough, site 11). Similar coarse gravel with boulders was also present at headlands near the entrance from the main channel into Broad Water (sites 10 & 26). These tide swept gravels had high species diversity and contained rare species (*Leptochiton scabridus*) and species unusual on the shore (*Limaria hians, Stelletta grubii, Venus verrucosa*) (MS13). The habitat at the low water mark on one rocky shore on the open coast (site 31) was sand, contained in a small cove surrounded by rocks (MS12). The Sediment was dominated by a *Zostera marina* bed with a variety of red algae. Sandy shores are frequent in the area studied but were not sampled.

Littoral hard substrata communities

The open coast on the northern edge of the Fanad peninsula and the outer part of Lough Swilly consisted largely of granite bedrock. These bedrock shores were exposed to wave action and the granite had a smooth, rounded appearance. Loose boulders were usually present on the lower shore, but were mobile and restricted in their animal and plant cover as a result of this. The typical profile for these open coast sites consisted of a lichen zone at the highest level (MS1) on the shore, followed by a rather bare zone characterised by barnacles *Semibalanus balanoides* and scattered red algae, either *Porphyra umbilicalis* or *Palmaria palmata* (MS6). Mussels, *Mytilus edulis,* became common in addition to the barnacles at the next level down the shore, with the red alga *Nemalion helminthoides* also characteristic (MS7). The lower shore differed only in an increase in proportions of algae present, with *Palmaria palmata* becoming superabundant at one site and with a variety of red algae including *Corallina officinalis* in run-off channels in the rock. The sublittoral fringe at these sites was characterised by *Laminaria digitata* and *Alaria esculenta* with a few sponges, ascidians and hydroids present (MS11). Rockpools were extensive on shores near Ballyhoorisky Point (sites 30, 32) and included pools dominated by the sea urchin *Paracentrotus lividus* and others domintated by algae such as *Fucus serratus* and *Bifurcaria bifurcata* (MS9, MS10). These pools were at a high physical level on the shore for the algal assemblages they contained.

The sheltered shores within the two sea loughs were generally characterised by being algal dominated, with the fucoid *Ascophyllum nodosum* forming dense beds on the main part of the

shore (MS5). Diversity at these sites was not particularly high and no unusual species were recorded.

Sublittoral soft substrata communities

Soft substrata were the main habitat types for most of Mulroy Bay and Lough Swilly. The seabed in Mulroy Bay is predominantly muddy, with coarser sediments present only in the areas exposed to tidal streams, i.e. Moross Channel and the main channel. The extremely sheltered muddy seabed of Mulroy Bay was dominated by the tunicate *Ascidiella aspersa* with mounds of mud in deeper water which were constructed by an unidentified organism, possibly the echiuran *Maxmulleria lankesteri* (MS18). In shallow water the alga *Asperococcus turneri* was abundant, together with a variety of filamentous algae (MS14). At the head of the bay sea-grass beds of *Zostera marina* were extensive in shallow water (MS15). The synaptid sea cucumber, *Leptosynapta inhaerens,* which normally burrows in sediment, was abundant amongst filamentous algae in the *Zostera* beds. Extensive *Zostera marina* beds were also observed in the wider parts of the entrance channel but were not sampled. The mollusc *Haminea navicula* was found to be common at the lower limit of the algae in most of Broad Water. Beds of *Limaria hians* were found in consolidated shelly gravel in the Moross Channel, between Broad Water and North Water (MS25). Coarse gravel in the entrance channel to Mulroy Bay and in the area where the channel enters Broad Water supported beds of the sea cucumber *Neopentadactyla mixta* with a more diverse associated fauna at the second of these sites (MS26).

Lough Swilly, in contrast, is more exposed to swell entering from the north-west and has tidal currents in most areas; as a consequence the seabed is predominantly gravel and sand. The coarser sand and gravel appeared rather barren but a wide variety of bivalve shells were present and at sites towards the sides of the lough the sediment had a rich infauna. An *Amphiura brachiata* and *Echinocardium cordatum* community was recognised at one of these sites (MS21). The inner part of Lough Swilly was not sampled due to increasing turbidity and tidal streams. The innermost site was characterised by the bryozoan *Vesicularia spinosa* and the hydroid *Rhizocaulus verticillatus* (MS24).

Sublittoral hard substrata communities

Infralittoral bedrock on the open coast was characterised by *Laminaria hyperborea* forest, thinning out at 16-20m depth (MS29). A wide variety of foliose red algae were present with sparse kelp in the lower infralittoral zone including *Drachiella spectabilis* and *Radicilingua thysanorhizans* (MS30).

The circalittoral zone on the open coast was characterised by the sponge *Phorbas fictitius* and the bryozoan *Flustra foliacea* at the most exposed sites, with some indication of sand scour at 25m or deeper (MS43). At Melmore Head the sea squirt *Stolonica socialis* was frequent at 25-28m. The starfish *Stichastrella rosea,* which is a scarce species, was occasional at this site.

In the shelter of Mulroy Bay hard substrata occurs as steep bedrock or boulders in strong tidal streams in the main entrance channel and also as extremely sheltered, silty cliffs at a few places in Broad Water and in North Water. The infralittoral zone in the channel had *Laminaria hyperborea* forest in shallow water with a variety of red algae in deeper water (MS32, MS35). The circalittoral in this channel was a mosaic of habitats due to the variable tidal streams, with sudden changes from bedrock to slopes of cobbles or boulders, each with distinctive communities. Bedrock and large, stable boulders had a rich fauna of hydroids, sea anemones and sponges. The hydroid fauna included *Sertularia argentea* and *Hydrallmania falcata* which are both typical of strong tidal streams and sand scour and *Halecium muricatum* (MS42). Less stable slopes of cobbles and small boulders were present at some sites, and were characterised by large colonies of the sponge *Esperiopsis fucorum* and the

ascidian *Tridemnum cereum*, together with the bryozoan *Flustra foliacea* (MS28). In shallower water these cobble and boulder habitats had sparse kelp forest with some foliose algae, the sponge *Esperiopsis fucorum* and ascidians (MS27).

One sheltered bedrock cliff in Broad Water provided an unusual habitat, with the sponges *Stelletta grubii* and *Dercitus bucklandi* in abundance, together with the small soft coral *Parerythropodium coralloides* (site 18, MS39). Similar sheltered bedrock cliffs in North Water also had *Stelletta grubii*, but were dominated by ascidians, especially *Ascidia virginea* (MS38). An apparently undescribed species of the sponge genus *Polymastia* was typical of these biotopes. The infralittoral zone at these sites was characterised by foliose algae but no kelp forest. The red alga *Griffithsia flosculosa* and the green alga *Codium tomentosum* were common and the southern species *Dudresnaya verticillata* was present (MS34).

Rugged bedrock outcrops at headlands in the outer part of Lough Swilly supported a circalittoral community of hydroids and the bryozoan *Flustra foliacea* (MS40). A distinct boundary between this community and a dense bed of brittlestars, *Ophiothrix fragilis* (MS41) was observed at one of these sites and must be attributable to a small change in exposure to tidal streams or wave action as the substratum and depth were the same. The area dominated by *Ophiothrix fragilis* was further into the lough and around the headland and therefore slightly more sheltered from wave action than the *Flustra foliacea* dominated area.

DISCUSSION

Previous work

Mulroy Bay seems to have been off the path of the Victorian naturalists who explored the natural history of Ireland. It attracted the attention of Robert Lloyd Praeger, who described some of the fauna of the area in a zoological note on the basis of some dredging in the North Water and Moross Channel (Praeger, 1894). He mentions the presence of *Lima* (now *Limaria*) *hians* in Moross Channel and notes the rarity of this species in Ireland. The *Limaria hians* live in interconnected galleries beneath the sediment and were recorded on the present survey (community MS25). Individuals from Mulroy Bay appear to belong to the variety *glaciata* Salis which has previously been reported from Donegal, Corwall and the Channel Islands (Tebble, 1976, p.66).

Parkes (1958a, 1958b) described the algae of Mulroy Bay and included a good general introduction to the shores and physical conditions. She provided details of the algal communities at 32 stations around the lough, including the exposed coast at the entrance. A map of the stations and a list of species recorded was given, but without station numbers. Four of Parkes' stations are located in the same places as sites surveyed on the present survey, including Ballyhoorisky Point which was also studied by Brennan (1945, 1950). Gibb (1957) was first to note the presence of the intertidal brown alga *Ascophyllum nodosum* form *mackaii* in Mulroy Bay, and the distribution of this species around the bay was described in detail by Parkes. Parkes also found the loose-lying form of *Fucus ceranoides* (form *ramosissima*) at the head of Mulroy Bay; when it was only then known in Ireland from Strangford Lough. The presence of the red alga *Odonthalia dentata*, nearing its southern distributional limit here, was noted in the drift along the exposed coast. This survey found a single specimen, attached to bedrock, at the low water mark of spring tides at Ballyhoorisky point (site 32).

Morton (1978) recorded the large green alga *Codium bursa* in North Water, Mulroy Bay. The only previous Irish record of this species, which is common in the Mediterranean, was based on specimens collected in drift in Belfast Lough by Templeton, a location considered doubtful by some later workers. Templeton describes this find in his unpublished manuscript *Hibernia Flora* (Ulster Museum accession Number L2-1939) but the specimens have not

been located. The species has since been collected by Picton (unpublished) in Roskeeda Bay, Kilkieran Bay, Co Galway (specimen in Galway University herbarium), but appears to be very rare in Ireland. It was not found on the present survey although tha habitat was surveyed (MS34).

Minchin has carried out studies of Mulroy Bay in relation to its importance as a source of spat of the scallop *Pecten maximus* (Minchin, 1981). One area of concern was the use of Tri-Butyl-Tin (TBT) antifouling agents on nets used by the salmon farm (Minchin, *et al*, 1987). This was shown to result in the reduction or failure of spat settlement both of *Pecten* and of *Limaria hians*, the file shell. Since 1985 the use of TBT ceased and in 1986 a recovery of settlement was recorded for *Pecten*. The *Limaria* beds in Moross channel were reported to have been reduced to less than 2% of their former extent. Other publications resulting from this work include work on spawning of the large predatory starfish, *Marthasterias glacialis* (Minchin, 1987), and records of the rare Couch's goby, *Gobius couchi* (Minchin, 1988). *Gobius couchi* was recorded on the present survey amongst steep bedrock with ledges and heavily silted upward facing surfaces, in North Water (site 24). It is known in Ireland only from Mulroy Bay and Lough Hyne, and elsewhere only from the Helford River in Cornwall.

Somerfield (1985) studied the anatomy, behaviour and general biology of the opisthobranch mollusc *Haminea navicula* in the Wee Sea, a shallow lagoon in the south-east corner of North Water, Mulroy Bay. The first section included a study of the Wee Sea, detailing bathymetry, tidal regime and habitats present. He described a rich bed of *Zostera marina* and a rapids area where a sill restricts the outgoing tide.

Records of individual species from the area include the scarce octocoral *Parerythropodium corallioides* from Campbell's Bed in Mulroy Bay (Picton, 1985), as well as large numbers of the common gastropod *Bittium reticulatum* from Lough Swilly (McLaughlin, 1930) and a species of parasitic copepod new to Britain and Ireland from North Water (Holmes & Gotto, 1987).

The lichen zone of the upper shore (Sheard 1968) and the feeding biology of feral rainbow trout in North Water (Fahy 1983) have also been studied. Fanad Fisheries Ltd. have unpublished reports of sea bed and water quality monitoring around their fish cage sites.

Biotopes present

A wide range of biotopes was observed in the area covered by this report. The typical open coast rocky zonation of upper and lower infralittoral followed by upper and lower circalittoral communities were present, with a number of species present amongst both algae and animals which are close to their northern geographical limits. The two inlets, Lough Swilly and Mulroy Bay, provided a wide range of sediment biotopes. These were predominantly sandy and tide swept in Lough Swilly, and rocky, bouldery and cobbly with strong tidal streams in the entrance channel to Mulroy Bay. Muddy, sheltered biotopes were found in Mulroy Bay together with unusual extremely sheltered rocky biotopes.

Human impacts

Mulroy Bay has presumably been affected to some degree by the *Pecten* fishery and by salmon farming but the effects seem to be minor at present. The scallops and *Limaria hians* appear to have recovered from the effects of TBT. Pollution from land-based sources also appear to be having little effect on the lough at present and it can be considered to be in a fairly natural state. Lough Swilly appears to have considerable sewage input from Letterkenny and Buncrana, and a large catchment via its tributary rivers. The turbidity observed was high, with shallow limits to the algal dominated zones. This could be in part due to man-made factors and it is difficult to know how much contribution such factors make

without measuring flows and inputs. The seabed and shores on the open coast in the area appear to be largely in a natural state with little coastal development.

Conservation interest

Mulroy Bay is of considerable conservation interest. It has a range of marine biotopes which are unusual in Ireland, in particular the tide-swept biotopes in the main channel and the sheltered and extremely sheltered biotopes in the Broad Water and North Water. The main channel has a variety of communities in varying tidal streams and depths of water, with substrata ranging from bedrock through cobbles and gravel to sand. These biotopes make up a diverse and complex mosaic due to the varying width and depth of the channel. Broad Water is hydrographically and biologically unusual, with considerable isolation from the open sea and a much reduced tidal range, yet fully saline due to the relatively small catchment. A number of species are present in abundance here at or near the northern limits of their distributions. Their presence may indicate higher summer temperatures within the lough than on the open coast as occurs in Lough Hyne (Costello & Myers, 1991) and is believed to contribute to the high species richness there. Particularly notable are the high numbers of the opisthobranch mollusc *Haminea navicula* and the sea anemone *Anthopleura ballii*, the latter in a wide range of habitats.

The rich *Limaria hians* beds in the Moross Channel are rare in Ireland and of conservation importance. The fact that these were nearly destroyed by inadvertent side-effects of TBT use indicates the potential fragility of this biotope. *Limaria* also occurs in smaller numbers underneath boulders and was found at several other sites on the survey.

The deep, sheltered, rock within Mulroy Bay is an unusual habitat. Similar sheltered, steep rock occurs in Lough Hyne, which makes an interesting comparison, but is there not as isolated from the influence of the open sea. Normally rock exists in sites exposed to wave action or tidal streams and in extreme shelter it becomes covered by sediment unless it is unusually steep, as in this case. Such habitats are relicts of glaciation and although not unusual in Scottish sea lochs they are rather rare in Ireland.

The low shore rapids habitat at Marks Point (site 26, community MS13) was noted by Light & Baxter (1990) as unusual and worthy of conservation due to its species richness. 81 species were recorded at Marks Point (Site 26(3)) and an average of 60 species at the three sites. The sites differed considerably in the species present. At site 26(3) species of note included the sponge *Stelletta grubii*, normally found in the circalittoral zone and the nudibranch mollusc *Aeolidiella alderi* rarely recorded in Ireland and at its most northerly known limit here. The chiton *Leptochiton scabridus* was found to be quite frequent beneath rocks embedded in gravel at this site. It was first reported from here by Light & Baxter (1990); the first Irish record of the species which is otherwise known from very few records in south-west England and the Channel Isles. It has since been reported from Lettermore Island in Kilkieran Bay, Co Galway by Strack (1991). The site at Back Lough Narrows (11(1)) was rather different as it was a shallow channel rather than a headland, and had extensive beds of gravel containing the bivalves *Venus verrucosa* and *Venerupis senegalensis*. The rapids habitats at the entrance to the Wee Sea (Somerfield, 1985) is similar to this habitat and these small sites should be given protection from pollution or excessive disturbance.

The open coast near the entrance to Mulroy Bay has a range of interesting open coast biotopes and several species of interest, notably the algae *Drachiella spectabilis* and *Radicilingua thysanorhizans*, and which are close to the northern limits of their ranges on the north coast of Ireland. The record of the sea-squirt *Stolonica socialis* from Melmore Head is currently its northernmost known locality. The first author has observed this species from other sites to the west of this area, i.e. Duncap Head on the north coast and at several sites near Arranmore in west Donegal. Otherwise its distribution is mostly from the Saltee Islands,

Co. Wexford and Pembrokeshire southwards and it is not currently known from further south on the west coast of Ireland. This distribution may be linked to sand scour and tidal streams which seem to be factors determining the preferred habitat of the species. The two algae were both recorded from the north coast of Northern Ireland during the Northern Ireland Sublittoral Survey (Erwin *et al.*, 1990). This stretch of coast should probably be included with the whole of Mulroy Bay to make a marine unit which could be afforded some sort of protective designation.

Lough Swilly already has designation as an Area of Scientific Interest (ASI) from an ornithological standpoint. The biotopes here were not of great intrinsic interest but did provide examples of a range of sediment biotopes which, given the existing status of the lough, could justify conservation of the seabed as well as the foreshore. The sites at the headlands in the outer part of the lough (sites 34, 40) were visited by the first author in 1990 and the rare nudibranch *Caloria elegans* was found in considerable numbers, the only Irish record and only the fourth record of this species for the British Isles. Further work would be necessary to determine the present man-made pressures on this lough.

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APPENDICES

Appendix 1: Description of sites surveyed in 1993 as described at the time of the survey and entered into the database.

1 Outer Claddaghanillian Bay **55° 14.98'N 007° 48.80'W**

The site was situated in the outer part of a bay on the open coast and facing NW. The seabed of rugged bedrock and steep sided gullies at 12m BCD to 16m BCD was characterised by open kelp forest with a diverse understorey of red algae, including several species of interest, i.e. *Drachiella spectabilis & Radicilingua thysanorhizans*.

2 N of Frenchmans Rock **55° 15.43'N 007° 49.14'W**

The site was located on the north side of an isolated rock on the open coast. The seabed dropped steeply through a kelp forest to open rock at 13.6m BCD characterised by *Alcyonium digitatum, Nemertesia* spp. and sponges, particularly *Cliona celata*. The seabed dropped to a level plain of cobbles at 25.6m BCD which although obviously mobile because of the layer of bare rock at the cobble plain edges, supported superabundant juvenile *Antedon bifida* and numerous *Polycera quadrilineata*. The visibility was more than 10m giving the site the feeling of a giant rockmill.

3 Limeburner Rock **55° 17.96'N 007° 48.10'W**

Submerged pinnacle 2-3 miles offshore from the mouth of Mulroy Bay. Bedrock dropping steeply from 8m to in excess of 34m, but gently sloping from approximately 30m. Upper circalittoral characterised by *Corynactis viridis* and small *Alcyonium digitatum* with scattered patches of *Flustra foliacea* and *Securiflustra securifrons*. Lower limit of kelp at 25m BCD becoming dense forest at 20m. The understorey was similar to that on the upper circalittoral bedrock with *Delesseria sanguinea* abundant on the kelp stipes. *Mytilus edulis* on kelp stipes and on bedrock at 8-10m.

4 S side of Limeburner Rock **55° 17.97'N 007° 48.04'W**

Offshore rock pinnacles reaching to 2m (charted). Fully exposed to NW and Atlantic swell. Large kelp plants to 25m depth. Rock dominated by *Corynactis viridis*. Rock platform at 35m with *Flustra foliacea* and *Securiflustra securifrons*.

5 W of Melmore Head **55° 15.39'N 007° 47.34'W**

The site was an exposed headland on the open coast, facing north, with moderate tidal streams running east-west. There was terraced bedrock to 28m BCD, giving way to rounded boulders. From 21m BCD to 24m BCD the bedrock terraces were covered with small, abraded *Halidrys siliquosa* plants and sheets of *?Cruoria rosea* and encrusting bryozoans. From 24m BCD to 29m BCD the bedrock terraces were colonised by *Nemertesia antennina, Stolonica socialis* and *Polycarpa cf. fibrosa*.

6 E of Melmore Head **55° 15.36'N 007° 47.18'W**

An exposed headland near the entrance to Mulroy Bay. The seabed was a plain of course rippled sand with *Echinocardium cordatum*. The bedrock adjacent to the sand was colonised by *Flustra foliacea, Sertularia argentea* and *Caryophyllia smithii*. There were steep narrow gullies with *Corynactis viridis* growing on the walls and *Urticina felina* attached to the bottom. The horizontal surfaces had a rich turf of red algae, with *Acrosorium uncinatum* being the most conspicuous species. The vertical faces of the bedrock had a similar assemblage of species as the walls of the gullies. The kelp park extended to approximately 13m BCD, however it probably would have gone deeper had suitable substrate been available. *Echinus esculentus* was abundant amongst the kelp and many of the plants had their fronds missing.

7 N of Ravedy Island **55° 15.22'N 007° 46.86'W**

The site was on the open coast at the entrance to a sea lough. The habitat was lower infralittoral kelp park on bedrock divided by shallow gullies with kelp growing on the tops of the ridges. Between the kelp the dominant algae were *Callophyllis laciniata & Dictyota dichotoma*. The absence of sand in the gullies suggested a bedrock base below 20m. *Delesseria sanguinea* was also common with heavy incrustations of *Electra pilosa*. Numerous fish particularly *Pollachius virens*, *Pollachius pollachius* and one small *Conger conger* were present.

8 W of Bar Rocks **55° 14.39'N 007° 46.94'W**

Located in the outer bay of Mulroy Bay system in the centre of the main channel. A shallow plain of rippled sand with some drift algae. Sediment was medium sand characterised by *Crangon crangon* with *Echinocardium cordatum*, *Spisula elliptica*, *Angulus tenuis* and some *Ensis arcuatus*. Likely to be a very extensive habitat.

9 W of Knox's Hole **55° 12.78'N 007° 48.34'W**

The site consisted of a deep depression in the seabed opposite a small indent off the main entrance channel to the sea lough, Mulroy Bay. The incoming tidal stream increased rapidly after slack water, but eddied considerably. The shore side of the hole consisted of a steep dune of maerl gravel, then a steep to vertical bedrock cliff. The bottom of the hole was filled with angular boulders which extended up into the upper infralittoral, and a separate vertical cliff face also extended into the upper infralittoral.

10 Mark's Point **55° 10.80'N 007° 44.50'W**

The site was located on a headland projecting into a sheltered channel with strong tidal streams running around the headland. The littoral width was narrow, the substratum consisted of gravel and cobbles on the upper shore and gravel with small boulders on the low shore.

11 Back Lough Narrows **55° 09.96'N 007° 43.55°'W**

The site was located at the entrance channel to a small lough off the main channel into an enclosed bay system. The current through the channel was strong although the channel was generally shallow with boulders, cobbles and patches of gravel and clean sand. The channel was longer than 0.5 km, and approximately 30m wide. There was a distinct lag in the tide from the main system. The channel was characterised by dense growths of algae and sponges on the rocks with the bivalves *Venus verrucosa* and *Tapes* occuring in the gravels between the boulders. The shores displayed restricted zonation of a *Fucus spiralis* zone and a very limited *Pelvetia canaliculata* zone although these were not surveyed. A very interesting site.

12 SE of Scalpmore, Broadwater **55° 09.77'N 007° 41.97'W**

The site was to the SE of a large intertidal bank of rocks in a wide but fully enclosed sea lough. The seabed consisted of a gentle mud slope with many clumps of *Ascidiella aspersa* and flocculent algae in 5m to 8m BCD. Below 8m the algae were no longer present and the *Ascidiella* became less abundant, *Turritella communis* were abundant to the maximum depth surveyed, 12m.

13 N of Pan Bay **55° 09.61'N 007° 42.29'W**

The site was located within Broad Water to the east of the final narrows. The site was in deep water adjacent to the shallow area where strong currents occur. It is likely that the currents are in the surface water and slow over the area depositing any suspended material. The deeper in the hole the more rotting /drift material was experienced and the area looked anoxic i.e. black. The seabed was predominantly maerl gravel with some live plants. Dominant in the shallower areas <16m BCD was the cucumber *Neopentadactyla mixta* and the sea squirts *Ascidiella scabra* and *Ascidiella aspersa*. *Nemertesia ramosa* was also common.

14 SE of Deegagh Point **55° 09.23'N 007° 41.55°'W**

The site was selected because it was one of the few rocky areas on the west side of the enclosed sea lough known as Broadwater. On the seabed there was a ridge of bedrock with a thin covering of silt. Some species more typical of sediment were present in small pockets of mud. The sponge fauna was abundant and diverse.

15 E of Deegagh Point **55° 09.16'N 007° 41.55°'W**

A plain of soft mud with large mounds. *Ascidiella aspersa* was abundant/common and the brittlestars *Ophiocomina nigra* and *Ophiothrix fragilis* were present in crevices between the *Ascidiella aspersa*.

16 SW of Rough Island (Long Island group) **55° 07.24'N 007° 41.61'W**

A slope of soft mud covered with flocculent algae in shallow water. There was a narrow band of *Zostera marina* in the sublittoral fringe then flocculent algae and *Chorda filum*. Large numbers of *Leptosynapta inhaerens* amongst flocculent algae. The deeper water was dominated by *Ciona intestinalis* and *Ascidia virginea*.

17 E of Gortnatraw Bay **55° 08.70'N 007° 40.10'W**

The site was located on the eastern shore of a large enclosed body of water, which was very sheltered with no deep water offshore. The shore was restricted in width to approximately 10m and the three habitats recorded were narrow. The upper shore was characterised by a very restricted *Fucus spiralis* zone on angular cobbles extending to a wider band of *Ascophyllum nodosum* and *Fucus vesiculosus*. This zone was dominant on the shore. The lower shore was characterised by *Fucus serratus* with *Mastocarpus stellatus* and *Codium* sp. extending into the sea. Patches of sandy mud supported *Arenicola marina*. This site was generally typical of the eastern shore of North Water, Mulroy Bay, although some larger areas of muddy sand do occur.

18 SW of Campbells Bed **55° 09.07'N 007° 40.76'W**

The site was located on the west side of large enclosed bay, adjacent to a bedrock reef which rises above chart datum. The seabed dropped noticeably from 6.5m BCD down a cliff to a steep muddy slope at 13.5m BCD. The mud was very soft with no obvious species (not surveyed). The cliff was characterised by *Parerythropodium coralloides* amongst large clumps of sponge *Steletta grubei* and *Dercitus bucklandi*. The top of the cliff was covered with *Ascidiella aspersa*. Further back from the edge the seabed was soft mud with the bubble shell *Haminea navicula* and the cucumber *Thyone fusus* present.

19 White Mares Bay, Broadwater **55° 10.32'N 007° 42.04'W**

A broad channel in Mulroy Bay. The site was chosen because the chromoscope showed the bottom as being soft but uneven with areas of bedrock on the mud. It is speculated that the uneveness is due to large and abundant *Ascidiella aspersa*. The site was characterised by *Ascidiella aspersa, Thyone fusus, Pecten maximus* and *Cereus pedunculatus*. The bedrock held a similar suite of species as the adjacent mud due to the thick layer of sediment covering it.

20 SE of Mullaghanardy Point **55° 10.80'N 007° 42.27'W**

Entrance to Moross channel from Broadwater. Soft mud slope with abundant *Ascidiella aspersa. Ophiothuria fragilis* was common and *Anthopleura ballii* common becoming abundant in shallow water. *Thyone fusus* and *Leptopentacta elongata* both frequent among ascidian clumps.

21 S of Mullaghanardy Point **55° 10.90'N 007° 42.15'W**

The site was located on the southside of narrows joining two larger open expanses in a sea lough, adjacent to a large sea cage site holding salmon. The sea bed at 8m BCD was a flat

plain of gravel with file shells *Limaria hians*. In between and on the nests were anemones particularly *Cereus pedunculatus* with some small *Anthopleura ballii*. The sponge *Esperiopsis fucorum* was frequent on the consolidated *Limaria* galleries. *Ophiothrix fragilis* were abundant with *Ophiocomina nigra* common on the sediment. The habitat was extensive, sloping very gently to 7m BCD.

22 Moross Castle, Moross Channel **55° 11.81'N 007° 43.10'W**

The narrow channel joining the two main water bodies in Mulroy Bay. The site was selected because beds of *Limaria* had been recorded previously. The channel was approximately 8-9m BCD. *Limaria hians* was dominant. The brittlestar *Ophiothrix fragilis* was common, so too was the anemone *Anthopleura ballii*.

23 Stookan Rocks **55° 12.53'N 007° 42.39'W**

The seabed was a terraced rock slope, heavily silted, with clumps of angular boulders. The rock faces had sponges beneath sediment, especially *Polymastia* species.

24 S of Greers Island **55° 12.71'N 007° 42.82'W**

The site was located south of an islet in the north basin of a sea lough. There was a bedrock slope surveyed to 14.2m BCD although it continued downwards. The bedrock was covered with aggregated silt with patches of muddy/shelly gravel. The rock was characterised by sponges in particular *Esperiopsis fucorum* and *Iophon hyndmani* and tunicates particularly *Ascidia virginea* and *A. mentula*. At 6.2m BCD bedrock slope became algal dominated with *Griffithsia corallinoides* and *Codium* sp. At 2.2m *Laminaria saccharina* was dominant but this zone was not completely surveyed.

25 Outer Millstone Bay **55° 11.41'N 007° 45.61'W**

A plain of small cobbles mixed with maerl and empty shells of *Circomphalus casina*. Small boulders were also present with *Laminaria hyperborea* and *Laminaria saccharina* attached to the upward faces of the boulders. *Ophiocomina nigra* was abundant on the cobbles and *Anemonia viridis* was common on the cobbles and shells.

26 Mark's Point, Broadwater **55° 10.15'N 007° 42.53'W**

The site was on a headland with an offshore islet and a shallow channel at the entrance to main channel from broad sea lough. The tidal streams flow strongly through the channel, which is floored with boulders, gravel and sand, with some bedrock. The lower shore is rich, with a variety of sublittoral species living in the flowing water and particularly abundant growths of sponges. The middle shore has cover of *Ascophyllum nodosum*, with few other species. There was a narrow upper band of *Pelvetia canaliculata* and well developed lichens in the supralittoral.

27 N of Tirloughan Bay **55° 11.28'N 007° 46.25'W**

The site was a depression in the seabed to west of Rawros Point, marked as 14.8m on chart, but actually 19.4m BCD. The seabed consisted of cobbles and small boulders with *Laminaria hyperborea* to 10m, red algae slightly deeper. The slope into the hole (flood tide) had boulders covered with *Tridemnum cereum* and *Esperiopsis fucorum*, the slope out with *Flustra foliacea* and *Urticina felina*, otherwise similar.

28 Dundooan Rocks **55° 13.13'N 007° 47.89'W**

The site was an isolated rock in the entrance of Mulroy Bay with a hole charted to 18m. The kelp forest extended to 12m BCD, and there were shallow patches of coarse sand with no algae. Below the kelp forest there was a mixture of steep and vertical rocks and boulders.

29 Off Doaghmore Strand **55° 13.60'N 007° 46.97'W**

Mobile sand with occasional clumps of *Polyides rotundus* and *Gracilaria verrucosa* attached to underlying rock. Very barren, no large infaunal animals.

30 W of Ballyhoorisky Island **55° 14.82'N 007° 45.70'W**

An exposed rocky shore at the entrance to a sea lough. The shore consisted of granite bedrock, steeply sloping at the upper shore level and becoming a more gentle slope in the lower shore region. The bedrock was divided by wide fissures and also weathered parallel to the sea to give frequent long crevices. The *Alaria/Mytilus*, *Mytilus/Chthalamus* and *Porphyra/Semibalanus* zones were narrow with the *Mytilus/Chthalamus* zone being the widest. Lichens were present above the *Porphyra/Semibalanus* zone but this region was not examined.

31 Portnagarribane, Fanad **55° 16.62'N 007° 38.55°'W**

The site was located on the open coast, facing north-west. It consisted of an extensive rugged granite shore with a small sandy bay behind a natural rock barrier. The sand at LWST had extensive growths of *Zostera marina*. The rocky shore was densely populated with *Fucus* and *Ascophyllum nodosum*. The shore backing was of rounded granite boulders with no *Pelvetia canaliculata* zone present.

32 Ballyhoorisky Point **55° 15.42'N 007° 45.40'W**

The site was located at the top of a peninsula facing north, at the entrance to Mulroy Bay. The shore consisted of a series of platforms of well rounded granite bedrock, with interesting rockpools on the upper shore. Most of the shore was barnacle dominated, with small patches of *Fucus* sp. At low water there were well rounded granite boulders and kelp. Large pools on the upper shore had a diverse collection of lower shore algae, including *Halidrys silquosa* and *Fucus serratus*. Some pools had less algae and *Paracentrotus lividus* present. Most of the lower shore was mussel dominated bedrock with *Fucus vesiculosus* common on more sheltered surfaces. *Corallina officinalis* and coralline crusts were present in runnels, upper surfaces had *Porphyra umbilicalis* on mussels. Bare granite rock had *Patella vulgata* on the open surfaces and cracks in the bedock had coralline crusts with small clumps of *Corallina officinalis* and *Lomentaria articulata*. The limpets had caps of *Palmaria palmata*, *Enteromorpha* sp. and filamentous red algae. On the low shore the rounded granite boulders and bedrock were covered with abundant *Laminaria digitata*. Smaller boulders were mostly devoid of animals, medium sized ones had encrusting bryozoans and *Halisarca dujardini* on the underside and coralline crusts on the upper surfaces. Larger boulders and bedrock had coralline crusts, *Patella ulyssiponensis*, *Mastocarpus stellatus* and *Laminaria hyperborea* attached.

33 Great Pollet Arch **55° 15.40'N 007° 37.11'W**

Exposed rocky shore close to the entrance of a large marine inlet. Bedrock strata lay at an angle of approximately of 40 degrees and had eroded to give several parallel peaks down the shore. The supralittoral fringe was dominated by the lichen *Verrucaria maura*, *Ramalina* spp. and *Xanthoria parietina*. Below the lichens the *Pelvetia canaliculata* and *Fucus spiralis* zone was restricted to the top of bedrock peaks and for a short distance down the gently sloping seaward facing bedrock. Below this zone on the sloping bedrock was the *Mytilus edulis* and *Semibalanus balanoides* zone with frequent *Fucus vesiculosus*. *Palmaria palmata* was common in both these zones. The sublittoral fringe occured partly on the gently sloping bedrock and partly on a vertical seaward face dominated by *Alaria esculenta* in the upper part and *Laminaria digitata* seaward. A crevice running parallel to the sea in the mid sublittoral fringe had abundant bryozoan crusts and *Asterias rubens*.

34 Knockalla Point **55° 10.86'N 007° 34.29'W**

The site was located on a headland with moderately strong tidal streams. The first habitat was at the tip of the headland and the second habitat was slightly in the lee of the headland. The bedrock was rugged with pockets and areas of coarse sand. In the first habitat *Alcyonium*

digitatum was dominant with a wide variety of other species present. In the second habitat *Ophiothrix fragilis* was dominant and the diversity of species was lower than in the first.

35 Bay S of Carnsore Point **55° 09.70'N 007° 33.55°'W**

A shallow sheltered bay on the western side of Lough Swilly. The seabed was a plain of fine rippled sand with sparse plants of *Zostera marina*. The polychaete worm *Lanice conchilega* was characteristic and the gastropod mollusc *Hinia reticulata* was common.

36 S side of Anny Point **55° 09.34'N 007° 32.97'W**

A rocky headland on the west side of Lough Swilly, close to some fish farms. There was a plain of uneven, extensively worked sand with *Echinocardium cordatum*, bivalves and polychaetes, a narrow strip of wave rippled gravel, then small boulders with red foliose algae and a few *Laminaria hyperborea* plants.

37 SE of Macamish Point **55° 08.17'N 007° 31.05'W**

The site was located on the west side of a sea lough close to shore just south of a point. The habitat of fine sand/mud at 4.3m BCD with small ripples was unlikely to extend over a large area. The habitat was characterised by *Echinocardium cordatum* buried approximately 5-10cm below the surface, the most abundant species on the surface was *Ophiura albida*. Visibility was < 5m.

38 Saltpans Bank **55° 08.00'N 007° 30.45'W**

A large offshore bank of mobile clean sand extending into Lough Swilly, mostly about 7m BCD. There was no obvious infauna in core samples and the sand was too coarse to pass through a 0.5mm sieve. *Ophiura ophiura* and *Ophiura albida* were common on surface.

39 W of White Sands Rocks **55° 09.04'N 007° 30.00'W**

The site was on the east side of White Sands Bay. The seabed consisted of soft fine sandy/mud on a very gentle current swept incline. *Ophiura ophiura* was common with *Ophiura albida* abundant. Numerous dabs *Limanda limanda* were in the area. The surface was covered with small bivalve shells, probably tellins but none were found alive. Tufts of bryozoans were common on the larger pebbles.

40 W of Dunree Head **55° 12.86'N 007° 33.28'W**

The site was located on the eastern side of a large inlet adjacent to a prominent headland. The seabed consisted of a large rocky pinnacle (possibly an extension of the cliff) rising from a sandy plain at 14.4m BCD vertically to its peak at 8.3m BCD. The sand at the base of the pinnacle was rippled but not surveyed. The bedrock was characterised by *Alcyonium digitatum* and sponges particularly *Cliona celata* and *Raspailia ramosa* (Habitat 2). At 7.1m BCD red algae were recorded from the rock (Habitat 1) predominantly *Hypoglossum hypoglossoides* and some *Delesseria sanguinea*. Generally not a very inspiring site.

Appendix 2: Community descriptions

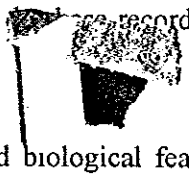
A detailed description of each community recorded during the present survey is given below. Each description comprises the following sections:

a. A title for the **community type**, which indicates the main characterising taxa. The community types are numbered consecutively with the prefix MS denoting the survey area, Mulroy Bay to Lough Swilly. These numbers do not relate to numbers given for community descriptions in other BioMar or MNCR type survey reports.

b. The key physical characteristics of the **habitat type**.

c. A **site and habitat classification** according to MNCR terms (see Hiscock 1990). Where the habitat is present over a range of conditions the range within each category is indicated.

d. The recorded **distribution** of the community within the survey area. The numbers given refer to the site and habitat records, which correspond with MNCR [illegible] records, for example, 14(1) is site record 14 and habitat record 1.



e. The known or expected **extent** of the habitat within the survey area.

f. A **description** of the habitat, including the important physical and biological features, and any variations in community structure at particular sites.

g. The **species composition** of the community. Species included occurred at 50% or more of the stations from which the community was recorded, unless otherwise stated. Beside each species the range and median abundance within the community is shown (see Hiscock 1990 for abundance scales). **Frequency** is the number of habitats, from those assigned to each community, from which the species was recorded. **%** displays this as a percentage of the total number of records assigned to that community. The **abundance** relates to the scale defined in Hiscock 1990. i.e.

P-present
R-rare
O-occasional
F-frequent
C-common
A-abundant
S-super abundant

COMMUNITY MS1	**Lichen zone**
HABITAT	Supralittoral fringe bedrock
Classification	
Situation:	Open coast and enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered to exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Supralittoral fringe
Substratum:	Bedrock
Distribution	33(1)

Extent

This community is likely to occur throughout the area wherever bedrock or stable boulders occur in the supralittoral zone. Although observed at other sites on the open coast and in Mulroy Bay it was not recorded in detail elsewhere.

Description

The community was recorded from the one bedrock shore surveyed which supported the typical maritime lichen community with *Verrucaria maura, Anaptychia fusca, Lecanora atra, Xanthoria parietina*, and *Ramalina* sp. *Verrucaria maura* was superabundant in the lower part of the zone with *Ramalina* sp. and *Xanthoria parietina* restricted to the upper part of the zone.

Species composition

Species name	Abundance
Anaptychia fusca	O
Lecanora atra	O
Ramalina sp.	F
Verrucaria maura	S
Xanthoria parietina	C
Grey lichens indet.	O

COMMUNITY MS2 — *Pelvetia canaliculata* zone

HABITAT — Lower littoral fringe bedrock, boulders and cobbles

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Moderately exposed to very sheltered
Tidal streams:	Weak to very weak
Geology:	Hard
Zone/range:	Littoral fringe
Substratum:	Bedrock, boulders or cobbles

Distribution — 17(1); 33(2)

Extent

This community is present along most of the coastline in the area surveyed, wherever there are hard substrata and some shelter from wave action.

Description

This community was present as a narrow band at the top of the intertidal zone. In the shelter of Mulroy Bay it was well developed on cobbles as well as on less mobile substrata. At the site in Lough Swilly where this community was surveyed it was slightly more diverse, with the lichen *Lichina confinis* present and sheltering large numbers of the small winkle *Littorina neglecta*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Littorina saxatilis	2	100	F-A	C

Fucus spiralis	2	100	F-F	F
Pelvetia canaliculata	2	100	O-F	F

COMMUNITY MS3 *Porphyra* **zone**

HABITAT Exposed bedrock in littoral fringe

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Littoral fringe
Substratum:	Bedrock

Distribution 30(1)

Extent

A narrow zone likely to be extensive on the open coast in this area.

Description

Rounded granite bedrock with crevices, many of which were extensive and running along the shore. Much of the rock was bare but barnacles (*Semibalanus balanoides*) were common in the crevices and the red alga *Porphyra* sp. was frequent on the upper faces of the bedrock.

Species composition

Species name	Abundance
Semibalanus balanoides	C
Patella vulgata	O
Littorina neglecta	A
Porphyra umbilicalis	F
Corallinaceae	O
Corallina officinalis	R
Lichina pygmaea	R

COMMUNITY MS4 *Fucus vesiculosus* **zone**

HABITAT Mid eulittoral bedrock and boulders, strong tidal streams

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Strong
Geology:	Hard
Zone/range:	Mid eulittoral
Substratum:	Bedrock, boulders and cobbles

Distribution 10(1); 26(1)

Extent

Both sites where this biotope was recorded were on headlands on the shores of the entrance channel to Mulroy Bay. It is likely to be widespread along this channel except for the bays where the tidal streams are further offshore.

Description

This zone of the shore was covered with *Fucus vesiculosus* but with *Ascophyllum nodosum* absent. Sheltered shores at this level were normally *Ascophyllum* dominated elsewhere in the area; apparently the strong tidal stream was responsible for the absence of *Ascophyllum* at these sites.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Dynamena pumila	1	50		C
Chthamalus stellatus	1	50		C
Carcinus maenas	1	50		O
Patella vulgata	1	50		O
Littorina	1	50		F
Mytilus edulis	1	50		O
Fucus spiralis	1	50		C
Fucus vesiculosus	2	100	C-C	C
Pelvetia canaliculata	2	100	R-F	O
Enteromorpha	1	50		O

COMMUNITY MS5 — *Ascophyllum nodosum* zone

HABITAT — Mid eulittoral bedrock, boulders and cobbles

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Moderately exposed to very sheltered
Tidal streams:	Moderate to very weak
Geology:	Hard
Zone/range:	Mid eulittoral
Substratum:	Boulders and cobbles

Distribution — 17(2); 26(2); 31(1)

Extent

This is the commonest intertidal community in the area at this level on the shore. It occurs on all shores where there is bedrock, boulders or cobbles in conditions fully sheltered from wave action and tidal streams, and in smaller areas off the edges of the channels in Mulroy Bay as well as in sheltered inlets on the open coast.

Description

This biotope is characterised by dense growths of egg wrack *Ascophyllum nodosum* on bedrock or boulders. The zone was normally the broadest on the shore, more extensive than the *Fucus serratus* zone below or the *Fucus spiralis* or *Pelvetia canaliculata* zone above. The fucoid algae *Fucus serratus* and *Fucus vesiculosus* were also usually present. This biotope

was species poor at most sites, but richest on the east side of Broad Water, Mulroy Bay, where the substratum was heterogeneous, including gravel and small and large boulders.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 3)	%	Range	Median
Halichondria panicea	1	33	O-O	O
Actinia equina	1	33	O-O	O
Carcinus maenas	1	33	R-R	R
Patella vulgata	2	66	C-O	F
Littorina mariae	1	33	O-O	O
Nucella lapillus	2	66	F-R	O
Mastocarpus stellatus	1	33	O-O	O
Ascophyllum nodosum	3	100	A-C	A
Fucus serratus	2	66	C-O	C
Fucus vesiculosus	2	66	A-A	A

COMMUNITY MS6 **Barnacle and *Palmaria palmata* zone**

HABITAT Exposed bedrock in the mid-eulittoral

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Moderately exposed to exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Mid-eulittoral
Substratum:	Bedrock

Distribution 32(3); 33(3); 33(4)

Extent

Likely to be extensive on the open north coast of County Donegal.

Description

Bare bedrock with extensive barnacles, mostly *Semibalanus balanoides*, sparse *Fucus vesiculosus* and common to abundant *Palmaria palmata.* Limpets, *Patella vulgata,* are common and the *Palmaria palmata* and other algae may be controlled by their grazing; the limpets often wear 'hats' of *Palmaria palmata.* Common mussels, *Mytilus edulis,* are a component of the biotope at all sites suveyed.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 3)	%	Range	Median
Semibalanus balanoides	2	67	F - C	F
Patella vulgata	3	100	C - C	C
Nucella lapillus	2	67	C - S	C
Mytilus edulis	3	100	O - S	C
Palmaria palmata	3	100	F - S	A

Corallina officinalis	2	67	F - F	F
Enteromorpha	3	100	O - O	O

COMMUNITY MS7 **Barnacle and limpet dominated rock**

HABITAT Upper eulittoral bedrock

Classification

Situation: Open coast
Salinity: Normal
Wave exposure: Exposed
Tidal streams: Negligible
Geology: Hard
Zone/range: Upper eulittoral
Substratum: Bedrock

Distribution 30(2); 32(2)

Extent

Likely to be widespread on the open coast sites within the survey area and much of exposed sites around the north-west of Ireland.

Description

Exposed bedrock dominated by the barnacle *Chthamalus stellatus* and the common limpet *Patella vulgata*. Common mussels *Mytilus edulis* were abundant, covering much of the rock and the seaweeds *Porphyra umbilicalis* and *Nemalion helminthoides* were also very characteristic of the biotope.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Chthamalus stellatus	2	100	A-S	A
Mytilus edulis	2	100	A-A	A
Porphyra umbilicalis	2	100	O-C	C
Nemalion helminthoides	2	100	F-F	F
Corallina officinalis	2	100	O-F	F

COMMUNITY MS8 ***Fucus serratus* zone**

HABITAT Lower eulittoral bedrock and boulders

Classification

Situation: Enclosed coast
Salinity: Normal
Wave exposure: Very sheltered
Tidal streams: Very weak
Geology: Hard
Zone/range: Lower eulittoral
Substratum: Bedrock and boulders

Distribution 17(3); 31(2)

Extent

Widespread on the lower shore in areas with some shelter from wave action, both within Mulroy Bay and on the open coast.

Description

The zone was characterised by the fucoid algae *Fucus serratus* on the upward faces of the stable boulders and on granite bedrock. Other algae present were *Mastocarpus stellatus, Chondrus crispus* and *Laurencia pinnatifida*. The sponge *Halsarca dujardini* was present on the blades of the *Fucus*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Halisarca dujardini	2	100	R-F	O
Urticina felina	2	100	O-O	O
Spirorbidae	2	100	C-A	A
Patella vulgata	2	100	R-C	F
Littorina littorea	2	100	O-F	F
Nucella lapillus	2	100	R-O	O
Mastocarpus stellatus	2	100	O-C	O
Chondrus crispus	2	100	O-O	O
Laurencia pinnatifida	2	100	R-C	F
Fucus serratus	2	100	F-A	C
Enteromorpha	2	100	O-O	O

COMMUNITY MS9 — **Mid shore pools with *Bunodactis verrucosa***

HABITAT — Mid shore open coast rockpools

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Mid eulittoral
Substratum:	Bedrock

Distribution — 30(3)

Extent

The granite bedrock on the open coast at the entrance to Mulroy Bay supported rockpools in both the areas surveyed.

Description

A shallow rockpool in the *Chthalamus stellata / Mytilis edulis* zone supported numerous *Mytilus edulis* and the sea anemones *Sagartia elegans* and *Bunodactis verrucosa*.

Species composition

Species name	Abundance
Actinia equina	C

Bunodactis verrucosa	C
Sagartia elegans	R
Mytilus edulis	A
Corallinaceae	F
Corallina officinalis	O
Laminaria digitata	C
Alaria esculenta	F

COMMUNITY MS10 — **Upper shore pools with *Paracentrotus lividus***

HABITAT — Upper shore open coast rockpools

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Mid-eulittoral
Substratum:	Bedrock

Distribution — 32(1)

Extent

The granite bedrock on the open coast at the entrance to Mulroy Bay supported rockpools in both the areas surveyed.

Description

Shallow rockpools on the upper shore supported numerous *Paracentrotus lividus* and a variety of lower shore algae. Pools with large numbers of *Paracentrotus* had little algal cover, those nearby without urchins had dense growths of *Halidrys siliquosa*, *Fucus serratus* and *Bifurcaria bifurcata*.

Species composition

Species name	Abundance
Actinia equina	F
Paracentrotus lividus	O
Lipophrys pholis	F
Leathesia difformis	F
Dictyota dichotoma	F
Fucus serratus	F
Himanthalia elongata	F
Bifurcaria bifurcata	F
Cystoseira sp.	F
Halidrys siliquosa	F

COMMUNITY MS11 — **Sublittoral fringe with *Alaria esculenta***

HABITAT — Exposed sublittoral fringe bedrock

Classification

Situation:	Open coast
Salinity:	Normal

Wave exposure:	Exposed
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Sublittoral fringe
Substratum:	Bedrock

Distribution 30(4); 32(4); 33(5)

Extent

This biotope is probably present as a narrow band all round the open coast of the area wherever bedrock substrata are present.

Description

A fringe of *Laminaria digitata* and *Alaria esculenta* was present at the lowest level on the shore. The rock beneath the erect algae was covered by pink coralline encrusting algae and the erect *Corallina officinalis*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 3)	%	Range	Median
Actinia equina	3	100	O-F	O
Urticina felina	3	100	R-O	O
Patella vulgata	3	100	O-C	F
Electra pilosa	3	100	O-O	O
Asterias rubens	3	100	F-R	O
Corallinaceae	3	100	C-S	A
Corallina officinalis	3	100	O-F	F
Laminaria digitata	3	100	O-A	C
Alaria esculenta	3	100	F-S	C

COMMUNITY MS12 **Sandy cove with *Zostera marina***

HABITAT Open coast, sheltered sand and boulders

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Sublittoral fringe
Substratum:	Sand and boulders

Distribution 31(3)

Extent

This biotope was found in a small sheltered area behind exposed rocks on the open coast and is likely to be rare. It occupied only about 100 metres of foreshore.

Description

A small sandy cove with boulders embedded at the base of grainite bedrock. A rampart of granite almost separated the cove from the open sea at low water. An extensive bed of *Zostera marina* extended into the shallow sublittoral.

Species composition

Species name	Abundance
Leucosolenia botryoides	O
Leuconia nivea	F
Oscarella lobularis	F
Ophlitaspongia seriata	F
Actinia equina	C
Urticina felina	O
Bunodactis verrucosa	O
Verruca stroemia	C
Porcellana platycheles	O
Acanthochitona crinitus	O
Gibbula cineraria	F
Schizomavella linearis	C
Electra pilosa	F
Sidnyum turbinatum	O
Botryllus schlosseri	F
Pholis gunnellus	O
Palmaria palmata	F
Corallinaceae	A
Corallina officinalis	F
Mastocarpus stellatus	C
Chondrus crispus	F
Plocamium cartilagineum	O
Lomentaria articulata	C
Sphondylothamnion multifidum	O
Cryptopleura ramosa	F
Leathesia difformis	F
Cladostephus spongiosus	O
Dictyota dichotoma	F
Chorda filum	F
Laminaria digitata	C
Laminaria saccharina	F
Halidrys siliquosa	O
Ulva sp.	F
Zostera marina	C

COMMUNITY MS13	**Tide swept sublittoral fringe with *Cereus pedunculatus* and sponges**
HABITAT	Sublittoral fringe tide swept boulders and gravel
Classification	
Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Strong

Geology:	Hard
Zone/range:	Sublittoral fringe
Substratum:	Boulders and gravel
Distribution	10(2); 11(1); 26(3)

Extent

This biotope occurred on headlands where strong tidal streams in the entrance channel to Mulroy Bay ran close to shore. It is likely to be very restricted in extent but of considerable conservation importance due to the subtidal emergence phenomenon which results in many species normally confined to the sublittoral occurring in the littoral zone.

Description

This community was rich, with 81 species recorded at Marks Point (Site 26(3)) and an average of 60 species at the three sites. The sites differed considerably in the species present. At site 26(3) species of note included the sponge *Stelletta grubii*, normally found in the circalittoral zone and the nudibranch mollusc *Aeolidiella alderi* rarely recorded in Ireland and at its most northerly known limit here. The chiton *Leptochiton scabridus* was found to be quite frequent beneath rocks embedded in gravel at this site. It was first reported from here by Light & Baxter (1990); the first Irish record of the species which is otherwise known from very few records in south-west England and the Channel Isles. It has since been reported from Lettermore Island in Kilkieran Bay, Co Galway by Strack (1991). The site at back lough narrows (11(1)) was rather different as it was a shallow channel rather than a headland, and had extensive beds of gravel containing the bivalves *Venus verrucosa* and *Venerupis senegalensis*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 3)	%	Range	Median
Clathrina coriacea	3	100	O - C	F
Scypha ciliata	2	67	O - O	O
Grantia compressa	3	100	O - F	O
Terpios fugax	2	67	R - O	R
Halichondria panicea	3	100	F - C	F
Esperiopsis fucorum	3	100	O - C	O
Stylostichon plumosum	2	67	F - C	F
Ophlitaspongia seriata	2	67	O - F	O
Haliclona fistulosa	2	67	O - O	O
Dysidea fragilis	2	67	O - O	O
Aplysilla rosea	2	67	R - O	R
Halisarca dujardini	3	100	O - O	O
Dynamena pumila	2	67	O - F	O
Sertularia argentea	2	67	R - F	R
Anemonia viridis	2	67	O - F	O
Urticina felina	2	67	O - F	O
Anthopleura ballii	3	100	O - F	F
Metridium senile	2	67	O - O	O
Sagartia elegans	2	67	F - F	F
Cereus pedunculatus	3	100	O - F	O
Eupolymnia nebulosa	2	67	P - F	P
Verruca stroemia	2	67	O - O	O

Palaemon serratus	2	67	R - O	R
Carcinus maenas	3	100	O - F	O
Diodora graeca	2	67	O - O	O
Mytilus edulis	2	67	R - O	R
Limaria hians	2	67	R - O	R
Chlamys varia	2	67	O - F	O
Hiatella arctica	2	67	R - R	R
Crisia eburnea	2	67	O - F	O
Schizomavella linearis	2	67	F - F	F
Asterina phylactica	3	100	O - O	O
Asterias rubens	3	100	O - F	O
Ophiothrix fragilis	3	100	O - O	O
Amphipholis squamata	2	67	O - F	O
Clavelina lepadiformis	2	67	O - O	O
Diplosoma listerianum	3	100	O - F	F
Ascidiella scabra	2	67	O - F	O
Dendrodoa grossularia	3	100	O - F	O
Botryllus schlosseri	2	67	O - F	O
Pholis gunnellus	2	67	R - R	R
Laminaria digitata	2	67	F - C	F
Himanthalia elongata	2	67	F - A	F
Ulva lactuca	2	67	O - O	O
Codium sp.	2	67	F - C	F

COMMUNITY MS14 **Shallow mud with *Anthopleura ballii***

HABITAT Sheltered shallow mud

Classification

Situation: Enclosed coast
Salinity: Normal
Wave exposure: Very sheltered
Tidal streams: Weak
Zone/range: Supralittoral fringe
Substratum: Mud

Distribution 20(2)

Extent

Probably typical of this depth range around the shores of the open part of Broad Water, Mulroy Bay.

Description

Soft mud with the brown algae *Asperococcus turneri* and *Chorda filum* loosely attached to shells or small stones. The anemone *Anthopleura ballii* was abundant but was commonly found in a variety of habitats in Mulroy Bay and reaches the northern limits of its distribution in this area, so it should not be considered characteristic of this habitat.

Species composition

Species name	Abundance
Anthopleura ballii	A
Cereus pedunculatus	O
Edwardsia claparedi	O

Inachus dorsettensis	F
Turritella communis	O
Buccinum undatum	O
Elysia viridis	C
Asterias rubens	O
Ophiothix fragilis	F
Ophiocomina nigra	O
Chorda filum	F
Asperococcus turneri	C

COMMUNITY MS15 — **Mud with *Zostera marina* and *Leptosynapta inhaerens***

HABITAT — Very sheltered shallow mud

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak
Zone/range:	Infralittoral, to 6m BCD.
Substratum:	Mud

Distribution — 16(1)

Extent

Probably present as a narrow band at these depths alongside all tidal channels in the southern part of Broad Water, Mulroy Bay. The same biotope was observed by BEP in 1986 on the western shore opposite this site.

Description

Mud with dense *Zostera marina* and some *Chorda filum*. Amongst filamentous algae at the base of the *Zostera* plants there are many sea cucumbers *Leptosynapta inhaerens*. This species normally burrows beneath mud or sand and further records of it living in these conditions would be of interest.

Species composition

Species name	Abundance
Anemonia viridis	C
Anthopleura ballii	C
Haminoea navicula	F
Amphipholis squamata	F
Leptosynapta inhaerens	C
Clavelina lepadiformis	F
Ascidiella aspersa	F
Gobius niger	C
Chorda filum	C
Laminaria saccharina	C
Zostera marina	C

COMMUNITY MS16 — ***Zostera marina* bed with *Amphiura brachiata***

HABITAT — Sublittoral sand

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Weak
Zone/range:	Sublittoral
Substratum:	Sand

Distribution 35(1)

Extent

This biotope was observed at only one site in Lough Swilly, but may occur in small patches at the appropriate depth in the middle part of the outer lough. *Zostera* beds in Mulroy Bay were much more extensive, but normally on muddy substrata rather than sand. *Zostera* beds were observed in shallow water (less than 1m BCD) in the entrance channel to Mulroy, but were not sampled. These beds were quite extensive over the bank called Ottiergarve, where the entrance channel is widest between the first and second narrows, mostly 0.3 to 0.6m ACD. The sediment here was sand and there was a weak but steady tidal stream.

Description

A sparse bed of *Zostera marina* on sand, with a range of species present typical of sandy seabeds. The anemone *Sagartiogeton undatus* was frequent.

Species composition

Species name	Abundance
Hydractinia echinata	F
Sagartiogeton undatus	F
Terebellidae	O
Lanice conchilega	F
Pagurus bernhardus	F
Pagurus prideaux	O
Liocarcinus marmoreus	O
Polinices poliana	R
Buccinum undatum	O
Hinia reticulata	C
Asterias rubens	O
Amphiura brachiata	O
Ophiura albida	F
Ophiura ophiura	O
Echinocardium cordatum	O
Pomatoschistus pictus	C
Zostera marina	F

COMMUNITY MS17 **Mud with *Ciona intestinalis* and *Ascidia virginea***

HABITAT Very sheltered mud

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak

Zone/range:	6m to at least 13m BCD
Substratum:	Mud

Distribution 16(2)

Extent

The deeper parts of the channels in the southern part of Mulroy Bay are probably all similar to this site.

Description

A very soft mud with clumps of the ascidians *Ciona intestinalis* and *Ascidia virginea* loosely attached to shell fragments and small stones. Bundles of tubes built by amphipods were present on the surface of the mud, which was covered with pseudofaeces of the tunicates. Terebellid worms were common and the sea cucumbers *Thyone fusus* and *Ocnus lactea* were frequent and common respectively.

Species composition

Species name	Abundance
Ciona intestinalis	C
Ascidia virginea	C
Ocnus lactea	C
Thyone fusus	F

COMMUNITY MS18 **Mud with *Ascidiella aspersa* clumps**

HABITAT Sheltered mud

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Zone/range:	Circalittoral
Substratum:	Mud

Distribution 12(1); 12(2); 15(1); 20(3)

Extent

This community appears to be extensive in the Broad Water of Mulroy Bay, between 5m and 17m depth.

Description

This community occurred on horizontal or shallow slopes of mud, often with some shells present. The most conspicuous elements of the community were clumps of *Ascidiella aspersa* loosely attached to small shells and each other on the surface of the mud. Scallops, *Pecten maximus*, were usually present in fairly high numbers, though the Mulroy Bay populations are found on much softer ground than is normal for scallops elsewhere. The tower shell *Turritella communis* was normally present both at the surface and buried in the mud. The sea cucumbers *Thyone fusus* and *Leptopentacta elongata* were also characteristic. The sea anemone *Anthopleura ballii* was normally present, though as already noted it occurred in a range of biotopes within Mulroy Bay, on the other hand the anemone *Sagartiogeton laceratus* was particularly characteristic of this biotope, all records of this species on the present survey were from this habitat. Other species which were frequent in this habitat include the spider crab *Inachus dorsettensis* and the bubble shell *Haminoea navicula*.

Species composition

Species name	Frequency of occurrence No. of records Median (Total 4)	%	Abundance Range	
Suberites carnosus	2	50	O - O	O
Polymastia mamillaris	2	50	O - F	O
Hydractinia echinata	3	75	O - F	O
Cerianthus lloydii	3	75	R - O	O
Anemonia viridis	2	50	O - F	O
Anthopleura ballii	3	75	O - C	F
Metridium senile	2	50	R - O	R
Sagartiogeton laceratus	3	75	R - R	R
Edwardsia claparedii	2	50	O - O	O
Terebellidae	4	100	O - F	O
Pagurus bernhardus	3	75	O - F	O
Hyas araneus	2	50	R - O	R
Inachus dorsettensis	3	75	O - C	F
Carcinus maenas	2	50	O - O	O
Turritella communis	3	75	F - A	F
Haminoea navicula	3	75	O - C	O
Pecten maximus	3	75	O - C	F
Crossaster papposus	3	75	R - O	O
Henricia oculata	2	50	O - O	O
Asterias rubens	4	100	O - F	O
Marthasterias glacialis	3	75	O - O	O
Ophiothrix fragilis	3	75	F - F	F
Ophiocomina nigra	2	50	O - C	O
Trachythyone elongata	2	50	F - C	F
Thyone fusus	3	75	O - C	F
Ascidiella aspersa	3	75	C - A	A
Ascidia virginea	2	50	R - O	R
Gobius niger	3	75	O - F	O
Pomatoschistus pictus	2	50	F - F	F

COMMUNITY MS19 — **Sand with *Gracilaria verrucosa***

HABITAT — Moderately exposed shallow sand with rocks

Classification

Situation:	Narrows
Salinity:	Normal
Wave exposure:	Moderately exposed
Tidal streams:	Weak
Zone/range:	9m
Substratum:	Sand

Distribution — 29(1)

Extent

This biotope was probably restricted to the tide swept entrance channel outside the first narrows of Mulroy Bay.

Description

Mobile sand with few species present. Small rocks buried beneath the sand supported a few species of algae including the scour resistant *Polyides rotundus* and *Gracilaria verrucosa*. The sand swimming crab *Liocarcinus marmoreus* was present.

Species composition

Species name	Abundance
Crangon crangon	O
Liocarcinus marmoreus	R
Gracilaria verrucosa	O
Polyides rotundus	O
Plocamium cartilagineum	O

COMMUNITY MS20 — **Sand with *Spisula elliptica***

HABITAT — Moderately exposed medium sand

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Moderately exposed
Tidal streams:	Weak
Zone/range:	3.5 - 21m BCD
Substratum:	Medium sand

Distribution — 8(1); 6(2)

Extent

The entire bay at the entrance to Mulroy Bay is shallow sand flats with occasional rock outcrops. The sand probably all supports this biotope.

Description

A plain of medium sand in moderately exposed areas with the bivalves *Spisula elliptica* and *Angulus tenuis* frequent. The shrimp *Crangon crangon* was common on the surface of the sediment and the heart urchin *Echinocardium cordatum* was occasional, buried in the sand. Site 6(2) was an impoverished region of coarser sand at the margin of this area and in deeper water. *Echinocardium cordatum* and *Echinocardium flavescens* were present but bivalves were apparently absent.

Species composition

Species name	Abundance (Site 8(1) only)	
Crangon crangon	C	
Pagurus bernhardus	R	
Liocarcinus marmoreus	R	
Spisula elliptica	F	
Ensis arcuatus	R	
Angulus tenuis	F	
Circomphalus casina	O	
Echinocardium cordatum	O-C	
Echinocardium flavescens	O	(Site 6(2) only)
Ammodytes tobianus	O	

COMMUNITY MS21	Sand with *Echinocardium cordatum* and *Amphiura brachiata*
HABITAT	Sublittoral sand

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Weak
Zone/range:	Sublittoral
Substratum:	Sand
Distribution	36(3)

Extent

Probably extensive areas within Lough Swilly at the appropriate depths.

Description

Sheltered, well worked sand with *Echinocardium cordatum, Amphiura brachiata* and a variety of bivalves and polychaetes.

Species composition

Species name	Abundance
Hydractinia echinata	O
Cereus pedunculatus	R
Pagurus bernhardus	O
Pagurus prideaux	O
Liocarcinus depurator	O
Hinia reticulata	F
Philine aperta	R
Facelina bostoniensis	O
Nucula sp.	C
Mya arenaria	O
Thracia sp.	O
Asterias rubens	O
Amphiura brachiata	F
Ophiura albida	F
Echinocardium cordatum	C
Scyliorhinus canicula	O
Callionymus reticulatus	F
Pomatoschistus pictus	F
Limanda limanda	O

COMMUNITY MS22	Sand with *Ophiura albida* and *Echinocardium cordatum*
HABITAT	Sublittoral sand

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered

Tidal streams:	Moderately strong
Zone/range:	4-4.5m BCD
Substratum:	Sand

Distribution 37(1)

Extent

Probably extensive areas within Lough Swilly at the appropriate depths.

Description

Fine well-sorted sand with shell fragments and small ripples. *Echinocardium cordatum* was abundant and *Ophiura albida* common. *Lanice conchilega* tubes were frequent.

Species composition

Species name	Abundance
Hydractinia echinata	R
Lanice conchilega	F
Pagurus bernhardus	F
Pagurus prideaux	O
Carcinus maenas	R
Ophiura albida	C
Echinocardium cordatum	A

COMMUNITY MS23 **Sand with *Ophiura ophiura* and *Ophiura albida***

HABITAT Duned mobile coarse sand with moderate tidal streams

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Moderately strong
Zone/range:	7-8m BCD
Substratum:	Coarse sand

Distribution 38(1)

Extent

This biotope was probably typical of the large bank of mobile coarse sand in Lough Swilly opposite Buncrana, known as Saltpans Bank.

Description

Mobile clean sand with no apparent infauna, recently dead shells of *Angulus squalidus* were numerous on the surface of the sand. On the surface of the sand the brittlestars *Ophiura ophiura* and *Ophiura albida* were common. The only other species seen was the common hermit crab *Pagurus bernhardus*.

Species composition

Species name	Abundance
Pagurus bernhardus	R
Ophiura albida	C

Ophiura ophiura	C

COMMUNITY MS24	**Sand with *Vesicularia spinosa***
HABITAT	Sand with moderate tidal streams
Classification	
Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Moderately strong
Zone/range:	Circalittoral
Substratum:	Muddy sand
Distribution	39(1)

Extent

This biotope probably occupies most of the deeper water (below 15m BCD) in the inner three quarters of Lough Swilly. Turbidity was high and a dive at a second site which had apparently the same biotope was abandoned due to the current and poor visibility.

Description

A range of species characteristic of scoured sandy areas and high turbidity was present. Characteristic species were the bryozoans *Alcyonidium parasiticum* and *Vesicularia spinosa*, the hydroids *Sertularia cupressina* and *Rhizocaulus verticillatus* and the brittlestar *Ophiura ophiura*.

Species composition

Species name	Abundance
Hydractinia echinata	O
Halecium halecinum	O
Sertularella polyzonias	P
Sertularia cupressina	F
Rhizocaulus verticillatus	O
Aphrodita aculeata	O
Pygospio elegans	C
Chaetopterus variopedatus	F
Lanice conchilega	O
Pagurus bernhardus	F
Cuthona caerulea	P
Alcyonidium parasiticum	C
Vesicularia spinosa	O
Asterias rubens	F
Ophiura albida	C
Ophiura ophiura	A
Psammechinus miliaris	O
Agonus cataphractus	O
Pomatoschistus minutus	F
Limanda limanda	A

COMMUNITY MS25	**Mud, sand and shells with *Limaria hians***
HABITAT	Lower infralittoral shelly sand

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Lower infralittoral
Substratum:	Mud, sand and shells

Distribution 21(1); 22(1)

Extent

This biotope occurred in the Moross channel at depths of 6.5m to 8m. It is not to be expected anywhere else in the area and is characteristic of areas with weak to moderate tidal streams and full shelter from wave action.

Description

An uneven seabed of sand which is completely covered by a mat of shell and gravel particles consolidated by the byssus threads of the file shell *Limaria hians*. This consolidated substrate provides attachment for algae and sessile animals. The *Limaria hians* live in interconnected galleries beneath the sediment. Individuals from Mulroy Bay appear to belong to the variety *glaciata* Salis which has previously been reported from Donegal, Corwall and the Channel Islands (Tebble, 1976). None of the other species present were characteristic of the biotope, but notable species were the anemones *Cereus pedunculatus* and *Anthopleura ballii* and the spider crab *Inachus dorsettensis*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Scypha ciliata	2	100	R-R	R
Esperiopsis fucorum	2	100	F-F	F
Anthopleura ballii	2	100	F-C	C
Metridium senile	2	100	O-R	O
Cereus pedunculatus	2	100	A-C	C
Inachus dorsettensis	2	100	F-R	F
Carcinus maenas	2	100	O-R	O
Buccinum undatum	2	100	C-F	C
Limaria hians	2	100	A-A	A
Pecten maximus	2	100	F-F	F
Henricia oculata	2	100	O-R	O
Asterias rubens	2	100	C-F	C
Ophiothrix fragilis	2	100	A-C	C
Thyone fusus	2	100	O-R	O
Plocamium cartilagineum	2	100	F-R	F

COMMUNITY MS26	**Coarse gravel and maerl with *Neopentadactyla mixta***
HABITAT	Coarse gravel

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Moderately strong
Zone/range:	7.5 - 15m BCD
Substratum:	Coarse gravel & maerl

Distribution 9(1); 13(1)

Extent

Small areas in Mulroy Bay with moderate tidal streams and coarse gravel supported this biotope, but were limited in extent.

Description

This biotope consisted of coarse, tide-swept gravel with the burrowing sea cucumber *Neopentadactyla mixta* in considerable numbers. The gravel consisted of dead maerl mixed with shell, with some live maerl at both sites where the biotope was observed. Live maerl, *Lithothamnion corallioides* was common at both sites, but otherwise the two sites were rather different. The bivalve *Lutraria lutraria* was frequent at one site, with little other fauna or flora present. The second site (13(1)) was much more heterogeneous, with cobbles present supporting sea squirts, especially *Ascidiella aspersa* and *Ascidiella scabra* and hydroids, especially *Nemertesia ramosa*. *Pecten maximus* was also frequent at this site. The anemone *Anthopleura ballii* was also present at both sites, but given its almost ubiquitous occurrence in Mulroy Bay this is not significant.

Species composition

Species name	Abundance
Anthopleura ballii	O
Lutraria lutraria	F
Neopentadactyla mixta	C
Lithothamion corallioides	C

COMMUNITY MS27 **Cobbles with *Esperiopsis fucorum* and red algae**

HABITAT Infralittoral cobbles in strong tidal stream

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Moderately strong
Geology:	Hard
Zone/range:	Infralittoral
Substratum:	Boulders and cobbles

Distribution 25(1); 27(1)

Extent

This community was described from two sites in the entrance channel to Mulroy Bay. This channel is very heterogeneous in depth, tidal stream strength, and substrata so it is difficult to

predict the extent of the present habitat, but it is probably present at depths of 7-12m in the centre of this channel.

Description

A plain of cobbles and small boulders with red algae, sponges and hydroids. At one of the sites (25(1)) the boulders were mixed with maerl and dead shells of *Circomphalus casina* and the black brittlestar *Ophiocomina nigra* was abundant on the seabed. At both sites the boulders had sparse *Laminaria hyperborea* and *Halidrys siliquosa* attached. The sponges *Esperiopsis fucorum* and *Halichondria panicea* were common, the latter encasing many of the kelp stipes. Hydroids were abundant, especially the scour-resistant *Hydrallmania falcata* and *Sertularia argentea*.

Species composition

Species name	Frequency of occurrence No. of records (Total 2)	%	Abundance Range	Median
Halichondria panicea	2	100	O - O	O
Esperiopsis fucorum	2	100	F - C	F
Ophlitaspongia seriata	2	100	O - O	O
Plumularia setacea	2	100	O - F	O
Amphisbetia operculata	2	100	O - F	O
Hydrallmania falcata	2	100	O - O	O
Sertularia argentea	2	100	O - O	O
Anemonia viridis	2	100	O - C	O
Anthopleura ballii	2	100	O - C	O
Cancer pagurus	2	100	O - O	O
Liocarcinus puber	2	100	O - F	O
Calliostoma zizyphinum	2	100	O - F	O
Alcyonidium hirsutum	2	100	O - F	O
Crossaster papposus	2	100	O - O	O
Asterias rubens	2	100	O - O	O
Clavelina lepadiformis	2	100	O - O	O
Diplosoma listerianum	2	100	O - F	O
Botryllus schlosseri	2	100	O - O	O
Plocamium cartilagineum	2	100	F - C	F
Delesseria sanguinea	2	100	F - C	F
Polyneura laciniata	2	100	F - C	F
Dictyota dichotoma	2	100	O - F	O
Laminaria hyperborea	2	100	F - C	F
Halidrys siliquosa	2	100	R - F	R

COMMUNITY MS28	Cobbles with *Hymedesmia brondstedi* and *Tididemnum cereum*
HABITAT	Circalittoral cobbles in tidal stream
Classification	
Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Strong

Geology:	Hard
Zone/range:	Circalittoral
Substratum:	Boulders and cobbles

Distribution 27(2); 27(3)

Extent

This biotope was encountered at a single site but divided into two habitat records at the time of the survey, this division was not supported by the analysis carried out here. The site was very restricted, being a deep hole in the narrow entrance channel to Mulroy Bay. No other similar features are shown on the chart.

Description

A steep slope of cobbles and boulders with abundant growths of sponges, especially *Esperiopsis fucorum* and *Hymedesmia brondstedi* and the sea squirts *Aplidium pallidum* and *Tridemnum cereum*. The biotope was very distinctive and was considered unusual at the time of survey. *Flustra foliacea* was common at the bottom and on the slope of the depression farthest from the open sea, but absent on the slope nearest the open sea.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Polymastia mamillaris	2	100	R-R	R
Cliona celata	2	100	O-O	O
Esperiopsis fucorum	2	100	C-A	C
Dysidea fragilis	2	100	O-F	F
Plumularia setacea	2	100	C-C	C
Sertularia argentea	2	100	F-F	F
Alcyonium digitatum	2	100	R-R	R
Anemonia viridis	2	100	O-F	F
Urticina felina	2	100	R-C	C
Anthopleura ballii	2	100	F-F	F
Sagartia elegans	2	100	F-F	F
Galathea squamifera	2	100	C-C	C
Cancer pagurus	2	100	F-F	F
Liocarcinus corrugatus	2	100	O-O	O
Liocarcinus puber	2	100	F-F	F
Calliostoma zizyphinum	2	100	C-C	C
Crossaster papposus	2	100	O-O	O
Henricia oculata	2	100	O-O	O
Asterias rubens	2	100	O-O	O
Marthasterias glacialis	2	100	O-O	O
Echinus esculentus	2	100	O-C	C
Clavelina lepadiformis	2	100	F-F	F
Trididemnum cereum	2	100	C-A	C
Botryllus schlosseri	2	100	O-O	O
Scyliorhinus canicula	2	100	O-O	O

COMMUNITY MS29 **Open coast kelp forest**

HABITAT Upper infralittoral exposed bedrock

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed - moderately exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Upper infralittoral
Substratum:	Bedrock

Distribution 3(1); 4(1)

Extent

This community appeared to be the normal one at the depth band occupied by the upper infralittoral zone on the open coast and is probably extensive between the depths of 3-10m around the open coast in this area.

Description

This biotope consisted of kelp forest of dense *Laminaria hyperborea* plants on bedrock. The rock surfaces beneath the kelp were colonised by the sea anemones *Corynactis viridis*, *Sagartia elegans* and *Metridium senile.*

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Pachymatisma johnstonia	2	100	F-O	F
Alcyonium digitatum	2	100	R-R	R
Metridium senile	2	100	C-F	F
Sagartia elegans	2	100	F-O	F
Corynactis viridis	2	100	A-O	C
Caprellidae	2	100	A-C	A
Mytilus edulis	2	100	A-C	C
Electra pilosa	2	100	A-F	C
Asterias rubens	2	100	C-F	F
Echinus esculentus	2	100	F-O	F
Pollachius virens	2	100	C	C
Corallinaceae	2	100	F-F	F
Laminaria hyperborea	2	100	A-A	A

COMMUNITY MS30 **Open coast kelp park with *Drachiella spectabilis***

HABITAT Lower infralittoral exposed bedrock

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed - moderately exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Lower infralittoral
Substratum:	Bedrock

Distribution 1(1); 6(1); 7(1)

Extent

This community appeared to be the normal one at the depth band occupied by the lower infralittoral zone on the open coast and is probably extensive between the depths of 10-20m around the open coast in this area.

Description

This biotope consisted of open kelp park with scattered *Laminaria hyperborea* plants and an extensive and diverse underflora of red algae and the brown algae *Dictyota dichotoma* and *Dictyopteris membranacea*. The richest of the sites was 1(1), outer Cladaghanillian Bay, where the algae *Radicilingua thysanorhizans* and *Drachiella spectabilis*, which are both near the northern limits of their range in this area, were both frequent.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 3)	%	Range	Median
Clathrina coriacea	2	67	O - O	O
Leucosolenia complicata	2	67	R - O	R
Scypha ciliata	3	100	O - O	O
Pachymatisma johnstonia	3	100	O - O	O
Cliona celata	3	100	R - F	F
Phorbas fictitius	2	67	O - O	O
Haliclona viscosa	2	67	R - O	R
Halecium halecinum	2	67	R - O	R
Aglaophenia pluma	2	67	O - F	O
Obelia geniculata	2	67	F - F	F
Alcyonium digitatum	2	67	O - O	O
Sagartia elegans	2	67	O - O	O
Corynactis viridis	3	100	O - C	O
Caryophyllia smithii	3	100	O - F	F
Gibbula cineraria	2	67	R - O	R
Calliostoma zizyphinum	3	100	O - O	O
Acanthodoris pilosa	2	67	R - O	R
Limacia clavigera	2	67	P - F	P
Alcyonidium hirsutum	2	67	O - O	O
Membranipora membranacea	2	67	O - O	O
Electra pilosa	3	100	F - A	C
Bugula plumosa	2	67	O - F	O
Antedon bifida	3	100	O - F	O
Henricia oculata	3	100	O - O	O
Asterias rubens	2	67	F - F	F
Marthasterias glacialis	3	100	O - F	O
Echinus esculentus	3	100	R - C	O
Holothuria forskali	2	67	F - F	F
Clavelina lepadiformis	3	100	O - O	O
Botryllus schlosseri	2	67	O - F	O
Pollachius pollachius	2	67	O - F	O
Ctenolabrus rupestris	2	67	O - O	O
Labrus bergylta	2	67	O - O	O
Pholis gunnellus	2	67	R - O	R

Bonnemaisonia asparagoides	2	67	O - F	O
Dilsea carnosa	3	100	O - F	O
Callophyllis laciniata	3	100	O - C	F
Kallymenia reniformis	3	100	O - F	O
Plocamium cartilagineum	3	100	F - F	F
Acrosorium uncinatum	3	100	R - A	C
Cryptopleura ramosa	3	100	O - F	F
Delesseria sanguinea	3	100	F - C	F
Drachiella spectabilis	3	100	R - F	R
Hypoglossum hypoglossoides	3	100	O - F	F
Nitophyllum punctatum	2	67	O - F	O
Phycodrys rubens	2	67	O - O	O
Heterosiphonia plumosa	2	67	O - F	O
Dictyopteris membranacea	2	67	R - F	R
Dictyota dichotoma	3	100	F - A	C
Laminaria hyperborea	3	100	F - C	F
Halidrys siliquosa	2	67	O - F	O

COMMUNITY MS31 **Open coast kelp park with *Halidrys siliquosa***

HABITAT Lower infralittoral exposed bedrock with sand scour

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Lower infralittoral
Substratum:	Bedrock

Distribution 5(1)

Extent

This biotope was recorded at only one site on the present survey. It is probably present at headlands on the open coast where the tidal streams are accelerated by the topography.

Description

Bedrock in the lower infralittoral zone at Melmore Head, at the entrance to Mulroy Bay, was characterised by scattered plants of *Halidrys siliquosa* and sheets of the encrusting alga *Cruoria rosea* and the bryozoan *Umbonula littoralis*. Scour from mobile sand clearly had a significant effect on the animals and plants present. The ascidians *Botryllus schlosseri* and *Polyclinum aurantium* were both frequent, the *Polyclinum* with sand embedded into the colonies.

Species composition

Species name	Abundance
Scypha ciliata	O
Pachymatisma johnstonia	O
Polymastia boletiformis	O
Cliona celata	O
Stelligera stuposa	O

Aglaophenia pluma	F
Abietinaria filicula	F
Corynactis viridis	O
Caryophyllia smithii	O
Crisia denticulata	F
Umbonula littoralis	F
Antedon bifida	C
Crossaster papposus	O
Henricia oculata	O
Asterias rubens	O
Marthasterias glacialis	O
Ophiothrix fragilis	F
Echinus esculentus	O
Holothuria forskali	O
Clavelina lepadiformis	O
Polyclinum aurantium	F
Botryllus schlosseri	F
Botrylloides leachi	O
Laminaria hyperborea	O
Halidrys siliquosa	C

COMMUNITY MS32 **Cliff with *Rhodymenia pseudopalmata***

HABITAT Upper infralittoral sheltered bedrock

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Upper infralittoral
Substratum:	Bedrock

Distribution 9(3)

Extent

This biotope was recorded from a short section of vertical bedrock in the entrance channel to Mulroy Bay.

Description

A vertical bedrock cliff in the upper infralittoral zone with dense cover of the red alga *Rhodymenia pseudopalmata*, mixed with *Rhodymenia holmesii*. The hydroid *Halecium halecinum* was frequent, as was the red alga *Meredithia microphylla*.

Species composition

Species name	Abundance
Pachymatisma johnstonia	F
Cliona celata	F
Halecium halecinum	F
Meredithia microphylla	F
Plocamium cartilagineum	F

Rhodymenia holmesii	C
Rhodymenia pseudopalmata	C

COMMUNITY MS33	**Shallow bedrock with *Hypoglossum hypoglossoides***
HABITAT	Upper infralittoral sheltered bedrock

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Lower infralittoral
Substratum:	Bedrock

Distribution 40(1)

Extent

This biotope was only recorded from a headland in the outer part of Lough Swilly. It is probably not extensive in its occurrence, but other rocky areas in the vicinity might be expected to have the same biotope between the same depths.

Description

Bedrock in the lower infralittoral zone in Lough Swilly was characterised by a narrow range of algae, principally the red alga *Hypoglossum hypoglossoides,* the sea anemone *Metridium senile* and the barnacle *Balanus crenatus.*

Species composition

Species name	Abundance
Leucosolenia complicata	O
Scypha ciliata	O
Cliona celata	F
Esperiopsis fucorum	O
Sertularia argentea	R
Alcyonium digitatum	O
Metridium senile	C
Sagartia elegans	F
Balanus crenatus	C
Bugula plumosa	O
Asterias rubens	O
Marthasterias glacialis	R
Clavelina lepadiformis	O
Polyclinum aurantium	F
Polycarpa pomaria	O
Delesseria sanguinea	F
Hypoglossum hypoglossoides	C
Phycodrys rubens	O

COMMUNITY MS34	**Sheltered rock with *Griffithsia corallinoides***
HABITAT	Extremely sheltered bedrock
Classification	
Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Upper infralittoral
Substratum:	Bedrock
Distribution	24(1)

Extent

Bedrock in shallow water in the North Water of Mulroy Bay is subject to little water movement and the biotopes are likely to be uniform througout the North Water where rock is present in shallow water.

Description

This biotope was only described from one site in the North Water of Mulroy Bay. It was poor in species, and characterised by the abundance of the red alga *Griffithsia corallinoides* and the green alga *Codium tomentosum*. The rare seaweed *Codium bursa* was collected from this habitat in this area (Morton, 1978) and *Dudresnaya verticillata* is a notable species, recorded at this site by this survey.

Species composition

Species name	Abundance
Asterias rubens	F
Dudresnaya verticillata	O
Griffithsia corallinoides	C
Membranoptera alata	R
Chorda filum	R
Codium tomentosum	F

COMMUNITY MS35	**Boulders with *Plocamium cartilagineum* and other red algae**
HABITAT	Upper infralittoral sheltered boulders
Classification	
Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak to moderate
Geology:	Hard
Zone/range:	Upper infralittoral
Substratum:	Boulders
Distribution	9(4); 36(1)

Extent

This biotope was recorded from boulders in the entrance channel to Mulroy Bay and from shallow boulders in Lough Swilly.

Description

Boulders covered by red algae, especially *Plocamium cartilagineum, Heterosiphonia plumosa* and *Dictyota dichotoma*. The kelp *Laminaria hyperborea* was common in this biotope, but the *Laminaria* forest was quite open and the red algal understorey was dense and diverse compared with kelp forest on bedrock.

Species composition

Species name	Abundance	
Bonnemaisonia asparagoides	F	O
Dilsea carnosa	F	O
Callophyllis laciniata	F	O
Plocamium cartilagineum	C	F
Cryptopleura ramosa	F	O
Delesseria sanguinea	F	O
Myriogramme bonnemaisonii	F	F
Heterosiphonia plumosa	F	F
Dictyota dichotoma	F	F
Laminaria hyperborea	C	F

COMMUNITY MS36 — Sheltered rock with *Polymastia mamillaris*

HABITAT — Sheltered rock outcrops

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Upper infralittoral
Substratum:	Bedrock

Distribution — 20(1)

Extent

This biotope was only found on a bedrock outcrop in Broad Water of Mulroy Bay at the entrance to Moross Channel. It is likely that the biotope was influenced by the slight tidal streams, and would not be found generally in the area.

Description

This biotope is characterised by the sponges *Polymastia mamillaris, Polymastia boletiformis* and *Stelligera rigida,* in combination with some red algae and the sugar kelp *Laminaria saccharina.*

Species composition

Species name	Frequency of occurrence	Abundance
Clathrina coriacea	O	

Pachymatisma johnstonia	F
Polymastia boletiformis	F
Polymastia mamillaris	C
Stelligera rigida	F
Raspailia ramosa	O
Nemertesia ramosa	F
Plumularia setacea	F
Alcyonium digitatum	O
Anthopleura ballii	F
Phoronis hippocrepia	F
Ascidiella aspersa	F
Callophyllis laciniata	O
Kallymenia reniformis	F
Corallinaceae	C
Rhodophyllis divaricata	O
Dictyota dichotoma	O
Laminaria saccharina	F

COMMUNITY MS37 **Sheltered rock with *Ascidiella aspersa***

HABITAT Extremely sheltered rock outcrops

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Circalittoral, lower infralittoral
Substratum:	Bedrock, boulders and mud

Distribution 18(1); 19(1)

Extent

Bedrock and boulder outcrops in Broad Water of Mulroy Bay and in appropriate depths may all support this biotope, but such rocky outcrops are scattered and small in extent.

Description

This biotope is very similar to MS18 with the addition of bedrock and boulders which provide a hard substratum for several additional species.

Species composition

Species name	Frequency of occurrence No. of records (Total 2)	%	Abundance Range	Median
Raspailia ramosa	2	100	R - O	R
Amphilectus fucorum	2	100	O - F	O
Hydractinia echinata	2	100	O - F	O
Kirchenpaueria similis	2	100	R - O	R
Prostheceraeus vittatus	2	100	O - O	O
Terebellidae	2	100	O - C	O

Pagurus bernhardus	2	100	R - F	R
Inachus dorsettensis	2	100	O - F	O
Liocarcinus depurator	2	100	O - F	O
Haminoea navicula	2	100	F - F	F
Crossaster papposus	2	100	R - O	R
Asterias rubens	2	100	O - C	O
Ophiocomina nigra	2	100	R - O	R
Thyone fusus	2	100	F - C	F
Ciona intestinalis	2	100	O - F	O
Ascidiella aspersa	2	100	C - A	C
Griffithsia corallinoides	2	100	R - F	R

COMMUNITY MS38 **Sheltered bedrock with *Ascidia virginea***

HABITAT Steep very sheltered bedrock

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Circalittoral
Substratum:	Bedrock

Distribution 14(1); 23(1); 23(2); 24(2)

Extent

This biotope is extensive in the North Water of Mulroy Bay, where extreme shelter is combined with steep rocky slopes with one similar site located in Broad Water. Steep rock appears to be rather rare in Broad Water, the other site with this type of topography was more exposed and supported a rather different biotope.

Description

Steep bedrock with ledges and upward facing surfaces heavily silted. Several silt-tolerant sponges are common, including *Polymastia boletiformis and Suberites carnosus.* In the North Water sponges identified at the time as *Polymastia mammillaris* have since been found to belong to an apparently undescribed species of *Polymastia* similar to *Polymastia agglutinans* in that it has particles of shell or gravel embedded in its surface. These were common or abundant and quite characteristic of the habitat. The sponge *Iophon hyndmani* was also characteristic of this habitat forming anastomosing clumps. Beneath the silt the rock surface had several species of encrusting sponges, including the rarely recorded *Raspailia aculeata.* The ascidians *Ascidia virginea* and *Ascidiella aspersa* were also common and characteristic. The rare goby *Gobius couchi* was also present in this habitat in the North Water, as previously reported by Minchin (1988).

Species composition

Species name	Frequency of occurrence No. of records Median (Total 4)	%	Abundance Range	
Clathrina coriacea	2	50	R - O	R

Scypha ciliata	3	75	R - O	O
Tethya aurantium	3	75	O - O	O
Suberites carnosus	4	100	O - C	F
Polymastia boletiformis	4	100	F - C	F
Polymastia cf. *agglutinans*	3	75	C - A	C
Stelligera stuposa	3	75	O - F	F
Raspailia ramosa	3	75	O - F	O
Esperiopsis fucorum	4	100	F - A	F
Iophon hyndmani	3	75	C - C	C
Kirchenpaueria similis	4	100	O - O	O
Prostheceraeus vittatus	3	75	O - F	O
Pandalus montagui	2	50	F - F	F
Galathea squamifera	2	50	O - F	O
Inachus dorsettensis	4	100	F - C	F
Turritella communis	2	50	F - F	F
Pecten maximus	3	75	O - O	O
Bugula plumosa	3	75	O - F	F
Phoronis hippocrepia	2	50	O - O	O
Crossaster papposus	4	100	O - O	O
Henricia oculata	4	100	O - O	O
Asterias rubens	4	100	F - C	F
Marthasterias glacialis	4	100	O - F	O
Ophiothrix fragilis	4	100	O - F	F
Ophiocomina nigra	2	50	O - F	O
Thyone fusus	2	50	O - F	O
Clavelina lepadiformis	3	75	R - F	O
Ciona intestinalis	3	75	O - O	O
Ascidiella aspersa	3	75	C - C	C
Ascidiella scabra	3	75	O - F	F
Ascidia mentula	2	50	O - O	O
Ascidia virginea	3	75	C - C	C
Dendrodoa grossularia	4	100	O - F	O
Botryllus schlosseri	2	50	P - O	P
Scyliorhinus canicula	2	50	R - R	R
Ctenolabrus rupestris	3	75	O - O	O
Gobius couchi	2	50	O - C	O
Gobius niger	4	100	F - C	F
Pomatoschistus pictus	3	75	O - C	F
Corallinaceae	2	50	F - C	F
Griffithsia corallinoides	2	50	O - C	O
Laminaria saccharina	2	50	O - O	O

COMMUNITY MS39 — **Bedrock cliff with *Parerythropodium corallioides***

HABITAT — Sheltered circalittoral bedrock

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Circalittoral

Substratum: Bedrock

Distribution 18(2)

Extent

This community was only found on one rock outcrop on the eastern side of Broad Water, Mulroy Bay. It is the most extensive and deepest such outcrop shown on the chart.

Description

A steep and overhanging cliff very sheltered from wave action. The rockface was covered with sponges with large colonies of *Stelletta grubii* and large areas of *Dercitus bucklandi* especially notable. The soft coral *Parerythropodium coralloides* was abundant. This community may be just the best developed of the Mulroy Bay circalittoral rock biotopes, but *Parerythropodium* has not been seen at any other site in Mulroy Bay.

Species composition

Species name	Abundance
Clathrina coriacea	C
Dercitus bucklandi	C
Stelletta grubii	C
Pachymatisma johnstonia	O
Tethya aurantium	O
Polymastia boletiformis	O
Polymastia mamillaris	F
Cliona celata	O
Stelligera stuposa	O
Raspailia ramosa	O
Esperiopsis fucorum	F
Obelia longissima	F
Parerythropodium coralloides	A
Metridium senile	O
Caryophyllia smithii	O
Cancer pagurus	O
Crisiidae	O
Bugula plumosa	F
Phoronis hippocrepia	O
Henricia oculata	F
Asterias rubens	F
Marthasterias glacialis	O
Ophiothrix fragilis	O
Clavelina lepadiformis	O
Ciona intestinalis	O
Ascidiella aspersa	C
Ascidiella scabra	F
Ascidia mentula	O
Ascidia virginea	O
Botryllus schlosseri	O
Ctenolabrus rupestris	O
Thorogobius ephippiatus	F
Griffithsia flosculosa	O

COMMUNITY MS40	**Bedrock with *Flustra foliacea* and *Tridemnum cereum***
HABITAT	Circalittoral tide-swept bedrock
Classification	
Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Moderately exposed
Tidal streams:	Moderately strong
Geology:	Hard
Zone/range:	Circalittoral
Substratum:	Bedrock
Distribution	34(1); 40(2)

Extent

This biotope was observed on the headlands at Knockalla Point and Dunree Head, where Lough Swilly narrows abruptly. There was a sharp boundary with biotope MS41 at Knockalla Point, the headland on the western side of the lough. Both biotopes occurred at the same depth but were presumably subject to slightly different water movement regimes.

Description

Rugged circalittoral bedrock with hydroids, bryozoans and sponges, especially upright sponges and those resistant to siltation. On the east side of the lough the community was relatively poor in species 32 being recorded as opposed to 66 species on the west side. Hydroids were diverse on the west side of the lough, accounting for some of the difference. The hydroid species recorded at this site only were *Halecium beanii, Halecium halecinum, Halopteris catharina, Plumularia setacea, Abietinaria abietina, Sertularella gayi, Sertularella polyzonias, Sertularella rugosa* and *Sertularia argentea.* Another notable species at Knockalla Point was the sponge *Ciocalypta penicillus* attached to rock partly buried by mobile gravel.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Polymastia mamillaris	2	100	F-F	F
Cliona celata	2	100	C-F	F
Stelligera rigida	2	100	F-O	O
Stelligera stuposa	2	100	F-O	O
Raspailia ramosa	2	100	C-F	F
Esperiopsis fucorum	2	100	O-R	R
Hemimycale columella	2	100	F-O	O
Nemertesia antennina	2	100	A-F	C
Nemertesia ramosa	2	100	C-F	F
Alcyonium digitatum	2	100	A-A	A
Urticina felina	2	100	F-O	O
Metridium senile	2	100	C-C	C
Sagartia elegans	2	100	F-F	F
Caryophyllia smithii	2	100	F-O	O
Balanus crenatus	2	100	C-O	F
Cancer pagurus	2	100	O-O	O

Liocarcinus puber	2	100	O-O	O
Flustra foliacea	2	100	C-O	F
Bugula plumosa	2	100	F-O	O
Henricia oculata	2	100	O-O	O
Asterias rubens	2	100	F-F	F
Marthasterias glacialis	2	100	O-O	O
Clavelina lepadiformis	2	100	F-O	F
Aplidium punctum	2	100	O-O	O
Tridemnum cereum	2	100	C-O	F
Polycarpa pomaria	2	100	O-O	O

COMMUNITY MS41 ***Ophiothrix fragilis* dominated bedrock**

HABITAT Circalittoral tide-swept bedrock

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Moderately strong
Geology:	Hard
Zone/range:	Circalittoral
Substratum:	Bedrock

Distribution 34(2)

Extent

This biotope was observed only in the lee of a headland on the west side of Lough Swilly. There was an abrupt boundary with biotope MS40 at the headland. This biotope probably extends along the coast to the south until the rock ceases, probably at the next small headland, Yellow Rocks.

Description

A dense bed of the brittlestars *Ophiothrix fragilis* with the dahlia anemone *Urticina eques* and the plumose anemone *Metridium senile*. Hydroids were notable for their absence, in contrast with the neighbouring biotope to the north of the headland.

Species composition

Species name	Abundance
Polymastia boletiformis	F
Polymastia mamillaris	C
Cliona celata	C
Haliclona oculata	O
Alcyonium digitatum	C
Urticina felina	C
Urticina eques	C
Metridium senile	C
Sagartia elegans	O
Sagartia troglodytes	O
Ophiothrix fragilis	A

COMMUNITY MS42	**Tide swept bedrock with *Sertularia argentea***
HABITAT	Steep bedrock in strong tidal stream, sheltered

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Strong
Geology:	Hard
Zone/range:	Circalittoral
Substratum:	Bedrock

Distribution 9(2); 28(2)

Extent

This habitat is very restricted in occurrence in the area, probably only to be found in small areas where bedrock extends into the narrow entrance channel of Mulroy Bay.

Description

This was a species rich community dominated by hydroids, sea anemones and sponges. The hydroid *Hydrallmania falcata* and the bryozoan *Flustra foliacea* probably indicate that the community was subject to some scour from moving sand and gravel, which make up the adjacent biotopes. The hydroid *Halecium muricatum,* which is very sporadic in its occurrence on the Irish coast, seems to require strong tidal streams. Other species of note were the encrusting sponge *Hymedesmia brondstedi,* the bryozoan *Bugula plumosa* and the ascidian *Tridemnum tenerum.* The presence of the anemone *Anthopleura ballii* would be notable except for its occurrence in a wide range of habitats in Mulroy Bay.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Clathrina coriacea	2	100	O-O	O
Leucosolenia botryoides	2	100	O-O	O
Scypha ciliata	2	100	O-O	O
Pachymatisma johnstonia	2	100	O-C	C
Cliona celata	2	100	O-C	C
Stelligera rigida	2	100	O-O	O
Raspailia ramosa	2	100	O-O	O
Esperiopsis fucorum	2	100	F-C	C
Hymedesmia brondstedi	2	100	O-O	O
Dysidea fragilis	2	100	O-O	O
Halecium halecinum	2	100	O-O	O
Halecium muricatum	2	100	F-F	F
Nemertesia antennina	2	100	F-F	F
Nemertesia ramosa	2	100	F-F	F
Plumularia setacea	2	100	F-F	F
Hydrallmania falcata	2	100	F-C	F
Sertularia argentea	2	100	F-C	C
Alcyonium digitatum	2	100	O-F	F
Urticina felina	2	100	F-C	F
Anthopleura ballii	2	100	O-O	O

Metridium senile	2	100	O-F	F
Sagartia elegans	2	100	O-F	F
Cereus pedunculatus	2	100	O-C	C
Caryophyllia smithii	2	100	O-O	O
Balanus crenatus	2	100	O-O	O
Cancer pagurus	2	100	O-F	O
Liocarcinus puber	2	100	O-O	O
Calliostoma zizyphinum	2	100	O-F	O
Flustra foliacea	2	100	F-C	F
Bugula plumosa	2	100	F-F	F
Henricia oculata	2	100	O-O	O
Marthasterias glacialis	2	100	O-O	O
Tridemnum cereum	2	100	F-C	C
Polycarpa rustica	2	100	O-O	O

COMMUNITY MS43 **Circalittoral bedrock with *Phorbas fictitius***

HABITAT Open coast circalittoral bedrock with moderate tidal streams

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Very exposed - exposed
Tidal streams:	Moderately strong
Geology:	Hard
Zone/range:	Circalittoral
Substratum:	Bedrock

Distribution 2(1); 3(2); 4(2); 5(2)

Extent

The open coast in this area is mostly exposed to moderate tidal streams and this community is probably present wherever bedrock extends into the circalittoral zone, below about 20-25m depth and especially on headlands or isolated rocks.

Description

The distinction between upper and lower circalittoral was not very evident on the open coast and these records combine these two biological zones. The algae present in the upper circalittoral were sparse, mostly *Delesseria sanguinea* and the other components of the two zones were similar. The site at Frenchman's Rock (2(1)) had the hydroids *Gymnangium montagui* and *Halecium muricatum* both present, the former close to its northern limit of distribution and the latter a northern species. At Melmore Head (5(2)) the sea squirt *Stolonica socialis* was frequent at 25-28m, currently its northernmost known locality. The author has observed this species from other sites to the west of this area, i.e. Duncap Head on the north coast and at several sites near Arranmore in west Donegal, but otherwise its distribution is mostly from Pembrokeshire southwards and it is not currently known from further south on the west coast of Ireland. This distribution may be linked to sand scour and tidal streams which seem to be factors determining the preferred habitat of the species. The notable starfish *Stichastrella rosea* was also occasional at this site.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 4)	%	Range	Median
Leucosolenia botryoides	2	50	O - O	O
Scypha ciliata	4	100	O - F	O
Pachymatisma johnstonia	2	50	O - F	O
Polymastia boletiformis	4	100	F - F	F
Polymastia mamillaris	3	75	O - F	F
Cliona celata	4	100	O - F	F
Stelligera stuposa	3	75	R - O	O
Raspailia ramosa	3	75	R - O	R
Phorbas fictitius	4	100	R - C	F
Haliclona viscosa	2	50	O - F	O
Dysidea fragilis	2	50	O - O	O
Tubularia indivisa	2	50	O - C	O
Halecium halecinum	2	50	O - O	O
Nemertesia antennina	4	100	F - A	F
Nemertesia ramosa	2	50	F - F	F
Abietinaria abietina	2	50	F - F	F
Sertularella gayi	3	75	R - F	R
Alcyonium digitatum	4	100	R - C	F
Metridium senile	2	50	O - F	O
Sagartia elegans	2	50	O - F	O
Corynactis viridis	4	100	O - S	C
Caryophyllia smithii	4	100	O - F	O
Pomatoceros triqueter	2	50	F - F	F
Balanus crenatus	3	75	R - F	O
Cancer pagurus	2	50	R - O	R
Calliostoma zizyphinum	4	100	O - F	O
Diapharodoris luteocincta	2	50	O - O	O
Polycera faeroensis	3	75	O - F	O
Janolus cristatus	4	100	O - F	O
Coryphella browni	2	50	O - F	O
Facelina bostoniensis	2	50	O - O	O
Crisia eburnea	3	75	R - F	O
Alcyonidium diaphanum	2	50	O - F	O
Pentapora foliacea	2	50	O - F	O
Flustra foliacea	4	100	O - C	F
Securiflustra securifrons	3	75	O - C	O
Bicellariella ciliata	2	50	O - O	O
Bugula plumosa	3	75	O - C	C
Antedon bifida	4	100	F - C	C
Luidia ciliaris	3	75	R - O	R
Crossaster papposus	2	50	R - O	R
Henricia oculata	3	75	R - O	O
Asterias rubens	4	100	O - F	O
Marthasterias glacialis	4	100	R - F	O
Echinus esculentus	4	100	O - F	F
Holothuria forskali	4	100	R - A	O
Clavelina lepadiformis	4	100	R - O	O

Aplidium pallidum	2	50	F - F	F
Polycarpa rustica	2	50	O - O	O
Botryllus schlosseri	2	50	O - O	O
Botrylloides leachi	2	50	O - O	O
Scyliorhinus canicula	2	50	O - O	O
Pollachius virens	2	50	P - C	P
Ctenolabrus rupestris	2	50	P - O	P
Labrus bergylta	3	75	O - F	O
Labrus mixtus	2	50	R - O	R
Delesseria sanguinea	2	50	O - O	O

Appendix 3: List of taxa recorded during the present survey

The sites at which each species was recorded are given.

PORIFERA

Clathrina coriacea	2; 3; 6; 7; 9; 10; 11; 14; 18; 20; 23; 26; 28; 32
Leucosolenia indet.	19; 21
Leucosolenia botryoides	2; 4; 6; 9; 14; 28; 31
Leucosolenia complicata	1; 7; 17; 40
Scypha ciliata	1; 2; 3; 4; 5; 6; 7; 9; 11; 13; 21; 22; 23; 24; 25; 26; 28; 32; 40
Leuconia nivea	2; 25; 26; 31
Grantia compressa	10; 11; 26; 32
Oscarella lobularis	26; 31
Dercitus bucklandi	18; 28
Stelletta grubii	18; 23; 26; 28
Pachymatisma johnstonia	1; 2; 3; 4; 5; 6; 7; 9; 18; 20; 23; 27; 28
Tethya aurantium	1; 5; 14; 18; 23; 26
Suberites indet.	11
Suberites carnosus	7; 12; 13; 14; 19; 20; 22; 23; 24; 34
Suberites domuncula	24
Terpios fugax	11; 26
Polymastia boletiformis	2; 3; 4; 5; 14; 18; 19; 20; 23; 24; 34
Polymastia mamillaris	2; 4; 5; 12; 14; 18; 19; 20; 23; 24; 26; 27; 28; 34; 40
Cliona celata	1; 2; 3; 4; 5; 6; 7; 9; 12; 13; 18; 19; 26; 27; 28; 34; 40
Stelligera rigida	2; 9; 14; 20; 27; 28; 34; 40
Stelligera stuposa	3; 4; 5; 18; 19; 23; 24; 34; 40
Raspailia hispida	24
Raspailia ramosa	2; 3; 4; 9; 14; 18; 19; 20; 23; 28; 34; 40
Halichondria panicea	10; 11; 17; 25; 26; 27; 30
Ciocalypta penicillus	24; 34
Hymeniacidon perleve	10
Mycale rotalis	25; 26; 27
Esperiopsis fucorum	9; 10; 11; 14; 18; 19; 21; 22; 23; 24; 25; 26; 27; 28; 34; 40
Myxilla fimbriata	4
Myxilla incrustans	17; 27
Myxilla rosacea	9
Iophon ingalli	23; 24
Hymedesmia brondstedi	9; 27; 28
Phorbas fictitius	1; 2; 3; 4; 5; 7
Stylostichon plumosum	10; 26
Hemimycale columella	34; 40
Ophlitaspongia seriata	9; 10; 25; 26; 27; 30; 31; 32
Microciona spinarcus	6
Haliclona cinerea	11
Haliclona fistulosa	5; 11; 14; 18; 25; 26; 27; 34
Haliclona oculata	34
Haliclona simulans	9; 26
Haliclona urceolus	14
Haliclona viscosa	1; 4; 5; 7; 26
Dysidea fragilis	2; 4; 9; 11; 23; 25; 26; 27; 28; 34
Aplysilla rosea	11; 26
Aplysilla sulfurea	26

Halisarca dujardini	2; 10; 11; 17; 26; 28; 31; 32
Porifera indet crusts	10; 14; 23; 24; 40
CNIDARIA	
Haliclystus indet.	32
Aurelia aurita	14
Tubularia indivisa	2; 4
Sarsia indet.	4
Sarsia eximia	32
Eudendrium	26; 28
Eudendrium annulatum	4
Bougainvillia ramosa	12; 14
Hydractinia echinata	12; 13; 14; 15; 16; 18; 19; 20; 35; 36; 37; 39
Clava multicornis	11
Halecium indet.	39
Halecium beanii	2; 9; 34
Halecium halecinum	1; 4; 5; 7; 9; 27; 28; 34
Halecium muricatum	2; 9; 28
Aglaophenia pluma	5; 6; 7; 9; 25; 26; 28
Gymnangium montagui	2
Halopteris catharina	34
Kirchenpaueria similis	4; 12; 13; 14; 16; 18; 19; 23; 24
Nemertesia antennina	2; 3; 4; 5; 6; 9; 23; 27; 28; 34; 40
Nemertesia ramosa	2; 5; 9; 13; 14; 20; 27; 28; 34; 40
Plumularia setacea	2; 4; 9; 13; 20; 25; 27; 28; 34
Abietinaria abietina	3; 4; 34
Abietinaria filicula	4; 5; 6
Amphisbetia operculata	25; 27; 28
Diphasia indet.	25
Diphasia rosacea	4; 27
Dynamena pumila	10; 11; 25; 26; 31
Hydrallmania falcata	3; 9; 25; 26; 27; 28
Sertularella gayi	3; 4; 5; 34
Sertularella polyzonias	4; 6; 34; 39
Sertularella rugosa	34
Sertularia argentea	4; 6; 9; 11; 25; 26; 27; 28; 34; 40
Sertularia cupressina	39
Obelia indet.	25
Obelia dichotoma	14
Obelia geniculata	1; 2; 4; 7; 27; 28
Obelia longissima	18; 24
Rhizocaulus verticillatus	39
Sarcodictyon roseum	14
Alcyonium digitatum	1; 2; 3; 4; 5; 6; 9; 14; 20; 27; 28; 34; 39; 40
Parerythropodium coralloides	18
Cerianthus lloydii	12; 13; 15; 16
Epizoanthus couchii	34
Actinia equina	11; 17; 30; 31; 32; 33
Anemonia viridis	7; 10; 11; 12; 13; 14; 16; 17; 19; 21; 25; 27; 32
Urticina felina	6; 9; 10; 13; 17; 26; 27; 28; 30; 31; 32; 33; 34; 36; 40
Urticina eques	34
Bunodactis verrucosa	30; 31
Anthopleura ballii	9; 10; 11; 12; 13; 14; 16; 19; 20; 21; 22; 25; 26; 27; 28

Metridium senile	2; 3; 4; 9; 11; 12; 14; 15; 18; 21; 22; 26; 28; 34; 40
Sagartia elegans	1; 2; 3; 4; 6; 9; 11; 13; 22; 25; 26; 27; 28; 30; 32; 34; 40
Sagartia troglodytes	34
Cereus pedunculatus	9; 10; 11; 13; 19; 20; 21; 22; 26; 27; 28; 36
Actinothoe sphyrodeta	1; 2; 4
Sagartiogeton laceratus	12; 15; 20
Sagartiogeton undatus	15; 16; 20; 35
Adamsia carciniopados	13
Edwardsia claparedii	12; 19; 20
Corynactis viridis	1; 2; 3; 4; 5; 6; 7; 32
Caryophyllia smithii	1; 2; 3; 4; 5; 6; 7; 9; 14; 18; 28; 34; 40
PLATYHELMINTHES	
Prostheceraeus vittatus	14; 18; 19; 23; 24
NEMERTEA	
Tubulanus annulatus	26; 28
Lineus longissimus	26
SIPUNCULA	
Golfingia elongata	19
ANNELIDA	
Polychaeta indet.	17; 35
Aphrodita aculeata	39
Eteone longa	19
Eulalia viridis	30; 33
Paranaitis kosterensis	19
Glycera tridactyla	19
Typosyllis indet.	19
Nematonereis unicornis	19
Lumbrineris gracilis	19
Prionospio malmgreni	19
Pseudopolydora antennata	19
Pygospio elegans	39
Spio filicornis	19
Chaetopterus variopedatus	13; 24; 27; 39
Pherusa plumosa	19
Arenicola marina	17
Euclymene oerstedii	19
Scalibregma inflatum	19
Terebellidae indet.	12; 15; 16; 18; 19; 20; 22; 35
Eupolymnia nebulosa	11; 26
Lanice conchilega	35; 36; 37; 39
Bispira volutacornis	14
Megalomma vesiculosum	27
Sabella pavonina	14
Pomatoceros triqueter	2; 5; 7; 11; 25; 27; 32
Serpula vermicularis	24
Protula tubularia	12; 14
Spirorbidae indet.	17; 26; 31; 32
CRUSTACEA	
Verruca stroemia	11; 25; 26; 27; 31
Chthamalus montagui	33
Chthamalus stellatus	10; 30; 31; 32
Semibalanus balanoides	30; 33

Balanus balanus	7; 13; 32
Balanus crenatus	2; 3; 5; 6; 9; 23; 25; 27; 28; 34; 40
Amphipoda indet.	17; 26; 33
Caprellidae indet.	3; 4
Idotea indet.	29
Palaemon serratus	10; 26; 34
Pandalus montagui	23
Crangon crangon	8; 29
Homarus gammarus	27
Palinurus elephas	4
Pagurus bernhardus	8; 12; 13; 14; 15; 18; 19; 20; 22; 27; 35; 36; 37; 38; 39
Pagurus prideaux	13; 19; 21; 35; 36; 37
Galathea squamifera	18; 23; 24; 27
Pisidia longicornis	26
Porcellana platycheles	31
Ebalia tuberosa	22
Hyas araneus	12; 15; 16; 19; 20; 22; 23
Hyas coarctatus	13
Inachus dorsettensis	12; 13; 14; 18; 19; 20; 21; 22; 23; 24; 39; 40
Inachus phalangium	25; 27; 34
Macropodia rostrata	9; 13; 20; 23; 25; 40
Cancer pagurus	2; 4; 9; 14; 18; 25; 27; 28; 30; 32; 33; 34; 40
Liocarcinus corrugatus	13; 27
Liocarcinus depurator	12; 14; 18; 19; 36
Liocarcinus marmoreus	8; 29; 35
Liocarcinus puber	4; 9; 14; 25; 27; 28; 34; 36; 39; 40
Liocarcinus pusillus	13
Carcinus maenas	10; 11; 12; 17; 19; 21; 22; 25; 26; 30; 37; 39
Pilumnus hirtellus	26
INSECTA	
Anurida maritima	33
MOLLUSCA	
Leptochiton asellus	11; 23
Lepidochitona indet.	26
Lepidochitona cinereus	26
Acanthochitona indet.	10
Acanthochitona crinitus	26; 31
Diodora graeca	1; 10; 26
Patella indet.	17; 30; 33
Patella ulyssiponensis	32
Patella vulgata	10; 30; 31; 32; 33
Helcion pellucidum	32; 33
Gibbula indet.	21
Gibbula magus	19; 22
Gibbula cineraria	2; 6; 7; 10; 31; 32
Gibbula umbilicalis	1; 7; 10; 25
Calliostoma zizyphinum	1; 2; 3; 4; 5; 6; 7; 9; 25; 26; 27; 28; 34
Littorina indet.	10
Littorina littorea	17; 31
Littorina mariae	17; 31
Littorina neglecta	30; 33
Littorina saxatilis	17; 33

Turritella communis	12; 14; 15; 20; 23
Simnia patula	4; 34
Trivia arctica	19; 28
Trivia monacha	13; 28; 32
Polinices poliana	35
Nucella lapillus	17; 30; 31; 33
Ocenebra erinacea	13; 28
Buccinum undatum	16; 18; 20; 21; 22; 35
Hinia incrassata	1; 32
Hinia reticulata	27; 35; 36
Philine aperta	36
Haminoea navicula	12; 16; 18; 19; 20
Elysia viridis	20
Hermaea bifida	14
Aplysia punctata	3
Berthella plumula	11
Tritonia hombergii	2; 34
Tritonia plebeia	3; 34
Dendronotus frondosus	2; 4
Doto fragilis	14; 34
Doto koenneckeri	6
Doto pinnatifida	34
Doto tuberculata	5
Goniodoris castanea	5
Acanthodoris pilosa	1; 7
Diapharodoris luteocincta	2; 4
Aegires punctilucens	1
Limacia clavigera	1; 4; 7; 9; 24; 28; 32; 34
Polycera faeroensis	2; 4; 5; 28; 34
Polycera quadrilineata	1; 5; 34
Cadlina laevis	5; 9; 20; 25; 27
Archidoris pseudoargus	1; 28; 32
Janolus cristatus	2; 3; 4; 5; 28
Coryphella browni	2; 4
Coryphella lineata	4; 20
Flabellina pedata	14; 20; 26
Cuthona amoena	4
Cuthona caerulea	34; 39
Catriona gymnota	3
Tergipes tergipes	25; 28
Eubranchus exiguus	6; 28
Eubranchus farrani	1; 20; 25
Eubranchus tricolor	13; 14; 20
Eubranchus vittatus	27
Facelina bostoniensis	2; 3; 36
Favorinus branchialis	1
Aeolidiella alderi	26
Nucula indet.	36
Mytilus edulis	3; 4; 10; 11; 26; 30; 32; 33
Limaria hians	11; 21; 22; 26
Chlamys varia	11; 23; 25; 26
Pecten maximus	12; 13; 14; 15; 16; 19; 20; 21; 22; 23; 24; 25

Anomia ephippium	11
Pododesmus patelliformis	10; 25
Spisula elliptica	8
Lutraria lutraria	9
Ensis arcuatus	8
Angulus tenuis	8
Venus verrucosa	11
Circomphalus casina	8
Venerupis senegalensis	11
Mya arenaria	36
Hiatella arctica	10; 11; 21; 32
Thracia indet.	36
BRYOZOA	
Crisiidae indet.	18
Crisidia cornuta	3; 40
Crisia indet.	26
Crisia denticulata	5; 6
Crisia eburnea	2; 3; 5; 6; 10; 26; 34
Alcyonidium diaphanum	2; 5; 9; 34
Alcyonidium hirsutum	1; 7; 13; 25; 26; 27; 28
Alcyonidium parasiticum	39
Flustrellidra hispida	31; 32
Vesicularia spinosa	39
Bowerbankia indet.	11
Pentapora foliacea	2; 4
Parasmittina trispinosa	3; 4; 7; 33
Porella compressa	4
Schizomavella linearis	4; 10; 26; 31
Cellepora pumicosa	2
Membranipora membranacea	1; 7; 25
Electra pilosa	1; 3; 4; 6; 7; 25; 30; 31; 32; 33
Flustra foliacea	2; 3; 4; 5; 6; 9; 27; 28; 34; 40
Securiflustra securifrons	2; 3; 4; 28; 34
Cellaria indet.	3
Cellaria sinuosa	5
Scrupocellaria indet.	9
Scrupocellaria scrupea	14
Bicellariella ciliata	3; 4; 7; 28; 40
Bugula indet.	18; 19
Bugula flabellata	4; 34
Bugula plumosa	2; 4; 5; 6; 7; 9; 14; 23; 24; 27; 28; 34; 40
Bryozoa indet. crusts	1; 5; 7; 25; 26; 30
PHORONIDA	
Phoronis hippocrepia	18; 19; 20; 23; 24; 25; 28
ECHINODERMATA	
Antedon bifida	1; 2; 3; 4; 5; 6; 7; 13; 19; 21; 25; 26; 34
Luidia ciliaris	3; 4; 5; 7; 10; 13; 19; 25; 28
Asterina gibbosa	26; 32
Asterina phylactica	10; 11; 26
Solaster endeca	6; 22
Crossaster papposus	1; 2; 5; 9; 12; 14; 15; 16; 18; 19; 20; 21; 23; 24; 25; 27; 34; 36

Henricia oculata	1; 2; 3; 5; 6; 7; 9; 12; 14; 15; 16; 18; 19; 21; 22; 23; 24; 26; 27; 28; 34; 40
Stichastrella rosea	5
Asterias rubens	1; 2; 3; 4; 5; 7; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 30; 32; 33; 34; 35; 36; 39; 40
Marthasterias glacialis	1; 2; 3; 4; 5; 6; 7; 9; 12; 14; 15; 18; 19; 21; 23; 24; 25; 27; 28; 34; 40
Ophiothrix fragilis	5; 10; 11; 12; 14; 15; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 34
Ophiocomina nigra	5; 10; 13; 14; 15; 18; 19; 20; 21; 23; 25
Ophiactis balli	1; 26
Amphiura brachiata	12; 35; 36
Amphiura chiajei	12; 19
Amphiura filiformis	12
Amphipholis squamata	10; 14; 16; 19; 21; 25; 26
Ophiura albida	15; 19; 35; 36; 37; 38; 39
Ophiura ophiura	35; 38; 39
Psammechinus miliaris	26; 32; 33; 39
Echinus esculentus	1; 2; 3; 4; 5; 6; 7; 9; 27; 32; 34
Paracentrotus lividus	32
Echinocardium cordatum	6; 8; 35; 36; 37
Echinocardium flavescens	6
Holothuriidae indet.	1
Holothuria forskali	1; 2; 3; 4; 5; 7; 34
Trachythyone elongata	12; 19; 20
Pawsonia saxicola	1; 26
Aslia lefevrei	34
Ocnus lactea	4; 16; 19
Thyone fusus	12; 16; 18; 19; 20; 21; 22; 23
Neopentadactyla mixta	9; 13
Leptosynapta inhaerens	16
TUNICATA	
Clavelina lepadiformis	1; 2; 3; 4; 5; 6; 7; 9; 10; 13; 14; 16; 18; 19; 23; 24; 25; 26; 27; 34; 40
Polyclinum indet.	24
Polyclinum aurantium	5; 9; 26; 27; 28; 32; 40
Synoicum incrustatum	5
Morchellium argus	1; 19; 27
Sidnyum turbinatum	2; 25; 31
Aplidium indet.	9
Aplidium nordmanni	5; 6
Aplidium pallidum	1; 2; 5; 9
Aplidium punctum	7; 19; 25; 26; 27; 34; 36; 40
Didemnidae indet.	13; 16; 24; 32; 40
Tridemnum cereum	9; 27; 28; 34
Didemnum indet.	25
Didemnum maculosum	11; 25; 28
Diplosoma listerianum	10; 11; 16; 25; 26; 27; 28
Diplosoma spongiforme	2; 9; 27; 28
Ciona intestinalis	11; 16; 17; 18; 19; 20; 21; 23; 24
Perophora listeri	19
Ascidiella aspersa	11; 12; 13; 14; 15; 16; 18; 19; 20; 23

Ascidiella scabra	10; 13; 17; 18; 23; 24; 26; 27
Ascidia mentula	5; 9; 13; 14; 18; 24; 26
Ascidia virginea	12; 15; 16; 18; 19; 21; 23; 24; 28
Polycarpa pomaria	34; 40
Polycarpa rustica	2; 4; 9; 23; 28
Dendrodoa grossularia	2; 10; 11; 13; 14; 19; 23; 24; 26
Stolonica socialis	5
Botryllus schlosseri	1; 2; 5; 7; 10; 13; 14; 17; 18; 24; 25; 26; 27; 28; 31; 36
Botrylloides leachi	4; 5; 12; 14; 32
Pyura microcosmus	19
Pyura squamulosa	24
Molgula indet.	36
CHONDRICHTHYES	
Scyliorhinus canicula	4; 5; 12; 13; 14; 19; 24; 27; 34; 36
Raja clavata	12
OSTEICHTHYES	
Conger conger	7
Lophius piscatorius	5
Molva molva	6
Pollachius pollachius	1; 4; 7
Pollachius virens	3; 4; 7
Trisopterus minutus	6; 28
Spinachia spinachia	20
Syngnathus acus	16; 20; 23
Eutrigla gurnardus	39
Myoxocephalus scorpius	27
Taurulus bubalis	4; 12; 28
Agonus cataphractus	39
Crenilabrus melops	4; 27
Ctenolabrus rupestris	3; 5; 6; 7; 14; 18; 23; 27
Labrus bergylta	2; 3; 4; 5; 6; 7; 24
Labrus mixtus	2; 4; 6; 25
Lipophrys pholis	31; 32
Parablennius gattorugine	34
Pholis gunnellus	1; 2; 7; 11; 26; 27; 28; 31
Ammodytes tobianus	8
Callionymus lyra	22
Callionymus reticulatus	5; 6; 13; 27; 36
Gobius couchi	14; 23
Gobius niger	12; 14; 16; 19; 20; 22; 23; 24; 25
Gobius paganellus	16; 20; 22; 26; 27
Gobiusculus flavescens	25
Pomatoschistus indet.	13
Pomatoschistus minutus	39
Pomatoschistus pictus	12; 14; 23; 27; 35; 36
Thorogobius ephippiatus	18
Phrynorhombus norvegicus	5
Zeugopterus punctatus	1; 2
Limanda limanda	36; 39
Microstomus kitt	4
Pleuronectes platessa	6

CYANOPHYTA	
Beggiatoa indet.	24
RHODOPHYTA	
Rhodophyta indet.	30
Porphyra indet.	30; 33
Porphyra umbilicalis	32
Nemalion helminthoides	30; 32; 33
Bonnemaisonia asparagoides	4; 6; 7; 9; 14; 19; 36
Bonnemaisonia hamifera (Trailliella)	19
Gelidium latifolium	9
Palmaria palmata	4; 13; 19; 30; 31; 32; 33
Dilsea carnosa	1; 6; 7; 9; 11; 27; 28; 32; 36
Dudresnaya verticillata	12; 14; 19; 22; 24
Callophyllis laciniata	1; 6; 7; 9; 19; 20; 22; 36
Kallymenia reniformis	1; 4; 6; 7; 9; 20; 22
Meredithia microphylla	1; 9
Hildenbrandia rubra	17; 33
Corallinaceae indet.	2; 3; 4; 11; 13; 17; 18; 20; 23; 24; 25; 26; 27; 30; 31; 32; 33
Corallina officinalis	4; 11; 17; 25; 30; 31; 32; 33
Lithothamnion corallioides	13; 21; 25
Lithothamnion glaciale	19
Phymatolithon calcareum	9
Maerl indet.	25
Gracilaria verrucosa	29
Ahnfeltia plicata	31
Phyllophora crispa	9
Schottera nicaeensis	3
Mastocarpus stellatus	17; 30; 31; 32; 33
Chondrus crispus	1; 17; 31; 32; 36
Polyides rotundus	10; 29; 36
Plocamium cartilagineum	1; 4; 6; 7; 9; 13; 19; 21; 22; 25; 27; 28; 29; 31; 36
Furcellaria lumbricalis	11; 17
Halarachnion ligulatum	36
Calliblepharis ciliata	19; 36
Rhodophyllis divaricata	9; 16; 20
Rhodymenia holmesii	9; 28
Rhodymenia pseudopalmata	36
Rhodymenia ardissonei	9
Lomentaria articulata	10; 30; 31; 32
Lomentaria clavellosa	4
Ceramium indet.	33
Griffithsia corallinoides	13; 14; 18; 19; 22; 23; 24
Griffithsia flosculosa	6; 9; 18; 21
Ptilota plumosa	3; 6
Sphondylothamnion	31
Sphondylothamnion multifidum	9
Acrosorium uncinatum	1; 2; 4; 6; 7; 36
Apoglossum ruscifolium	7
Cryptopleura ramosa	1; 2; 4; 6; 7; 9; 10; 27; 31; 36
Delesseria sanguinea	1; 2; 3; 6; 7; 9; 25; 27; 28; 36; 40
Drachiella spectabilis	1; 6; 7

Hypoglossum hypoglossoides	1; 3; 6; 7; 18; 36; 40
Membranoptera alata	24
Myriogramme bonnemaisonii	6; 9; 36
Nitophyllum punctatum	6; 7
Phycodrys rubens	1; 4; 6; 9; 27; 40
Polyneura laciniata	9; 25; 27
Radicilingua thysanorhizans	1
Heterosiphonia plumosa	1; 6; 9; 36
Brongniartella byssoides	7; 13; 36
Laurencia osmunda	30
Laurencia pinnatifida	10; 17; 31; 33
Polysiphonia indet.	17
Polysiphonia nigrescens	36
Pterosiphonia parasitica	1; 9
PHAEOPHYTA	
Leathesia difformis	10; 17; 31; 32
Cutleria multifida	14
Cladostephus spongiosus	31
Dictyopteris membranacea	1; 6
Dictyota dichotoma	1; 3; 4; 6; 7; 9; 11; 14; 19; 20; 25; 27; 31; 32; 36
Sporochnus pedunculatus	36
Desmarestia aculeata	9; 18; 25
Desmarestia ligulata	4; 25
Asperococcus indet.	12
Chorda filum	11; 14; 16; 17; 18; 20; 24; 31
Laminaria indet.	32
Laminaria digitata	11; 26; 30; 31; 32; 33
Laminaria hyperborea	1; 3; 4; 5; 6; 7; 9; 25; 27; 28; 32; 36
Laminaria saccharina	11; 14; 16; 17; 19; 20; 22; 23; 25; 28; 31
Saccorhiza polyschides	11
Alaria esculenta	4; 30; 32; 33
Ascophyllum nodosum	11; 17; 26; 31
Fucus indet.	30
Fucus serratus	17; 26; 31; 32
Fucus spiralis	17; 26; 33
Fucus vesiculosus	10; 17; 26; 31; 33
Pelvetia canaliculata	10; 17; 26; 33
Himanthalia elongata	10; 26; 32; 33
Bifurcaria bifurcata	32
Cystoseira indet.	17; 32
Halidrys siliquosa	5; 6; 7; 9; 25; 26; 27; 28; 31; 32
CHLOROPHYTA	
Enteromorpha indet.	10; 17; 31; 32; 33
Ulva indet.	10; 11; 17; 25; 31
Cladophora rupestris	10; 31
Bryopsis plumosa	10
Codium indet.	10; 11; 17; 24
ANGIOSPERMAE	
Zostera marina	16; 31; 35
LICHENS	
Anaptychia fusca	33
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Lichina confinis	33
Lichina pygmaea	30
Ramalina indet.	33
Verrucaria maura	33
Xanthoria parietina	33
Grey lichens	33