Marine communities of the Bantry Bay area, and an assessment of their nature conservation importance

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CONTENTS

Cover picture Several individuals of the solitary ascidian *Phallusia mammilata* on sheltered bedrock. In Ireland this species is only known from Bantry Bay.

Reference

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INTRODUCTION

The development of an oil terminal, and subsequent oil spillage, led to several ecological studies in Bantry Bay (Crapp 1973, Myers *et al.* 1978, 1979, 1980, Cross *et al.* 1979, Baker *et al.* 1981, Grainger *et al.* 1984). Of these , all except Grainger *et al.* (1984) were confined to littoral areas. Guiry (1973) surveyed benthic marine algae at 11 sites, including one sublittoral site.

Nine maritime areas of conservation interest have been identified in Bantry Bay, and three in the adjacent Kenmare River next to the current survey area (Office of Public Works, 1989). Although Dursey Island nature reserve extends 200 m out to sea, no particular marine conservation interests have been identified in the area.

As part of a survey of the marine habitats and communities of Ireland, the present study sampled 1 littoral and 19 sublittoral sites in Bantry Bay, and 2 littoral and 1 sublittoral site in Kenmare River. This report presents the results of this survey, summarises the results of previous studies, and provides a conservation assessment of the area.

STUDY AREA

Physical conditions

Bantry Bay is the largest of the long marine inlets in south-west Ireland. It is approximately 35 km long, running in a south-west to north-easterly direction (Figure 1). The entrance to the bay is approximately 10 km wide, steadily narrowing to 3-4 km at its head. Bere Island, situated on the north shore adjacent to Berehaven, and Whiddy Island lying near the head of the bay on the southern shore are the two largest islands in the bay.

The southern shore of the bay drops steeply down to the water from the thin peninsula separating Bantry Bay from Dunmanus Bay ending in Sheep's Head. The northern shore, east of Bere Island, is more heavily indented with numerous small inlets, most notably Adrigole Harbour, which dries to expose a muddy and mixed sediment bottom, and Glengarriff Harbour, near the head of the bay. Glengarriff Harbour has numerous rocky outcrops used for haul outs by seals. West of Bere Island the shores are backed by high cliffs extending out to Dursey Island and are generally very steep with a few areas of boulders and no sandy beaches.

Berehaven is listed as one of the largest natural harbours in the world. It has provided safe anchorage for many ships, with its narrow western entrance widening along its length to the east. Castletown Berehaven is tucked behind Dinish Island on the north side of the haven.

Human impacts

The majority of the area is not densely populated. The largest centres are the towns of Bantry (population 2579) on the southern shore and Castletown Berehaven (population 500-1000) on the northern shore next to Berehaven (1971 census, Royal Irish Academy 1979).

Bantry Bay is used extensively for both mariculture and aquaculture, particularly mussel and to a lesser extent salmon farming. The majority of the mussel farms are congregated around and behind Whiddy Island and along the coast west of Glengarriff Harbour (Figure 2). The sheltered inlets on the south side of the Kenmare River are also used extensively for mussel farming, particularly Kilmakilloge Harbour and Ardgroom Bay. Salmon farms are located on the northern shore of the bay near Bank Harbour, Berehaven and at one exposed site on the southern shore of Bere Island east of Doonbeg Head. Locations of the aquaculture sites are taken from Admiralty Charts (Nos. 1838 and 1840) (Hydrographic Office, 1981) and from observations in the field.

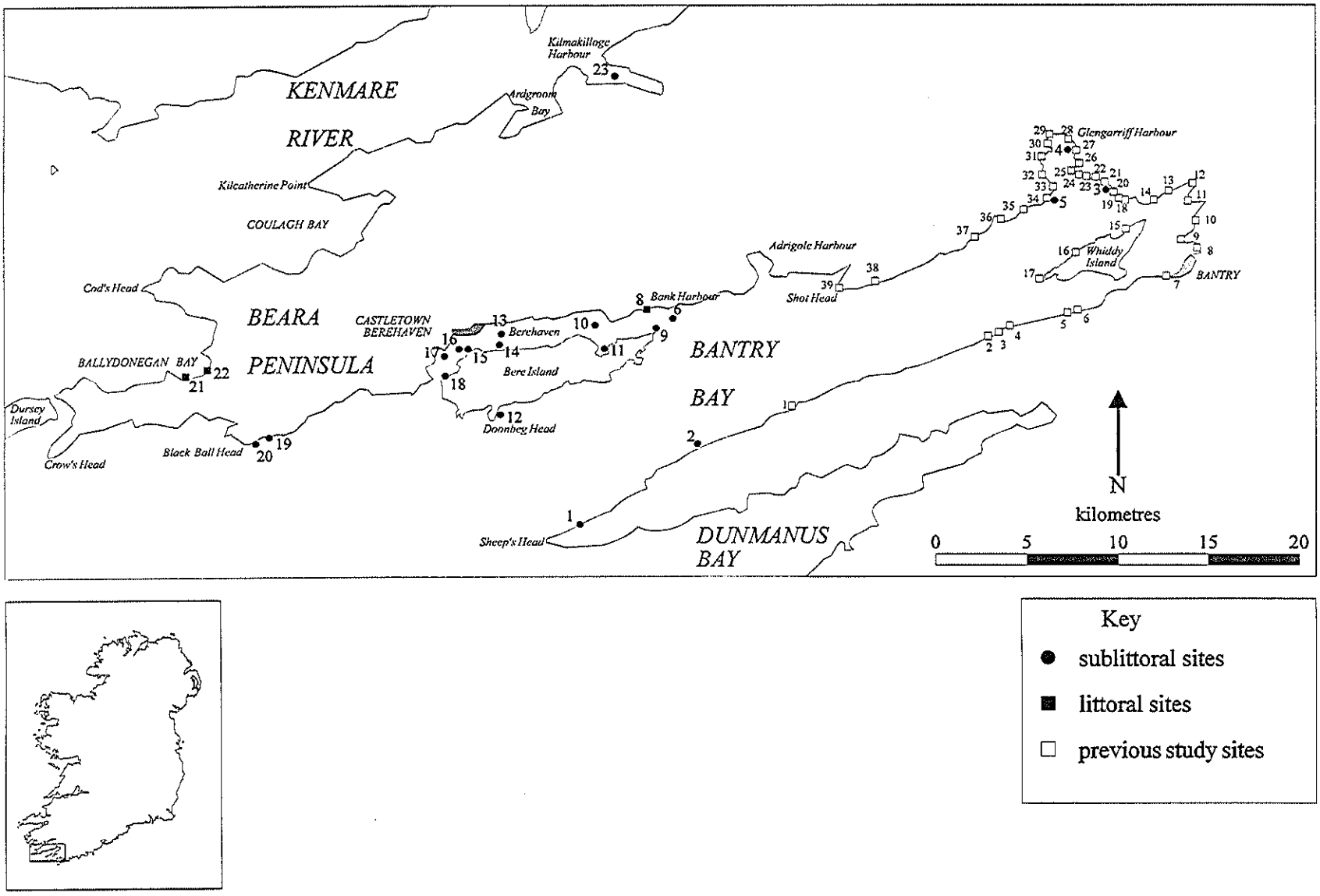

Figure 1. Survey area and sampling locations

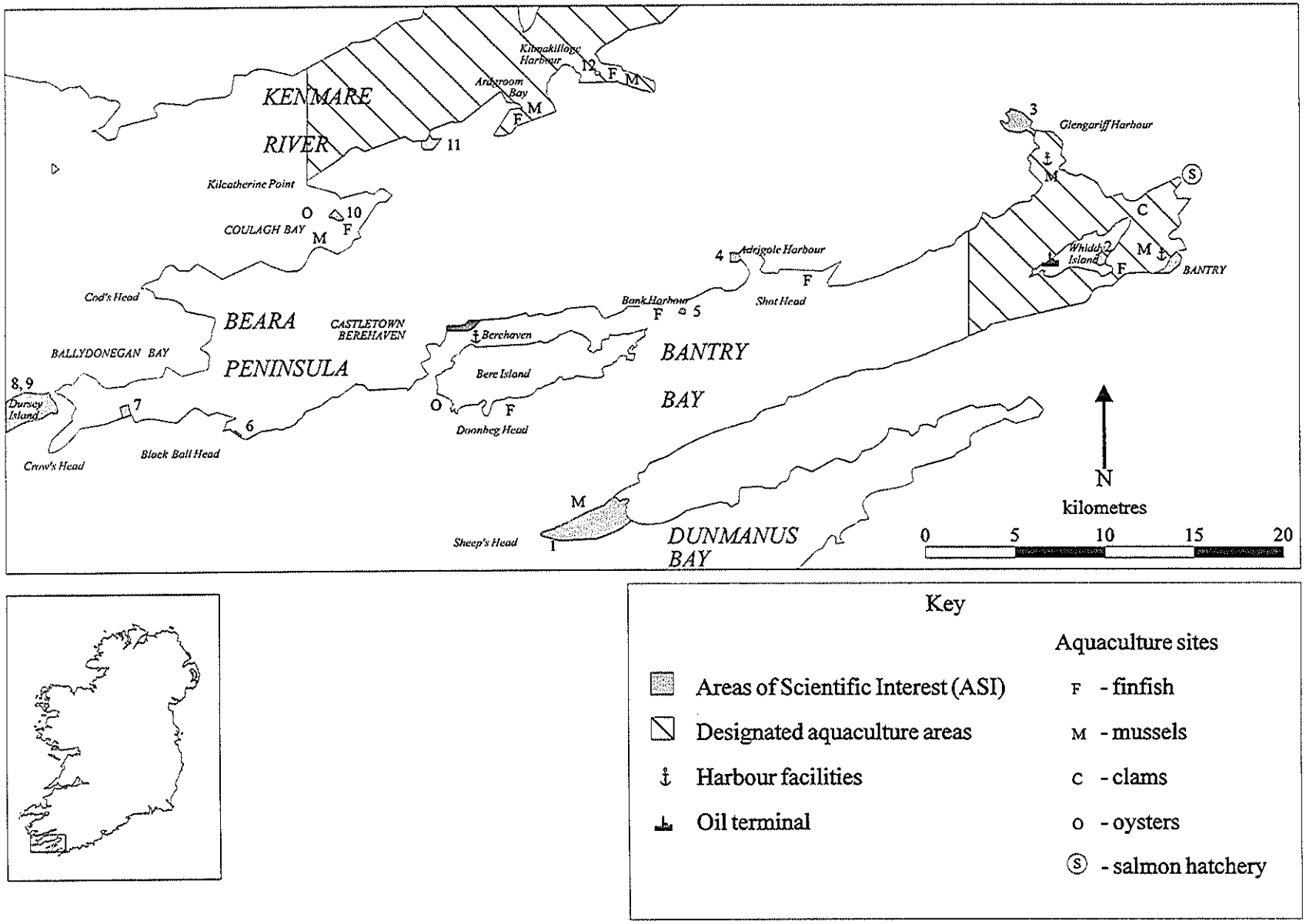

Figure 2. Areas of conservation interest (listed in Table 1) and aquaculture sites

Castletown Berehaven has a large anchorage and provides shelter and port facilities for a number of fishing vessels. Between 1970 and 1972 the average annual catch landed at Castletown Berehaven was estimate at between 100 and 250 thousand tonnes of which approximately 25% was shellfish, 30% demersal and 45% pelagic fish. Bantry also has port facilities harbouring a small fleet. The average annual catch between 1970 and 1972 was 10 to 50 thousand tonnes of fish, of which 25% were shellfish, 5% demersal fish and 75% pelagic (Royal Irish Academy 1979).

The harbourside at Castletown has areas set aside for net drying and mending. The majority of the nets are monofilament and are used for tangling the spiny crawfish *Palinurus elephas* (local fisherman pers. comm.). Fishermen were observed in the entrance to Bantry Bay using drift nets possibly for salmon. The nets were strung out between two buoys approximately 100-200 metres apart, and submerged apart from the float line. The southside of Berehaven near Bere Island is also fished for scallops (local fisherman pers. comm.).

Glengarriff Harbour has a jetty, and tourist boats offer trips around the harbour to view the seals. Local gardens attract tourists to the area.

In 1968 an oil terminal was opened by Gulf Oil Terminal (Ireland) Ltd. on Whiddy Island. Tankers of more than 300,000 tonnes off loaded crude oil ashore to tanks for storage before shipment to other European ports on smaller ships. The terminal was closed following the explosion of the tanker *Betelgeuse* in January 1979. Whilst the terminal was in existence, numerous small oil spillages and three major accidents occurred. On the 21-22 October 1974 a valve was left open overnight on the *Universe Leader* causing the loss of 2597 tonnes of Kuwait crude oil into Bantry Bay. In January 1975 the *Afran Zodiac* was damaged when leaving the terminal causing approximately 460 tonnes of bunker (heavy fuel) oil to spill into the bay (Grainger *et al.* 1984).

On the 8 January 1979 the oil tanker *Betelgeuse*, carrying 39,000 tonnes of Arabian light crude oil, exploded while discharging its cargo;.fifty people were killed. The tanker subsequently caught fire and burned for over 24 hours melting oil into an asphalt residue that covered the shore line immediately around the wreck. After the fire subsided oil began to leak from the hull at a rate of approximately 5 tonnes/hour for six days. Only then was the flow reduced to approximately 2 tonnes per hour until the remaining 10,000 tonnes still on board could be pumped ashore. It was estimated that over 30,000 tonnes of oil were burnt or released into Bantry Bay. Additional quantities were also released during the 18 months taken to salvage the tanker. Oil was initially washed ashore on the north side of Whiddy Island but spread to much of the inner bay. Easterly winds dispersed the oil further towards the mouth of the bay especially on the northern shore as far as Berehaven. Oil was collected using a variety of methods including towing booms behind ships and spreading straw on the shore and collecting it with garden forks. Dispersants, particularly BP 1100 WD, were used from ships and aeroplanes (Grainger *et al.* 1984).

In 1980 dredgers were employed to clear sunken oil from around the jetty at Whiddy Island as it was a known scallop (*Pecten maximus*) bed. The oil spill had a devastating effect on the local fisheries. Fishing was disrupted by the pollution and clean up process, but also by the rejection of some buyers of the shellfish caught in the area, particularly the Dublin Bay prawn *Nephrops norvegicus*. The exploitation of periwinkles *Littorina littorea*, scallops *Pecten maximus*, and the clam *Venerupis decussata* (= *Tapes decussatus)* was also greatly disrupted.

Current nature conservation status

Nine maritime areas of conservation have been identified in Bantry Bay and three in Kenmare River adjacent to the site surveyed on the current survey (Figure 1, Table 1). No particular marine conservation interest has as yet been identified in these areas.

Table 1 Current Areas of Scientific Interest (ASIs) of the coastal areas in Bantry Bay (Office of Public Works 1989)

No	Name	Importance	Area (ha)	Interest	Description	Location
1	Sheep's Head	Local	-	Botanical Ornithological	An exposed remote headland	V 75 59
2	Whiddy Island, Bantry Bay	Local	300	Ornithological	A sheltered island	V 967 487
3	Glengarriff Woods, Bantry Bay	International	-	Ecological	Woodland backing a small harbour	V 92 57
4	Adrigole Marsh, Bantry Bay	National	14	Botanical	A marsh containing several uncommon plant species including the Water Crowfoot *Ranunculus tripartitus* and the sedge *Carex punctata.*	V 80 49
5	Roancarrig Beg, Bantry Bay	Local	4	Ornithological	An exposed offshore rock which is a nesting site for terns	V 788 464
6	Black Bull Head, Bantry Bay	National	2	Geological	An exposure of igneous material that has intruded into the sedimentary country rock. The sea has eroded the cliff section exposing the internal structure of the intrusion.	V 582 395
7	Firkeel, Bantry Bay	Regional	-	Ornithological	-	V 530 412
8	Dursey Island	Regional	-	Ornithological	An exposed offshore island	V 48 40
9	Bull and Cow Rocks	National	9	Ornithological	An exposed offshore group of islets which is an important breeding site for seabirds	V 410 400
10	Eyeries Island, Kenmare River	Local	-	Ornithological	-	V 635 512
11	Cleanderry Wood, Kenmare River	Local	-	Ecological	-	V 67 55
12	Spanish Island, Kilmakilloge Harbour	Local	1	Ornithological	An offshore shingle island which is a nesting site for terns	V 740 590

METHODS

The aim of this survey was to provide descriptions of the littoral and sublittoral habitats and associated communities of Bantry Bay. Assessments of the biological interest and nature conservation importance of the area will be made from the data collected.

Sites were selected to give a broad spread of the habitats and communities likely to occur in the area. Inspection of Admiralty charts and Ordnance Survey maps indicated the topography, range of wave exposures and tidal currents in the area. The bad weather during the survey period limited travel time and accessibility to more exposed sites and restricted the sites that could be surveyed.

Sublittoral sites were surveyed by scuba diving from a rigid inflatable boat and littoral sites by direct observation on the shore. Sites were surveyed following the procedures laid out Hiscock (1990). For each site, and habitats within each site, a description was made of the main physical and biological features. The relative abundance of all conspicuous species present was recorded, categorised as rare, occasional, frequent, common, abundant or super

abundant using the scales in Hiscock (1990). Habitats were selected from the main biological subzones and range of substrata present.

Details of each site were recorded on sublittoral/littoral site sublittoral habitat and littoral habitat forms which facilitate data collation and transfer a database.

Photographs were taken to illustrate the range of habitats, communities and species present at as many of the sites as possible. All photographs were taken using a Nikon F4 (enclosed in an Aquatica underwater housing with a 20 mm wide angle lens for sublittoral pictures) on Kodachrome 64 and 200 film.

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 algae present in the area those that could not be identified was sent to Prof. M. Guiry, University College, Galway for identification. All records of these specimens were added to the appropriate habitat forms to be included in the data analysis.

All data collected during the survey were entered into a database at Trinity College, Dublin developed by the MNCR of the JNCC(UK) (Mills 1991). The species data was analysed using TWINSPAN (Hill 1979) allowing the records to be separated into broad groupings. The groupings formed the basis for community descriptions from the survey area. The dataset analysed was relatively small and the groupings TWINSPAN created were not always biologically meaningful. The results were modified to take into account factors not included within the analysis, such as substratum and sampling variations, with the final groupings were adjusted accordingly.

RESULTS

The survey extended over 13 days between 31 May and 8 June 1993. During the survey 23 sites were visited, 20 sublittoral and 3 littoral (Table 2, Figure 1). A description of each of the sites is given in Appendix 1. Fifty-four habitat records were completed and 335 species or higher taxa were identified (Appendix 3). Analysis of these habitat records enabled the identification of 10 littoral and 11 sublittoral communities (Table 3).

Table 2 Location, surveyors,dates sampled,type of survey and if photographs were taken (P), at the sites surveyed in this study

Surveyors: BEP-Bernard E. Picton; CSE-Chris S. Emblow; CCM-Christine C. Morrow

No.	Site name	Grid ref.	Latitude & Longitude	Surveyors	Date	Survey type
1	NE of Foilnadeal, Bantry Bay.	V 733 351	51°33.2'N 09°49.5'W	BEP	06.06.93	Sublittoral (P)
2	W of Glanrooncoosh, Bantry Bay.	V 788 393	51°35.6'N 09°44.9'W	CSE,CCM	06.06.93	Sublittoral (P)
3	SW of Yellow Rocks, Bantry Bay.	V 954 534	51°43.3'N 09°30.8'W	CSE	03.06.93	Sublittoral (P)
4	E of Slip Island, Glengarriff, Bantry Bay.	V 943 552	51°44.3'N 09°31.8'W	BEP,CSE	03.06.93	Sublittoral
5	Four Heads Point, Bantry Bay.	V 931 522	51°42.7'N 09°32.8'W	BEP,CCM	03.06.93	Sublittoral
6	E of Rooncarrigmore, Berehaven, Bantry Bay	V 793 460	51°39.2'N 09°44.6'W	CSE,CCM	02.06.93	Sublittoral
7	Centre of East Entrance, Berehaven, Bantry Bay	V 782 452	51°38.8'N 09°45.6'W	CSE,BEP	09.06.93	Sublittoral (P)
8	Bank harbour, Berehaven, Bantry Bay.	V 760 468	51°39.5'N 09°47.5'W	CCM,CSE, BEP	07.06.93	Littoral
9	NE of Lonehort Point, Berehaven, Bantry Bay	V 644 455	51°38.9'N 09°47.1'W	BEP,CSE	31.05.93	Sublittoral (P)
10	George Rock Buoy, Berehaven, Bantry Bay.	V 736 457	51°38.9'N 09°49.6'W	CSE	31.05.93	Sublitoral
11	Inner Lawrence's Cove, Berehaven, Bantry Bay	V 737 441	51°38.0'N 09°47.4'W	CCM,BEP	31.05.93	Sublittoral (P)
12	E of Doonbeg Head, Bere Island, Bantry Bay	V 697 414	51°36.6'N 09°52.8'W	CSE	05.06.93	Sublittoral (P)
13	Walter Scott Rock, Berehaven, Bantry Bay	V 683 451	51°38.5'N 09°54.2'W	BEP	01.06.93	Sublittoral (P)
14	W of Sheep Island, Berehaven, Bantry Bay	V 682 446	51°38.3'N 09°54.2'W	CSE,CCM	01.06.93	Sublittoral
15	S of Foilenaboe Rocks, Berehaven, Bantry Bay	V 677 442	51°38.0'N 09°54.6'W	BEP,CCM	01.06.93	Sublittoral (P)
16	Colt Rock, Berehaven, Bantry Bay.	V 673 442	51°38.0'N 09°55.0'W	CCM	02.06.93	Sublittoral
17	E of Piper Point, Berehaven, Bantry Bay.	V 668 432	51°37.5'N 09°55.4'W	BEP,CSE	02.06.93	Sublittoral (P)
18	Naglas Point, Berehaven, Bantry Bay.	V 672 428	51°37.3'N 09°55.0'W	BEP,CCM	07.06.93	Sublittoral (P)
19	Coosdanagan, NE of Black Ball Head, Bantry Bay.	V 601 399	51°35.6'N 10°01.1'W	BEP,CSE	05.06.93	Sublittoral (P)
20	S of Black Ball Head, Bantry Bay.	V 589 393	51°35.3'N 10°02.2'W	CCM,BEP	05.06.93	Sublittoral (P)
21	S of Ballydonegan Bay, Kenmare River.	V 563 439	51°37.7'N 10°04.5'W	CSE,CCM, BEP	06.06.93	Littoral (P)
22	Ballydonegan Bay, Kenmare River.	V 575 441	51°37.8'N 10°03.5'W	CSE,CCM, BEP	06.06.93	Littoral (P)
23	SW of Book Rocks, Kilmakilloge Harbour, Kenmare River.	V 738 598	51°46.5'N 09°49.7'W	BEP,CCM, CSE	08.06.93	Sublittoral

Littoral soft substrata communities

Of the littoral sites surveyed only one was sedimentary, a steep beach of very coarse sand exposed to wave action from the west (BB10,

Table 3). The community present was notable by the very low diversity of conspicuous animals present and the total absence of macro algae. The beach was very well drained and the sediment likely to be mobile. The profile of the beach was likely to alter from one season to the next. It is likely that the lack of firm stable substrata is the main cause for the paucity of species, the exception being talitrid amphipods that occurred on the upper shore.

Littoral hard substrata communities

The main substratum throughout the Bantry Bay area in the littoral zone is rock. Steep bedrock was the prominent habitat around much of the coastline in the survey area, areas of

broken bedrock and boulders occurred in small inlets and bays. At the latter locations wave action was reduced and, of the shores surveyed, the main communities present were dominated by a dense cover of fucoid algae. A typical sheltered shore zonation followed. The supralittoral fringe was dominated by band of maritime lichens (BB1) particularly the orange crust *Xanthoria parietina* with a narrow band of *Pelvetia canaliculata* (BB2) and *Fucus spiralis* (BB3) below. This zone was very restricted at the sites surveyed. A zone of *Fucus vesiculosus* (BB4) followed although again this was restricted to a narrow band at the sites surveyed. The bedrock ended in the midshore giving way to an area of boulders were *Ascophyllum nodosum* (BB5) provided dense. The profile of the shore was less steep than at the top and the *Ascophyllum* zone was more extensive than the bedrock communities. On the lower shore boulders *Fucus serratus* was dominant (BB6). The boulders provided additional microhabitats which increased the species richness. Under boulders, a rich association of sponges, anemones and tunicates notably *Leucosolenia* spp. and small *Ascidia mentula* occurred. Algae, particularly *Chondrus crispus*, covered much of the upward facing rock not colonised by *F. serratus*.

On the more wave exposed sites surveyed the zonation was much less evident with broad bands replacing the narrow strips on the sheltered site. The midshore was virtually devoid of plant species and dominated by the barnacle, *Chthamalus stellatus*, and the limpet, *Patella vulgata*, (BB7). The only plant present was the lichen *Lichina confinis* growing in crevices. Empty barnacle cases provided shelter for the periwinkle *Littorina neritoides*. Lower shore sites had a *Fucus serratus* dominated community (BB8) although species richness was reduced.

At one site towards the entrance to the bay (site no. 1) the sublittoral fringe was vertical bedrock dominated by a dense band of mussels, *Mytilus edulis*, with coralline crusts on the uncolonised rock faces (BB9). Predatory starfish, *Asterias rubens*, were common on the mussels.

Sublittoral soft substrata communities

Soft substrata were the main sublittoral habitat types for most of Bantry. The sediment composition at the sites surveyed could be classified into three broad types; soft mud, sand and maerl.

The finer, muddier sediments occurred in the more sheltered locations around the bay area where wave action and exposure to strong tidal currents were reduced. The soft muds (BB12) which occurred at a range of between 9 and 19 m BCD supported a range of species, most characteristic of which were populations of the seapen *Virgularia mirabilis* with the burrowing polychaete *Myxicola infundibulum* also present. The burrowing brittlestar *Amphiura chiajei* and *Amphiura filiformis* where abundant at sites where the sediment was mixed with sand (BB13). Megafauna burrows belonging to the Dublin Bay prawn *Nephrops norvegicus*, were widespread in the mud. At one site, an ultra sheltered bay, the sediment was anoxic and contained no obvious infauna (BB21). The sediment surface was covered with *Ostrea* and *Pecten* shells attached to which was the green algae *Ulva* sp. The only other notable species was the starfish *Asterias rubens* which was frequent on the mud surface.

Shallow sediment between 7 and 20 m BCD, occurring in locations where wave exposure and/or tidal streams were high, consisted mainly of firm fine sand with some mud. The sediment held a varied fauna most notably the otter shell, *Lutraria lutraria*, the burrowing anemone, *Cerianthus lloydii*, and the razor shell, *Ensis* sp., was widespread throughout the sites (BB14). The mobile fauna was characterised by *Gibbula magus*, *Pecten maximus*, and *Pomatoschistus pictus*.

The most restricted sediment habitat is likely to be maerl (BB15) which was recorded at two sites in Bantry Bay. The maerl *Lithothamnion coralloides* overlay mud whose most notably

inhabitants were anemones particularly *Anthopleura ballii* and *Cerianthus lloydii*. The matrix of the maerl provided shelter for crabs, *Macropodia rostrata* and *Liocarcinus corrugatus*, and suitable substratum for a rich flora of red and brown algae in particular *Calliblepharis ciliata* and *Dichtyota dichotoma*.

Sublittoral hard substrata communities

The communities found on the hard sublittoral substrata from Bantry Bay could be broadly divided by their exposure to wave action and depth distribution.

Infralittoral bedrock at sheltered sites towards the head of the bay and in Berehaven supported a community characterised by a kelp park of *Laminaria saccharina* and *Laminaria hyperborea* (BB20). The kelp park extended to a depth of approximately 13 m BCD. No habitats where surveyed at sheltered locations were a kelp forest was present. The substrata was generally silty as tidal currents were weak although hydroid species particularly *Nemertesia antennina* and *Halecium halecinum* occurred on ledges and ridges free from silt. The bedrock supported a rich understorey of algae dominated by *Delesseria sanguinea* and *Nitophyllum punctum* with *Chorda filum*. At site 13, the richest flora was noted with 16 algae species recorded.

The upper circalittoral supported a community of red algae, sponges, hydroids and anthozoans (BB19). The characteristic species of the community was the sea squirt *Phallusia mammilata* which previously has not been recorded in Ireland outside of Bantry Bay. At two locations (site 3 and 11) *Phallusia* was abundant on the rock faces. *Delesseria sanguinea* was the dominant floral component of the community, and *Rhodophyllis divaricata* and *Brongniartella byssoides* were frequent at some sites.

Hard substrata communities in the less sheltered locations towards the entrance to the bay, followed a similar pattern to the sheltered locations. Upper infralittoral rock supported a dense kelp forest of *Laminaria hyperborea* (BB16) which was recorded to a depth of 19 m BCD. The understorey flora was dominated by *Delesseria sanguinea*, and several species were epiphytic on the kelp stipes. *Corynactis viridis* and *Alcyonium digitatum* characterised the rock.

Lower infralittoral bedrock at sites towards the mouth of the bay supported a park of *Laminaria hyperborea* (BB17). Sites located on submerged rocky pinnacles at each end of Berehaven also supported similar communities. Here wave action was reduced although tidal currents were moderate.

At sites towards the entrance to the bay where wave action was likely to be high, much of the circalittoral hard substrata supported dense red algae, particularly *Delesseria sanguinea* at the shallower habitats. The fauna was characterised by hydroids and dead man's fingers *Alcyonium digitatum* (BB18).

Previous studies

None of the previous study sites listed in Appendix 4 corresponded with those locations surveyed during the current survey. The majority of the previous sites were located around the head of the bay near the oil terminal on Whiddy Island. None of the sites were sublittoral.

The development of the oil terminal at Whiddy Island and the subsequent oil spillages have focused the attentions of several studies on Bantry Bay. Crapp (1973) surveyed the distribution of the fauna and flora of the littoral hard substrata. Forty sites were located across a range of wave exposures based on the scale developed by Ballantine (1961), with the majority of the sites located around the head of the bay near Whiddy Island. A list of sites is given in Appendix 4 and a map is given on Figure 1. At each site a transect from Mean Low Water Springs (MLWS) to the top of the supralittoral zone was levelled using a cross staff

and spirit level. The interval between each station was one tenth of the spring tide range, (0.3 m for Bantry Bay) the lowest station at MLWS being 0.4 m above chart datum (ACD). This accommodated the sampling of shores during smaller tides. The abundance or absence of sixty commonly occurring littoral species were recorded from each transect using scales developed by Crisp and Southward (1958) and expanded by Ballantine (1961).

The littoral fringe was characterised by the lichen *Verrucaria maura*, *Littorina neritoides* and *Littorina saxatilis tenebrosa* with *Lichina confinis* in the upper levels of the habitat. This zone did not appear to fit well with the communities described from the current survey, although it may be a component of the communities BB2 and BB3.

The upper eulittoral was described as being dominated by *Pelvetia canaliculata*, *Fucus spiralis*, *Catenella reptans* (= *caespitosa*) and *Lichina pygmaea*, similar to communities BB2 and BB3. At the more exposed sites *Chthamalus stellatus*, *Littorina neglecta* and *Littorina neritoides* were dominant. This is similar to community BB7 from the current survey although algae, particularly *Porphyra umbilicalis*, *Mastocarpus stellata* and *Corallina officinalis* were present at the sites Crapp studied.

The mid-eulittoral was described by Crapp as containing the following dominant species; *Fucus spiralis, Ascophyllum nodosum, Patella vulgata, Mytilus edulis, Nucella lapillus, Actinia equina, Elminius modestus, Semibalanus balanoides, Littorina littorea* and *Littorina littoralis* (= *obtusata*). The zone was not split into communities but describes the extent of the communities across the shore at different exposures to wave action. The species composition corresponds well with that of community BB5.

The lower eulittoral zone was also described by overall species composition and listed as *Fucus serratus*, *Corallina officinalis*, *Lomentaria articulata* and *Laurencia pinnatifida.* The species composition compares well with community BB6.

The sublittoral fringe was described and was similar to community BB11.

Crapp concluded that the mussel and fucoid shores are the dominant community which Lewis (1964) describes as typical of Atlantic coasts and mild climates.

In 1969 the National Board of Science and Technology (NBST) provided funding for a baseline survey of the shores of Bantry Bay. The survey work began in 1977 following an initial survey of possible sites and is documented by Myers *et al.* (1978, 1979, 1980). The surveys aimed to provide baseline data in the event of environmental change due to the construction and operation of the oil terminal and to investigate the biological interactions occurring on the shores of south-west Ireland. Five sites were studied in Dunmanus Bay and Bantry Bay and are shown on Figure 1 and listed in Appendix 4. Sites were surveyed monthly over a period of 26 consecutive months. At each site a permanently marked transect, from the supralittoral fringe to MLWS, was monitored using a 0.25 m^2 quadrat placed at 30 cm vertical intervals down the shore. Dominant species were noted from each site and the population dynamics described over the 26 month period.

Cross *et al.* (1979) described the initial effects of the pollution from 7 sites around the head of the bay following the *Betelgeuse* disaster. Survey work was carried out during the first six days after the incident. A transect approach was adopted to assess the impact of the shore fauna and flora. Site locations are shown on Figure 1 and listed in Appendix 4.

Following the oil spills from the *Universe Leader* and the *Afran Zodiac* The sites surveyed by Crapp were re-surveyed in 1975 and early 1976 by Baker *et al.* (1981). The same methodologies were followed to allow comparison of the data, and by taking into account any major meteorological effects, changes in the littoral marine fauna and flora due to the oil spillages were noted. Additionally, information about the presence and persistent oil was

collected. Baker *et al.* (1981) attributes the major changes to natural effects and not oil pollution.

The *Betelgeuse* disaster prompted further work in Bantry Bay by Grainger *et al.* (1984). Hydrographic, zooplankton and diving surveys were undertaken and data was collected about the larvae and adults of commercially important fish and shellfish species.

Guiry (1973) lists the marine algae from 11 sites towards the head of Bantry Bay. Algae from 10 sites were surveyed in the littoral zone with one site surveyed by scuba diving. One hundred and sixty-six species were recorded, 88 of which were new records for the Bay and 7 for the Co. Cork.

Table 3 Community types and their distribution

Community type LS-littoral sand; LR-littoral rock; SM sublittoral mud; SS-sublittoral sand; SG-sublittoral gravel; SR-sublittoral rock

Site number

Community number	Community type	Community name	Sites present	No. of species recorded
BB1	LR	Lichen zone	8	6
BB2	LR	*Pelvetia canaliculata* zone	8	7
BB3	LR	*Fucus spiralis* zone	8	7
BB4	LR	*Fucus vesiculosus* zone	8	11
BB5	LR	*Ascophyllum nodosum* zone	8	16
BB6	LR	*Fucus serratus* zone	8	40
BB7	LR	Barnacle and limpet dominated bedrock	21	5
BB8	LR	Lower eulittoral exposed bedrock with *Fucus serratus*	21	26
BB9	LR	Exposed bedrock with *Mytilus edulis*	1	11
BB10	LS	Exposed coarse well drained sand	22	2
BB11	SR	Exposed sublittoral bedrock with mixed kelps	1	9
BB12	SM	Soft mud with burrows and *Virgularia mirabilis*	4	39
BB13	SM	*Amphiura chiajei* and *Amphiura filiformis* on soft mud	9; 10	28
BB14	SS	Shallow sands with bivalves and *Lutraria lutraria*	5; 14; 15; 16; 17	56
BB15	SG	Maerl bed with algae	12	29
BB16	SR	Infralittoral bedrock and stable boulders with *Laminaria hyperborea* forest	1; 2; 12; 18; 19	96
BB17	SR	Infralittoral rock with sparse *Laminaria hyperborea*	1; 6; 12; 18; 19	114
BB18	SR	Circalittoral rock with *Alcyonium digitatum* and hydroids	1; 2; 18; 19; 20	127
BB19	SR	Sheltered circalittoral bedrock with *Phallusia mammilata*	3: 4: 5; 9; 10; 11; 15	146
BB20	SR	Sheltered bedrock with *Laminaria hyperborea* park	13; 14	75
BB21	SM	Anaerobic mud with *Ulva* sp. UNCERTAIN STATUS	11	7

DISCUSSION

Biotopes present

The present survey together with results from previous studies has given an indication of the range of habitats, communities and species present in the Bantry Bay area.. From the current information, the communities do not appear atypical or unique compared to others in the British Isles. However, there is over 20 years historical data for some rocky shores. Continued monitoring of these shore communities is of value not only in determining relationships but the long term variation in natural communities to natural (e.g. climatic) or human impacts.

Human impacts

Bantry Bay is not heavily populated and has little industry. The bay, particularly the inner part, has been exposed to more oil spills and subsequent cleaning operations than any other part of Ireland. However, these are not considered to have had any lasting effect on the littoral fauna and flora (Baker *et al.* 1981), the zooplankton of numerous commercial fish species or the adult populations of the scallop *Pecten maximus* (Grainger *et al.* 1984). The main human impacts on the fauna and flora in the bay are likely to be due to dredging for scallops, tangle and drift netting for crawfish and salmon, and potting for lobsters and crabs. All of these fisheries will incur a bycatch of other species and/or cause distubance to the habitat and other benthic species.

Conservation interest

Of particular note is the presence of the sea squirt *Phallusia mammilata*. It is a southern species, occuring in northern France, and Portland Harbour and Salcombe Harbour on the south coast of England. It has also been recorded from Bardsey Island, North Wales (Hiscock 1984) and from Shetland (Moss and Ackers 1987). The latter record in almost certainly a misidentification and the Bardsey record should be considered doubtful. In Ireland *Phallusia* is only known from Bantry Bay, where it proved to be common, especially in sheltered rocky habitats. As this represents the northern limit of its known distribution, and it is common here, its ability to disperse must be limited. Thus its presence in Bantry Bay could indicate an interesting relict distribution or a relatively recent introduction. However special conservation measures would appear unnecessary as *Phallusia* is wide spread and common in Bantry Bay.

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APPENDICES

Appendix 1: Description of sites surveyed in 1993

(as described at the time of the BioMar survey and extracted from the database)

1 NE of Foilnadeal **51°33.2'N 09°49.5'W**

The site was located on the southern side of a large marine inlet exposed from the west to high wave action. The seabed was bedrock rising from 33 m BCD were the lower circalittoral was characterised by *Alcyonium digitatum* and *Caryophyllia smithii*. At 27 m BCD the upper circalittoral was dominated by *Delesseria sanguinea*. At 19 m BCD in the lower infralittoral *Laminaria hyperborea* park was present but was not dense until 16.3 m BCD. The sublittoral fringe at 6.4 m BCD was characterised by *Alaria esculenta* with a band of dense *Mytilus edulis* with *Asterias rubens* at 3.5 m BCD.

2 W of Glanrooncoosh **51°35.6'N 09°44.9'W**

The site was located on the south side of Bantry Bay, and consisted of moderately exposed bedrock. The kelp forest extended to 16 m. Below the kelp forest the rock was terraced, and the red algae *Delesseria sanguinea* was common. Coarse sand and shell were present in fissures and hollows within the rock and the sponge *Ciocalypta penicillus* was characteristic of this micro habitat. *Corynactis viridis* was characteristic of the vertical surfaces and *Polymastia* spp., *Urticina felina,* and *Stelligera rigida* of the horizontal surfaces.

3 SW of Yellow Rocks **51°43.3'N 09°30.8'W**

The site was located on the west side of an isolated rocky islet near the head of Bantry Bay. A sediment plain of fine sand and maerl gravel (few live pieces) at 11.9 m BCD supported *Cerianthus lloydii* and a few other species. The sediment sloped gently to a rocky outcrop at 10.6 m BCD dominated by red algae, particularly *Delesseria sanguinea* and *Heterosiphonia plumosa* with abundant *Phallusia mammillata*.

4 E of Slip Island, Glengarriff **51°44.3'N 09°31.8'W**

A deep channel at entrance to Glengarriff harbour. The chart shows steep sides to 20m. The bottom of the channel was mud plain with *Nephrops norvegicus* and large scattered *Virgularia mirabilis*. The rock slope was heavily silt-covered, with *Ascidiella aspersa, Polymastia boletiformis, Antedon bifida* and large clumps of *Obelia dichotoma*.

5 Four Heads Point **51°42.7'N 09°32.8'W**

A steep rocky reef at the base of offshore rocks. The sediment and the reef had a reasonably high abundance of *Pecten maximus*. The sediment consisted of muddy sand with shell debris. The sediment contained *Cerianthus lloydii, Owenia fusiformis, Lutraria lutraria* and *Myxicola infundibulum*. The rock had abundant *Ascidiella aspersa* on the more sheltered face, with *Suberites carnosus* common at approximately 13-15 m BCD. *Delesseria sanguinea* became more frequent above 13m. The lower limit of the kelp forest was 9 m BCD. The kelp forest consisted of *Laminaria hyperborea* and *Saccorhiza polyschides*

6 E of Rooncarrigmore, Berehaven **51°39.2'N 09°44.6'W**

The site was located on the east side of an isolated rock at the east end of Bere Island, away from the main swell. The seabed at 5m was dominated by a *Laminaria hyperborea* forest but not surveyed. At 10.5 m BCD the bedrock became less dominated by kelp in the lower infralittoral. *Delesseria sanguinea* and the brown algae *Dictyota dichotoma* and *Desmarestia aculeata* were the dominant algae. The jewel anemone *Corynactis viridis* was abundant on the more exposed rock faces. The crevices were filled with sea cucumbers particularly *Aslia lefevrei* and occasional *Pawsonia saxicola*. *Antedon bifida* was common on the rock surfaces, particularly on the upper parts.

7 Centre of East Entrance, Berehaven **51°38.8'N 09°45.6'W**

The site was located on a submerged rock in the entrance to an area of enclosed coast. The seabed was bedrock characterised in the lower circalittoral by sponges and *Corynactis viridis* with *Antedon bifida* common on upper circalittoral bedrock. The flora was dominated by *Delesseria sanguinea* and *Hypoglossum hypoglossoides*.

8 Bank harbour, Berehaven **51°39.5'N 09°47.5'W**

A very sheltered shore on the north side of Bantry Bay opposite Bere Island. Bouldery shore backed by bedrock with distinct zones of lichens, *Palmaria palmata* with *Fucus spiralis*, *Ascophyllum nodosum* and a relatively species rich zone of *Fucus serratus*. In the *Fucus serratus* the boulders had sponges and tunicates on their undersides. The shore was adjacent to a small jetty/quay used by local salmon fish farmers as a launching point. There was evidence of possible contamination by spilt food.

9 NE of Lonehort Point, Berehaven **51°38.9'N 09°47.1'W**

The site was located at the eastern end of an offshore island in a large marine inlet on the northern more sheltered side of the island. The seabed at 19 m BCD was a flat plain of mud with *Amphiura* spp. and occasional burrows. This led to ridges of bedrock at 14.5 m BCD with hydroids and tunicates. Beyond this at 7.5 m BCD was a dense maerl bed on mud.

10 George Rock Buoy, Berehaven **51°38.9'N 09°49.6'W**

Located in the centre of the channel to the east of Castletown Berehaven, marked by large buoy (chained). Seabed at 11 m BCD was flat muddy sediment . *Philine aperta* was abundant on the sediment surface. Decaying salmon were occassionally found. At 9.2 m BCD the sediment gave way to bedrock which rose to 7.2 m BCD. Rock dominated by hydroid material particularly *Halecium halecinum* with patches of *Antedon bifida* on the more prominent pieces. *Caryophyllia smithii* common on the rock surface.

11 Inner Lawrence's Cove, Berehaven **51°38.0'N 09°47.4'W**

A sheltered inlet on the north side of Bere Island. There was a horizontal plane of soft mud (anaerobic). The mud was almost completely covered with dead *Pecten maximus* and *Ostrea edulis* shells. There was a reef of bedrock with *Phallusia mammillata* abundant.

12 E of Doonbeg Head, Bere Island **51°36.6'N 09°52.8'W**

The site was located on the south side of Bere Island in the main Bantry Bay channel. It was adjacent to a sediment plain of coarse sand which was not surveyed completely. Rock faces were dominated by *Corynactis viridis* and *Antedon bifida* to 8.8 m BCD where the kelp forest (*Laminaria hyperborea*) started. Beneath the kelp *Delesseria sanguinea* was characteristic with some *Desmarestia aculeata* covered in *Electra pilosa*. Many ballan wrasse and pollack were around the site.

13 Walter Scott Rock, Berehaven **51°38.5'N 09°54.2'W**

Offshore rock in a sheltered channel with slight tidal stream. Rock very silty, dominated by algae and *Antedon bifida* with *Nemertesia antennina* and *Cereus pedunculatus*.

14 W of Sheep Island, Berehaven, **51°38.3'N 09°54.2'W**

Site was located on the south side of enclosed inlet to a potentially breaking rock. Sandy muddy plain at 7.6m leading to a rock outcrop at 6.5 m BCD. Muddy sand had shell debris, dominated by *Cerianthus lloydii* with red algae growing on larger shell pieces. Siphons of *Mya* sp. and *Ensis* sp. particularly nearer the rock/sediment interface. Rock was silty with few kelp plants, particularly *Laminaria saccharina* and *Saccorhiza polyschides*, although generally in poor condition. Some large *Cliona* on the lower parts of the rock with *Delesseria sanguinea* beneath the canopy.

15 S of Foilenaboe Rocks, Berehaven **51°38.0'N 09°54.6'W**

Offshore rock on the south side of an enclosed channel into Bear Haven. There was a plain of sand and broken shell at around 17 m BSL. Within the sediment *Cerianthus lloydii*, *Urticina felina*, *Lutraria lutraria* and *Venerupis* sp. were characteristic. Bedrock was found at approximately 15 m BSL characterised by *Urticina felina*, *Cereus pedunculatus*, *Nemertesia* and *Antedon bifida*.

16 Colt Rock, Berehaven **51°38.0'N 09°55.0'W**

A prominent rock in the middle of a channel between Bere Island and the mainland. The sediment around the rock was characterised by *Cerianthus lloydii*, *Pecten maximus*, *Lutraria lutraria* and clumps of red algae; mostly *Delesseria sanguinea* attached to empty *Lutraria* shells. The bedrock was terraced; with *Laminaria hyperborea* on the upper faces and *Urticina felina*, *Metridium senile*, *Corynactis viridis* and *Echinus esculentus* on the vertical faces.

17 E of Piper Point, Berehaven **51°37.5'N 09°55.4'W**

A headland on west side of west entrance to Berehaven. Slightly sheltered from prevailing wind and swell. There was a sediment plain at 19.4 m BCD of shelly, coarse sand with *Echinocardium flavescens* and *Lutraria lutraria*. The sand gave way to bedrock slope dominated up to 11.7 m BCD by *Corynactis viridis* and hydroids, particularly *Sertularella gayi*, *Nemertesia ramosa* and *Aglaophenia tubulifera* with *Antedon bifida* on the prominent rock. At 11.7 m BCD the kelp park started with red algae and hydroids dominant.

18 Naglas Point, Berehaven **51°37.3'N 09°55.0'W**

A channel at the entrance to Berehaven, with a maximum current of 2 knots on the outflow. The seabed consisted of ridges of bedrock running at an angle across the current. The tops of the ridges had sparse kelp cover, deeper bedrock with *Delesseria sanguinea* and hydroids, but no kelp. *Alcyonium digitatum* was abundant on the tops and on north faces of ridges reflecting maximum exposure to current. Hydroids were moderately diverse, with *Aglaophenia kirchenpaueri* frequent.

19 Coosdanagan, NE of Black Ball Head **51°35.6'N 10°01.1'W**

A headland on the north side of Bantry Bay, west of Berehaven. Shown on chart as an indentation with a depth of 31 m BCD on the inside of ridge at headland. A steep bedrock slope to south which ran into boulders at 31 m BCD. Typical exposed west coast habitats, rather sparse, with no unusual species.

20 S of Black Ball Head **51°35.6'N 10°01.1'W**

An exposed headland at the north east entrance to Bantry Bay. The seabed at 36 m BCD was steep rock with some vertical surfaces which were dominated by *Corynactis viridis* in the lower circalittoral and *Metridium senile* in the lower infralittoral. The hydroids *Thecocarpus myriophyllum* and *Nemertesia* spp. were common in the lower circalittoral. The kelp forest extended to approximately 16 m BCD and the main understorey species was *Cryptopleura ramosa*. *Alaria esculenta* was present in the sublittoral fringe.

21 S of Ballydonegan Bay **51°37.7'N 10°04.5'W**

The site was located to the south of Ballydonegan Bay adjacent to 930606/01. The shore was broken bedrock ridges with the strata running perpendicular to the shore. The lower shore was characterised by barnacles and *Patella vulgata*.

22 Ballydonegan Bay **51°37.8'N 10°03.5'W**

The site was located on the north side of Coulagh Bay, to the north of Bantry Bay. A very steep beach of coarse sand was backed by a stream which ran along the back and down to the side of the beach to the sea. Behind the stream was a small area of grassland used for

camping and caravans. The lower shore was compact coarse clean sand with no obvious species. The mid to upper shore (habitat 1) was dry sand with holes (talitrid amphipods were taken).

23 SW of Book Rocks, Kilmakilloge Harbour **51°46.5'N 09°49.7'W**

A check of the *Swiftia pallida* site in Kenmare River. The site is on a rock reef extending out SW of Book Rocks at the entrance to Kilmakilloge Harbour, Kenmare River. The upper part of the rocks form a ridged platform with red algae dominant and hydroids frequent. The rock slope is at 40-60 degrees and heavily silted; the silt was lifting in the swell. Kilmakilloge harbour is now almost full of mussel farms, with several salmon cages also present. One mussel farm is within 200 m of the site. The site appears to be much more heavily silted than on a previous visit by Picton (1985).

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 BB denoting the survey area, Bantry Bay. 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 and correspond with MNCR database records (e.g. 14(1) is site record 14 and habitat record 1). Where the record includes more than one community this is marked with an asterisk (*).

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 35% 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 which the species was recorded. The **%** displays this as a percentage of the total number of records assigned to that community. The **abundance** relates to those defined in Hiscock 1990. i.e.

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

COMMUNITY BB1 Lichen zone

HABITAT Supralittoral fringe bedrock

Classification

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

Distribution

8(1)

Extent

Much of the shoreline of Bantry Bay is bedrock extending above the supralittoral fringe. This community is likely to occur throughout the bay possibly being better developed at locations where exposure to wave action is greatest.

Description

The community was recorded from the one bedrock shore surveyed in the bay which supported the typical maritime lichen community with *Lecanora atra*, *Xanthoria parietina*, *Ochrolechia parella* and *Ramalina* sp. although none occurred in a particularly high abundance. The zone was restricted at the site surveyed.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Lecanora atra	1	100	R - R	R
Ochrolechia parella	1	100	R - R	R
Ramalina sp.	1	100	R - R	R
Verrucaria maura	1	100	R - R	R
Xanthoria parietina	1	100	O - O	O

COMMUNITY BB2 *Pelvetia canaliculata* zone

HABITAT Lower littoral fringe bedrock and boulders

Classification

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

Distribution

8(2)*

Extent

Although only recorded at one site, this community is likely to extend along much of the shoreline of the bay where exposure to wave action is low.

Description

At the site from which this community was recorded the amount of bedrock and boulders occurring in the lower littoral fringe was small. The upper part was characterised by the fucoid algae *Pelvetia canaliculata* with the limpet *Patella vulgata* on the bare rock faces. The black lichen *Verrucaria maura* covered much of the remaining rock.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Carcinus maenas	1	100	R - R	R
Patella vulgata	1	100	R - R	R
Monodonta lineata	1	100	F - F	F
Fucus spiralis	1	100	F - F	F
Pelvetia canaliculata	1	100	C - C	C
Verrucaria maura	1	100	O - O	O

COMMUNITY BB3 *Fucus spiralis* zone

HABITAT Upper eulittoral bedrock and boulders

Classification

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

Distribution

8(2)*

Extent

Although only recorded at one site, this community is likely to extend along much of the shoreline of the bay where exposure to wave action is low.

Description

The amount of lower littoral fringe bedrock or boulders was small at the site surveyed. The lower part of the zone was characterised by a narrow band of sparse *Fucus spiralis*. The topshell *Monodonta lineata* was present grazing on the algae.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Carcinus maenas	1	100	R - R	R
Patella vulgata	1	100	R - R	R
Monodonta lineata	1	100	F - F	F
Fucus spiralis	1	100	F - F	F
Pelvetia canaliculata	1	100	C - C	C
Verrucaria maura	1	100	O - O	O

COMMUNITY BB4 *Fucus vesiculosus* zone

HABITAT Stable mid eulittoral boulders, cobbles and pebbles

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Mid eulittoral
Substratum:	Boulders, cobbles and pebbles

Distribution

8(3)

Extent

Likely to occur throughout much of the survey area although only recorded from one site. The location was within a sheltered enclosed bay which probably does not represent the typical environmental conditions for this community.

Description

A mixed substrata of stable boulders and cobbles with a dense cover of bladder wrack *Fucus vesiculosus* characterising the zone. The algae was primarily grazed by the topshell *Monodonta lineata* and periwinkle *Littorina littorea* with flat periwinkles *Littorina obtusata* amongst the fronds. The dogwhelk *Nucella lapillus* was present on the rock surfaces, with the shore crab *Carcinus maenas* sheltering under the algae. The zone was narrow and very well defined.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Actinia equina	1	100	R - R	R
Amphipoda indet.	1	100	F - F	F
Carcinus maenas	1	100	F - F	F
Patella vulgata	1	100	O - O	O
Monodonta lineata	1	100	O - O	O
Littorina littorea	1	100	O - O	O
Littorina obtusata	1	100	R - R	R
Nucella lapillus	1	100	O - O	O
Ascophyllum nodosum	1	100	R - R	R
Fucus vesiculosus	1	100	A - A	A

COMMUNITY BB5	*Ascophyllum nodosum* zone
HABITAT	Stable mid eulittoral boulders and cobbles

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Mid eulittoral
Substratum:	Boulders and cobbles

Distribution

8(4)

Extent

Although recorded from one site only this biotope would most likely occur at areas throughout the bay where suitable substratum is present in the mid-eulittoral in sheltered conditions. Most likely to occur towards the head of bay and in enclosed inlets.

Description

This biotope is characterised by dense growths of egg wrack, *Ascophyllum nodosum*, on large boulders. The area covered by the wrack was fairly extensive over the shore. Attached to the algae was the epizooitic hydroid *Dynamena pumila* and encrusting spirorbid worms and bryozoans. *Mastocarpus stellata*, *Membranoptera alata*, and, to a lesser extent, *Lomentaria articulata* formed an understorey growth of algae. None however were particularly abundant. The boulders were covered by patches of the lichen *Verrucaria mucosa* with grazing gastropods *Patella vulgata*; *Littorina littorea* and *Gibbula umbilicalis* the most notable fauna present.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Dynamena pumila	1	100	O - O	O
Spirorbidae indet.	1	100	F - F	F
Carcinus maenas	1	100	R - R	R
Patella vulgata	1	100	O - O	O
Gibbula umbilicalis	1	100	F - F	F
Littorina littorea	1	100	O - O	O
Nucella lapillus	1	100	O - O	O
Bowerbankia sp.	1	100	O - O	O
Electra pilosa	1	100	R - R	R
Bryozoa crusts indet.	1	100	O - O	O
Mastocarpus stellatus	1	100	O - O	O
Lomentaria articulata	1	100	R - R	R
Membranoptera alata	1	100	O - O	O
Ascophyllum nodosum	1	100	A - A	A
Verrucaria mucosa	1	100	O - O	O

COMMUNITY BB6 *Fucus serratus* zone

HABITAT Lower eulittoral mixed substrata

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Lower eulittoral
Substratum:	Boulders, gravel, sand and mud

Distribution

8(5)

Extent

Likely to occur throughout the survey area where suitable substratum is present in the lower eulittoral, although only one example being recorded from the present survey.

Description

The zone was characterised by the fucoid algae *Fucus serratus* on the upward faces of the stable boulders. Towards the lower part of the zone kelp plants were present indicating the transition into the sublittoral fringe. Other algae present as an understorey were *Chondrus crispus* and *Lomentaria articulata*. Grazing on the algae were gastropods *Littorina littorea* and *Littorina mariae*, although these were present in lower numbers than higher up the shore. The upper surfaces of the boulders were dominated by the keelworm *Pomatoceros triqueter*.

The habitat surveyed had a particularly rich under boulder community dominated by sponges. *Leucosolenia* sp., *Leuconia nivea*, *Hymeniacidon perleve*, *Terpios fugax*, *Ophlitaspongia seriata* and *Aplysilla rosea* were the dominant species although they contributed little to the biomass of the total species present. Also present under the boulders were the bivalve *Chlamys varia* and the tunicates *Sidnyum turbinatum*, *Ascidia mentula* and *Botryllus schlosseri*.

The mixed sediment substrata of gravel, sand and mud between the boulders also added to the diversity of the biotope being colonised by the anemone *Anthopleura ballii*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Leucosolenia sp.	1	100	F - F	F
Leuconia nivea	1	100	O - O	O
Terpios fugax	1	100	O - O	O
Halichondria bowerbanki	1	100	R - R	R
Hymeniacidon perleve	1	100	O - O	O
Ophlitaspongia seriata	1	100	O - O	O
Aplysilla rosea	1	100	O - O	O
Halisarca dujardini	1	100	R - R	R
Anemonia viridis	1	100	O - O	O
Anthopleura ballii	1	100	R - R	R
Metridium senile	1	100	R - R	R

Harmothoe sp.	1	100	O - O	O
Pomatoceros triqueter	1	100	A - A	A
Spirorbidae indet.	1	100	F - F	F
Pisidia longicornis	1	100	O - O	O
Porcellana platycheles	1	100	O - O	O
Carcinus maenas	1	100	O - O	O
Acanthochitona crinitus	1	100	O - O	O
Diodora graeca	1	100	O - O	O
Littorina littorea	1	100	O - O	O
Littorina mariae	1	100	O - O	O
Ocenebra erinacea	1	100	R - R	R
Rostanga rubra	1	100	P - P	P
Jorunna tomentosa	1	100	O - O	O
Chlamys varia	1	100	R - R	R
Anomia ephippium	1	100	R - R	R
Membranipora membranacea	1	100	R - R	R
Bryozoa crusts indet.	1	100	F - F	F
Asterias rubens	1	100	O - O	O
Clavelina lepadiformis	1	100	R - R	R
Polyclinum aurantium	1	100	R - R	R
Sidnyum turbinatum	1	100	O - O	O
Ascidia mentula	1	100	O - O	O
Dendrodoa grossularia	1	100	R - R	R
Botryllus schlosseri	1	100	O - O	O
Chondrus crispus	1	100	F - F	F
Lomentaria articulata	1	100	O - O	O
Laminaria sp.	1	100	R - R	R
Fucus serratus	1	100	F - F	F

COMMUNITY BB7	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

21(1)

Extent

Likely to be widespread at the more exposed sites within the survey area and much of the open coastal sites around the south west of Ireland, although less extensive at the steeper less exposed shores.

Description

An extensive band of bedrock dominated by the barnacle *Chthamalus stellatus* and *Patella vulgata* which virtually monopolised the available rock surface within the zone. The empty cases of the barnacles provided shelter for the minute littorinid *Littorina neritoides*. Crevices within the rock surfaces and the less exposed areas supported the maritime lichen *Lichina confinis*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Chthamalus stellatus	1	100	A - A	A
Patella vulgata	1	100	A - A	A
Littorina neritoides	1	100	F - F	F
Lichina confinis	1	100	O - O	O

COMMUNITY BB8 Lower eulittoral exposed bedrock with *Fucus serratus*
HABITAT Exposed lower eulittoral bedrock

Classification

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

Distribution

21(2)

Extent

This community is likely to occur on the exposed coastlines of the survey area, where bedrock is present in the lower eulittoral and the profile of the shore line is not steep.

Description

The biotope is characterised by the algae *Fucus serratus* which was common as the main cover species. Also present and characterising are the high diversity of red algae forming dense growths between the fucoid plants. *Palmaria palmata*, *Lomentaria articulata*, *Membranoptera alata* and dense *Laurencia pinnatifida* in crevices were the most abundant red algae. *Enteromorpha* sp. was frequent on the rocky areas of water run-off and damp patches.

The rock surface was grazed by limpets *Patella vulgata* with *Littorina obtusata* on the algae.

Present in the habitat were rockpools and water filled depressions which supported a modified community from that on the open rock. The pools were lined with coralline encrusting algae with occasional *Corallina officinalis* plants. Stalked jellyfish, *Haliclystus* sp. were numerous on *Fucus serratus* fronds hanging into the pools. The sponges *Grantia compressa* and *Halisarca dujardini* occurred on the steep rock faces and under algae.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Scypha ciliata	1	100	O - O	O
Grantia compressa	1	100	O - O	O
Hymeniacidon perleve	1	100	R - R	R
Halisarca dujardini	1	100	R - R	R
Coryne muscoides	1	100	O - O	O
Dynamena pumila	1	100	F - F	F
Actinia equina	1	100	F - F	F
Urticina felina	1	100	R - R	R
Spirorbidae indet.	1	100	F - F	F
Idotea sp.	1	100	O - O	O
Cancer pagurus	1	100	R - R	R
Patella vulgata	1	100	F - F	F
Littorina obtusata	1	100	O - O	O
Flustrellidra hispida	1	100	O - O	O

Botrylloides leachi	1	100	O - O	O
Palmaria palmata	1	100	O - O	O
Corallinaceae indet.	1	100	O - O	O
Corallina officinalis	1	100	O - O	O
Mastocarpus stellatus	1	100	R - R	R
Gastroclonium ovatum	1	100	R - R	R
Lomentaria articulata	1	100	O - O	O
Membranoptera alata	1	100	O - O	O
Laurencia pinnatifida	1	100	F - F	F
Fucus serratus	1	100	C - C	C
Enteromorpha sp.	1	100	F - F	F

COMMUNITY BB9 Exposed bedrock with *Mytilus edulis*

HABITAT Sublittoral fringe bedrock

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Sublittoral fringe; 0 to 3.5 m BCD
Substratum:	Bedrock

Distribution

1(1)

Extent

Possibly widespread throughout the survey area at sites exposed to high wave action, particularly at steep or vertical sites. This would account for much of the coastline towards the entrance to the bay and along the open coast.

Description

A narrow band in the sublittoral fringe with very dense mussels *Mytilus edulis* covering much of the rock surface. The only kelp present was the typically exposed habitat species *Alaria esculenta* with red algae *Lomentaria clavellosa* and *Ceramium* sp. and the brown algae *Desmarestia ligulata* was the only other foliose species present. *Alaria*, although present, occurred at a very low abundance.

The rock not covered by mussels was heavily covered with encrusting coralline algae with the limpet *Patella ulyssiponensis* grazing the algae.

The mussels were covered with epizooitic hydroids. Most abundant was *Obelia geniculata* although *Plumularia setacea* was present.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Plumularia setacea	1	100	P - P	P
Obelia geniculata	1	100	C - C	C
Patella ulyssiponensis	1	100	P - P	P
Mytilus edulis	1	100	A - A	A
Asterias rubens	1	100	C - C	C
Corallinaceae indet.	1	100	A - A	A
Lomentaria clavellosa	1	100	O - O	O
Ceramium sp.	1	100	F - F	F
Desmarestia ligulata	1	100	F - F	F
Alaria esculenta	1	100	P - P	P

COMMUNITY BB10	Exposed coarse clean sand with talitrid amphipods
HABITAT	Exposed coarse sand

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed
Tidal streams:	Uncertain
Geology:	Not applicable
Zone/range:	Not applicable
Substratum:	Coarse sand

Distribution

22(1), 22(2)

Extent

Likely to be restricted to the open coast areas of the survey area and where exposure to wave action is high.

Description

A steeply sloping beach of coarse clean well sorted sand with few conspicuous species present. The only species notable were talitrid amphipods which were common on the upper shore. The habitat record from the lower shore was particularly barren.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Talitridae indet.	1	50	C - C	C

COMMUNITY BB11 Exposed sublittoral bedrock with mixed kelps

HABITAT Sublittoral fringe bedrock

Classification

Situation:	Open coast
Salinity:	Normal
Wave exposure:	Exposed
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Sublittoral fringe, 3.5 to 6.4 m BCD
Substratum:	Bedrock

Distribution

1(2)

Extent

Possibly widespread throughout the survey area at sites exposed to high wave action, particularly at steep or vertical bedrock in the sublittoral fringe. This would probably include much of the coastline towards the entrance to the bay and that on the open coast.

Description

The biotope occurred as a narrow band on bedrock in the sublittoral fringe. The characterising species were the mixed suite of kelp plants present. *Laminaria digitata* and *Alaria esculenta* were abundant with common *Saccorhiza polyschides*. *Desmarestia ligulata* and *Lomentaria clavellosa* were the dominant foliose algae growing on the rock faces.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Obelia geniculata	1	100	P - P	P
Corallina officinalis	1	100	P - P	P
Lomentaria clavellosa	1	100	F - F	F
Cryptopleura ramosa	1	100	P - P	P
Desmarestia ligulata	1	100	F - F	F
Laminaria digitata	1	100	A - A	A
Saccorhiza polyschides	1	100	C - C	C
Alaria esculenta	1	100	A - A	A

COMMUNITY BB12 Soft mud with burrows and *Virgularia mirabilis*

HABITAT Mud plain

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Extremely sheltered
Tidal streams:	Weak
Geology:	Not applicable
Zone/range:	Not applicable; 12 to 16 m BCD
Substratum:	Soft mud

Distribution

4(1)

Extent

This community is likely to be restricted within the survey area to the sheltered bays and inlets were tidal streams are not strong.

Description

The biotope is characteristic of fine soft mud. The sediment itself was well worked with large burrows and mounds possibly formed by the Dublin Bay prawn *Nephrops norvegicus*. The dominant species on the surface of the sediment was the sea pen *Virgularia mirabilis* which was occasional. The crab *Liocarcinus depurator* was frequent scavenging over the seabed.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Hydractinia echinata	1	100	O - O	O
Virgularia mirabilis	1	100	O - O	O
Cerianthus lloydii	1	100	O - O	O
Sagartiogeton undatus	1	100	O - O	O
Myxicola infundibulum	1	100	O - O	O
Nephrops norvegicus	1	100	C - C	C
Liocarcinus depurator	1	100	F - F	F
Carcinus maenas	1	100	R - R	R
Facelina bostoniensis	1	100	R - R	R
Pecten maximus	1	100	O - O	O
Lesueurigobius friesii	1	100	O - O	O

COMMUNITY BB13 *Amphiura chiajei* and *Amphiura filiformis* in soft mud

HABITAT Mud plain

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak
Geology:	Not applicable
Zone/range:	Not applicable, 7 to 19 m BCD
Substratum:	Soft mud

Distribution

9(1); 10(2)

Extent

This community is likely to be restricted within the survey area to the sheltered bays and inlets were tidal streams are not strong.

Description

The biotope is characteristic of fine, soft mud. The dominant species were the burrowing brittlestars *Amphiura chiajei* and *Amphiura filiformis* which were abundant throughout the habitat. The opistobranch *Philine aperta* was also abundant on the sediment surface at one of the sites. The burrowing polychaete *Myxicola infundibuliformis* was present within the sediment with populations of the sea pen *Virgularia mirabilis.*

On the surface of the sediment were hermit crabs *Pagurus bernhardus* and the starfish *Asterias rubens*.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Hydractinia echinata	1	50	R - R	R
Nemertesia antennina	1	50	R - R	R
Virgularia mirabilis	2	100	O - O	O
Cerianthus lloydii	1	50	F - F	F
Epizoanthus couchii	1	50	O - O	O
Metridium senile	1	50	R - R	R
Sagartiogeton undatus	1	50	R - R	R
Ophiodromus flexuosus	1	50	O - O	O
Chaetopterus variopedatus	1	50	O - O	O
Terebellidae indet	1	50	F - F	F
Lanice conchilega	1	50	R - R	R
Myxicola infundibulum	2	100	O - O	O
Protula sp.	1	50	O - O	O
Pagurus bernhardus	2	100	O - F	O
Liocarcinus depurator	1	50	F - F	F
Philine aperta	1	50	A - A	A
Pleurobranchus membranaceus	1	50	F - F	F
Aeolidiella glauca	1	50	R - R	R
Pecten maximus	1	50	O - O	O

Antedon bifida	1	50	O - O	O
Asterias rubens	2	100	O - F	O
Amphiura chiajei	2	100	A - A	A
Amphiura filiformis	2	100	A - A	A
Ascidia mentula	1	50	R - R	R
Phallusia mammillata	1	50	R - R	R
Callionymus reticulatus	1	50	R - R	R
Diatoms film	1	50	F - F	F

COMMUNITY BB14 Shallow sands with *Lutraria lutraria*

HABITAT Shallow sand

Classification

Situation:	Enclosed coast and narrows
Salinity:	Normal
Wave exposure:	Moderate to sheltered
Tidal streams:	Moderate to very weak
Geology:	Not applicable
Zone/range:	Not applicable; 7 to 20 m BCD
Substratum:	Sand with mud

Distribution

5(1), 14(2), 15(2), 16(2), 17(3)

Extent

Likely to occur widely throughout the survey area where wave exposure or tidal streams are reasonably high over sediment, though not so high or strong as to remove all the finer particulates. This biotope would probably be fairly extensive towards the entrance of the bay and around the narrows between the islands.

Description

The otter shell *Lutraria lutraria* and the razor shells *Ensis siliqua* and *Ensis* sp. were abundant; their siphons distinct in the sediment. Another bivalve, *Venerupis* sp., occurred in fairly dense abundances at a number of the sites. Other notable infaunal species were the anemone *Cerianthus lloydii* which was present at most of the sites surveyed and the parchment worm *Chaetopterus variopedatus*. The sediment surface had a rich and varied fauna, particularly the scallop *Pecten maximus* and hermit crabs *Pagurus bernhardus* and *Pagurus prideaux*.

This biotope was typical of an area locally regarded as a scallop fishing ground.

The painted goby *Pomatoschistus pictus* was present in large numbers at a few of the sites. *Chondria dasyphylla*, an algae which grows on stones in sand and mud, was present at two of the shallow examples of the biotope.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 5)	%	Range	Median
Nemertesia antennina	2	40	P - O	P
Cerianthus lloydii	4	80	C - C	C
Urticina felina	2	40	O - F	O
Chaetopterus variopedatus	3	60	P - F	O
Lanice conchilega	2	40	O - O	O
Megalomma vesiculosum	2	40	R - F	R
Myxicola infundibulum	2	40	O - F	O
Amphipoda indet.	3	60	F - C	C
Pagurus bernhardus	2	40	O - F	O
Pagurus prideaux	2	40	O - O	O
Gibbula magus	4	80	O - C	F
Turritella communis	2	40	O - O	O

Pecten maximus	4	80	F - C	F
Lutraria lutraria	5	100	O - C	C
Ensis sp.	3	60	F - C	C
Ensis arcuatus	2	40	F - F	F
Venerupis sp.	3	60	F - C	C
Luidia ciliaris	2	40	O - F	O
Asterias rubens	2	40	O - O	O
Ophiura albida	2	40	P - O	P
Pomatoschistus pictus	2	40	C - C	C
Chondria dasyphylla	2	40	O - O	O

COMMUNITY BB15 Maerl bed with algae

HABITAT Maerl and mud

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Very sheltered
Tidal streams:	Weak
Geology:	Not applicable
Zone/range:	Lower infralittoral
Substratum:	Live maerl and mud

Distribution

3(2), 9(3)

Extent

Likely to be restricted within the survey area to the eastern side of Berehaven.

Description

A dense band of live maerl *Lithothamnion corallioides* on soft mud. The maerl provided a suitable substratum for a diverse flora of red and brown algae, and shelter for a rich mobile fauna.

The most abundant alga was the brown *Dictyota dichotoma* with *Halarachnion ligulatum* and *Calliblepharis ciliata* also occurring in high abundance.

Within the matrix of the maerl the corrugated swimming crab *Liocarcinus corrugatus* and the spider crabs *Macropodia rostrata* and *Inachus phalangium* were frequent. The sea hare *Aplysia punctata* grazed the algae.

The mud beneath the maerl was inhabited by the anemones *Anthopleura ballii* and *Cerianthus lloydii* with the snakelocks anemone *Anemonia viridis* growing on the maerl and larger algae.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Haliclona fistulosa	1	50	F - F	F
Cerianthus lloydii	2	100	F - F	F
Anemonia viridis	1	50	F - F	F
Anthopleura ballii	2	100	R - F	R
Terebellidae indet.	1	50	R - R	R
Inachus phalangium	1	50	F - F	F
Macropodia rostrata	1	50	F - F	F
Liocarcinus corrugatus	1	50	F - F	F
Liocarcinus depurator	1	50	O - O	O
Gibbula magus	1	50	O - O	O
Calliostoma zizyphinum	1	50	P - P	P
Aporrhais pespelecani	1	50	R - R	R
Porcellana platycheles	1	50	O - O	O
Aplysia punctata	1	50	F - F	F
Archidoris pseudoargus	1	50	O - O	O

Favorinus branchialis	1	50	R - R	R
Pecten maximus	1	50	R - R	R
Asterina gibbosa	1	50	R - R	R
Henricia oculata	1	50	P - P	P
Asterias rubens	1	50	O - O	O
Lithothamnion corallioides	2	100	F - A	C
Stenogramme interrupta	1	50	O - O	O
Polyides rotundus	1	50	P - P	P
Halarachnion ligulatum	1	50	F - F	F
Calliblepharis ciliata	2	100	P - F	P
Dictyota dichotoma	1	50	C - C	C
Chorda filum	1	50	O - O	O

COMMUNITY BB16 Infralittoral bedrock and stable boulders with *Laminaria hyperborea* forest.

HABITAT Upper infralittoral bedrock

Classification

Situation:	Open and enclosed coast
Salinity:	Normal
Wave exposure:	Moderately exposed to very exposed
Tidal streams:	Very weak to moderate
Geology:	Hard
Zone/range:	Upper infralittoral; 5 to 19 m BCD
Substratum:	Bedrock and boulders

Distribution

1(3), 2(1), 12(1), 19(1), 20(1)

Extent

Likely to be extensive throughout the survey area apart from the extremely sheltered bays and inlets and where substrata is unsuitable.

Description

Moderately exposed to very exposed bedrock and stable boulders in the infralittoral supported a dense kelp forest of *Laminaria hyperborea*. The forest extended from 5 m BCD to its deepest limit at more exposed sites of 25 m BCD.

A rich understorey of red algae was present with several species epiphytic on the lower kelp stipes.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 3)	%	Range	Median
Scypha ciliata	2	67	O - F	O
Tubularia indivisa	2	67	O - F	O
Aglaophenia pluma	3	100	O - O	O
Obelia geniculata	2	67	F - C	F
Alcyonium digitatum	3	100	O - C	O
Metridium senile	2	67	O - F	O
Sagartia elegans	2	67	O - F	O
Corynactis viridis	3	100	O - C	F
Caryophyllia smithii	2	67	F - F	F
Calliostoma zizyphinum	3	100	O - F	F
Parasmittina trispinosa	2	67	P - O	P
Electra pilosa	2	67	F - C	F
Pycnoclavella aurilucens	2	67	F - F	F
Polyclinum aurantium	3	100	F - F	F
Sidnyum turbinatum	2	67	O - O	O
Aplidium nordmanni	2	67	F - F	F
Aplidium punctum	3	100	O - F	O
Botryllus schlosseri	3	100	F - F	F

Labrus bergylta	3	100	O - O	O
Bonnemaisonia asparagoides	2	67	O - F	O
Dilsea carnosa	3	100	O - F	O
Callophyllis laciniata	2	67	O - O	O
Kallymenia reniformis	2	67	O - F	O
Corallina officinalis	2	67	O - F	O
Griffithsia flosculosa	2	67	O - O	O
Cryptopleura ramosa	3	100	C - A	C
Delesseria sanguinea	3	100	F - F	F
Nitophyllum punctatum	3	100	O - O	O
Phycodrys rubens	3	100	F - C	F
Polyneura laciniata	3	100	O - F	O
Brongniartella byssoides	3	100	O - F	O
Dictyota dichotoma	3	100	F - F	F
Laminaria hyperborea	3	100	C - C	C

COMMUNITY BB17 Infralittoral rock with sparse *Laminaria hyperborea*

HABITAT Infralittoral rock

Classification

Situation:	Open coast and narrows
Salinity:	Normal
Wave exposure:	Moderately to very exposed
Tidal streams:	Very weak to moderate
Geology:	Hard
Zone/range:	Infralittoral; 7 to 22 m BCD
Substratum:	Bedrock

Distribution

1(4), 6(1), 12(2) 16(1), 17(1), 18(1), 19(2)

Extent

Likely to occur throughout the survey area where bedrock and boulders extended into the lower infralittoral.

Description

Bedrock and stable boulders in the lower infralittoral where characterised by growths of sparse kelp *Laminaria hyperborea* forming a park.

The understorey of algae was well developed at some sites although the grazing sea urchin *Echinus esculentus* occurred at all the sites. Algae present formed a dense growth usually dominated by one species. *Delesseria sanguinea* was the most abundant although the brown algae *Dictyota dichotoma* occurred at many of the sites.

On the more exposed rock faces the anemones *Caryophyllia smithii* and *Corynactis viridis* were found. The yellow boring sponge *Cliona celata* grew in its massive form on many of the open rock faces. Dead man's fingers, *Alcyonium digitatum* was present at the more exposed sites and on steep and overhanging faces within the habitat. The hydroid fauna was represented by *Halecium halecinum* and *Abietinaria abietina* which colonised the more exposed and current swept ridges within the community.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 7)	%	Range	Median
Cliona celata	7	100	O - F	F
Halecium halecinum	3	43	O - F	O
Abietinaria abietina	4	57	O - F	O
Alcyonium digitatum	6	86	R - C	O
Urticina felina	3	43	O - C	C
Metridium senile	4	57	O - F	O
Sagartia elegans	4	57	O - O	O
Actinothoe sphyrodeta	5	71	O - F	O
Corynactis viridis	7	100	O - A	C
Caryophyllia smithii	7	100	O - C	O
Liocarcinus puber	3	43	O - F	O
Calliostoma zizyphinum	3	43	O - F	O
Parasmittina trispinosa	3	43	O - F	F

Electra pilosa	4	57	P - F	O
Antedon bifida	4	57	O - A	F
Luidia ciliaris	3	43	O - O	O
Asterias rubens	4	57	O - O	O
Marthasterias glacialis	4	57	O - O	O
Echinus esculentus	7	100	O - F	O
Aslia lefevrei	3	43	O - O	O
Clavelina lepadiformis	5	71	R - F	O
Ascidia mentula	3	43	R - O	O
Botryllus schlosseri	4	57	P - O	R
Ctenolabrus rupestris	3	43	P - O	O
Labrus bergylta	3	43	O - F	F
Callophyllis laciniata	3	43	O - F	F
Corallinaceae indet.	3	43	P - P	P
Plocamium cartilagineum	5	71	P - F	O
Rhodymenia pseudopalmata	3	43	O - F	F
Cryptopleura ramosa	3	43	O - F	O
Delesseria sanguinea	6	86	F - C	C
Hypoglossum hypoglossoides	3	43	O - F	F
Phycodrys rubens	3	43	O - F	F
Brongniartella byssoides	4	57	O - F	O
Dictyota dichotoma	6	86	O - C	F
Laminaria hyperborea	7	100	R - C	F

COMMUNITY BB18 Bedrock with *Alcyonium digitatum* and hydroids

HABITAT Bedrock and stable boulders

Classification

Situation:	Open coast, narrows and enclosed coast
Salinity:	Normal
Wave exposure:	Moderate to very exposed
Tidal streams:	Weak to moderately strong
Geology:	Hard
Zone/range:	Lower infralittoral - upper circalittoral; 16 to 36 m BCD
Substratum:	Bedrock and boulders

Distribution

1(5), 1(6), 2(2), 18(2), 19(3), 20(2), 20(3)

Extent

Likely to occur in the more exposed and/or tide swept locations within the survey area where suitable substrata occurs in the circalittoral.

Description

Bedrock and boulders in the lower infralittoral/upper circalittoral dominated by the anthozoan *Alcyonium digitatum* which occurred at all the biotope examples. A rich and diverse hydroid fauna was characteristic of sites with high water movement. The most abundant hydroids were *Aglaophenia tubulifera*, which formed clumps on the rock ridges, and *Kirchenpaueria pinnata* which was occasional to frequent on the rock. *Nemertesia antennina* and *Nemertesia ramosa* were conspicuous at most of the sites particularly the more exposed locations.

The sponge fauna was represented by massive *Cliona celata* with *Suberites carnosus* and *Pachymatisma johnstonia* occurring at half the sites. *S. carnosus* was abundant at the deeper more exposed examples of the biotope.

The tentacles of the sea cucumber *Aslia lefevrei* were present protruding from crevices and fissures in rock faces and boulders in the habitat.

The shallower examples of the biotope had an algal element which was lost at the deeper location where light was limiting. Typically the algae were quite dense, with *Delesseria sanguinea* and *Dictyota dichotoma* characterising the flora.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 7)	%	Range	Median
Leucosolenia botryoides	4	57	O - O	O
Scypha ciliata	4	57	P - C	O
Pachymatisma johnstonia	4	57	R - O	O
Suberites carnosus	3	43	P - C	O
Cliona celata	7	100	O - C	F
Haliclona viscosa	3	43	P - O	O
Halecium halecinum	3	43	P - F	O
Aglaophenia tubulifera	5	71	P - F	F
Halopteris catharina	3	43	O - F	F
Kirchenpaueria pinnata	5	71	O - F	F
Nemertesia antennina	6	86	P - F	O

Nemertesia ramosa	4	57	O - C	O
Abietinaria abietina	5	71	O - F	F
Alcyonium digitatum	7	100	O - A	C
Urticina felina	5	71	O - C	F
Metridium senile	3	43	F - C	C
Sagartia elegans	6	86	O - F	O
Actinothoe sphyrodeta	3	43	O - O	O
Corynactis viridis	6	86	O - A	O
Caryophyllia smithii	7	100	F - A	C
Cancer pagurus	3	43	R - O	O
Liocarcinus puber	4	57	O - O	O
Calliostoma zizyphinum	4	57	O - O	O
Trivia arctica	3	43	O - O	O
Alcyonidium diaphanum	6	86	P - F	O
Parasmittina trispinosa	6	86	O - F	F
Antedon bifida	3	43	P - O	O
Luidia ciliaris	3	43	O - F	O
Henricia oculata	5	71	O - O	O
Asterias rubens	4	57	O - O	O
Marthasterias glacialis	3	43	O - O	O
Echinus esculentus	7	100	P - F	O
Aslia lefevrei	5	71	P - F	O
Clavelina lepadiformis	6	86	P - F	O
Ascidia mentula	4	57	O - O	O
Pollachius pollachius	3	43	O - F	O
Ctenolabrus rupestris	4	57	O - O	O
Labrus bergylta	5	71	O - F	F
Corallinaceae indet.	3	43	P - O	O
Schottera nicaeensis	3	43	O - F	F
Delesseria sanguinea	4	57	F - C	C
Dictyota dichotoma	4	57	O - F	O

COMMUNITY BB19	Sheltered lower infralittoral to upper circalittoral bedrock with *Phallusia mammillata* and red algae
HABITAT	Bedrock

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Ultra sheltered to sheltered
Tidal streams:	Very weak to weak
Geology:	Hard
Zone/range:	Lower infralittoral to upper circalittoral; 7 to 17 m BCD
Substratum:	Bedrock

Distribution

3(1), 4(1), 5(2), 9(2), 10(1), 11(1), 15(1)

Extent

This biotope occurred widely throughout the survey area in the more sheltered locations; within Berehaven and the inlets and bays towards the head of the bay. Although a similar biotope is likely to occur at similar physiographic locations around the coast of Ireland the ascidian *Phallusia mammillata* has not yet been recorded in Ireland outside of Bantry Bay.

Description

Bedrock sheltered from wave exposure and strong tidal streams was characterised by dense red algae and the ascidian *Phallusia mammillata*. Much of the upward facing bedrock was quite heavily silted. *Phallusia* was recorded at greatest abundance from sites least exposed to wave action; at several sites it was very dense on the upward facing rock.

Delesseria sanguinea was the most abundant alga although growths of *Callophyllis laciniata*, *Rhodophyllis divaricata* and *Brongniartella byssoides* were dense at one site. Echinoderms were represented by the common starfish *Asterias rubens* and the spiny starfish *Marthasterias glacialis* with the sea urchin *Echinus esculentus* grazing on algae at some sites.

The sponge fauna was diverse at some locations. *Suberites carnosus* occurred at all the sites surveyed. *Cliona celata*, and the erect sponges *Stelligera rigida*, *Raspailia ramosa* and *Esperiopsis fucorum* were present at high abundances at some of the biotope locations.

Anthozoans were also diverse. The Devonshire cup coral *Caryophyllia smithii* occurred at all the sites on the less silted rock faces. Where silt was present the minute anemones *Isozoanthus sulcatus* were abundant in patches. The hydroids *Halecium halecinum*, *Nemertesia antennina* and *Nemertesia ramosa* grew on the bedrock where distinct ridges were formed. At some of the sites the feather star *Antedon bifida* was common on the ridges.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 7)	%	Range	Median
Suberites carnosus	7	100	O - C	F
Polymastia mamillaris	3	43	O - F	F
Cliona celata	5	71	O - F	F
Stelligera rigida	4	57	R - F	O
Raspailia ramosa	4	57	O - F	O
Esperiopsis fucorum	3	43	O - C	F

Halecium halecinum	6	86	O - C	O
Kirchenpaueria pinnata	4	57	O - F	O
Nemertesia antennina	4	57	F - F	F
Nemertesia ramosa	4	57	O - F	O
Plumularia setacea	3	43	P - F	O
Sertularella polyzonias	4	57	P - F	O
Alcyonium digitatum	3	43	R - O	R
Epizoanthus couchii	4	57	P - F	O
Isozoanthus sulcatus	3	43	P - F	O
Anemonia viridis	4	57	P - F	O
Urticina felina	4	57	O - C	O
Anthopleura ballii	3	43	P - O	O
Metridium senile	3	43	P - R	R
Caryophyllia smithii	7	100	R - C	O
Balanus crenatus	3	43	P - O	P
Liocarcinus puber	6	86	O - F	O
Antedon bifida	4	57	O - C	C
Luidia ciliaris	3	43	O - F	F
Asterias rubens	6	86	O - F	O
Marthasterias glacialis	6	86	R - F	O
Echinus esculentus	5	71	P - O	O
Holothuria forskali	3	43	R - O	R
Clavelina lepadiformis	3	43	O - F	O
Morchellium argus	3	43	O - F	O
Ascidia mentula	4	57	O - C	F
Phallusia mammillata	7	100	P - A	F
Labrus bergylta	3	43	P - O	O
Callophyllis laciniata	3	43	O - F	F
Calliblepharis ciliata	4	57	O - O	O
Rhodophyllis divaricata	3	43	O - F	O
Delesseria sanguinea	5	71	P - C	C
Hypoglossum hypoglossoides	3	43	P - O	P
Brongniartella byssoides	3	43	F - F	F
Dictyota dichotoma	4	57	O - F	O

COMMUNITY BB20 Sheltered bedrock with kelp park

HABITAT Infralittoral bedrock

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Sheltered
Tidal streams:	Weak
Geology:	Hard
Zone/range:	Infralittoral; 7 to 13 m BCD
Substratum:	Bedrock

Distribution

13(1), 14(1)

Extent

Likely to be widespread throughout the survey area.

Description

Sheltered bedrock in the infralittoral characterised by a sparse kelp park of *Laminaria saccharina* and *Laminaria hyperborea*. The bedrock was heavily silted. Sponges were present, in particular *Scypha ciliata*, *Suberites carnosus* and *Cliona celata* which occurred at both the sites. Hydroids were present on the less silted ridges particularly *Halecium halecinum* and *Nemertesia antennina*.

Anthozoans occurred over much of the rock. *Alcyonium digitatum* and *Metridium senile* on the less silty areas with *Urticina felina* and *Cereus pedunculatus* on the rock where silt had accumulated.

The ascidians *Ascidia mentula* and *Phallusia mammilata* where frequently present and appeared to be typical of the sheltered bedrock areas of Bantry Bay.

The flora was dominated by the red algae *Delesseria sanguinea* and *Nitophyllum punctatum*. The brown alga, thongweed, (*Chorda filum)* was also notable.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 2)	%	Range	Median
Scypha ciliata	2	100	O - O	O
Suberites carnosus	2	100	O - F	O
Cliona celata	2	100	O - O	O
Raspailia hispida	1	50	R - R	R
Halichondria panicea	1	50	R - R	R
Esperiopsis fucorum	1	50	R - R	R
Haliclona viscosa	1	50	R - R	R
Halecium halecinum	2	100	O - F	O
Kirchenpaueria pinnata	1	50	F - F	F
Nemertesia antennina	2	100	O - F	O
Nemertesia ramosa	1	50	O - O	O
Plumularia setacea	1	50	F - F	F
Sertularella polyzonias	1	50	F - F	F
Obelia sp.	1	50	F - F	F

Obelia longissima	1	50	O - O	O
Rhizocaulus verticillatus	1	50	O - O	O
Alcyonium digitatum	2	100	R - O	R
Cerianthus lloydii	1	50	P - P	P
Epizoanthus couchii	1	50	O - O	O
Isozoanthus sulcatus	1	50	F - F	F
Anemonia viridis	2	100	R - O	R
Urticina felina	2	100	O - F	O
Metridium senile	2	100	R - F	R
Sagartia elegans	1	50	F - F	F
Cereus pedunculatus	2	100	O - C	O
Sagartiogeton laceratus	1	50	R - R	R
Caryophyllia smithii	2	100	R - R	R
Prostheceraeus vittatus	1	50	P - P	P
Homarus gammarus	1	50	R - R	R
Macropodia rostrata	1	50	F - F	F
Liocarcinus puber	2	100	O - O	O
Gibbula magus	1	50	F - F	F
Trivia arctica	1	50	R - R	R
Trivia monacha	1	50	R - R	R
Aplysia punctata	1	50	O - O	O
Doto pinnatifida	1	50	F - F	F
Crimora papillata	1	50	R - R	R
Polycera faeroensis	1	50	O - O	O
Eubranchus farrani	1	50	O - O	O
Eubranchus pallidus	1	50	O - O	O
Eubranchus vittatus	1	50	O - O	O
Pecten maximus	1	50	O - O	O
Bugula flabellata	1	50	O - O	O
Antedon bifida	1	50	A - A	A
Asterias rubens	1	50	O - O	O
Ophiothrix fragilis	1	50	R - R	R
Ophiura albida	2	100	P - O	P
Morchellium argus	2	100	P - R	P
Aplidium nordmanni	1	50	R - R	R
Ascidia mentula	2	100	O - O	O
Phallusia mammillata	2	100	O - O	O
Bonnemaisonia asparagoides	1	50	O - O	O
Callophyllis laciniata	1	50	F - F	F
Corallinaceae indet.	1	50	O - O	O
Corallina officinalis	1	50	O - O	O
Calliblepharis ciliata	1	50	O - O	O
Rhodophyllis divaricata	1	50	O - O	O
Chylocladia verticillata	1	50	F - F	F
Lomentaria articulata	1	50	R - R	R
Delesseria sanguinea	2	100	F - F	F
Nitophyllum punctatum	2	100	R - F	R
Brongniartella byssoides	1	50	F - F	F
Chondria dasyphylla	1	50	F - F	F
Spermatochnus paradoxus	1	50	F - F	F
Dictyota dichotoma	1	50	F - F	F
Sporochnus pedunculatus	1	50	F - F	F

COMMUNITY BB21 Anaerobic mud with *Ulva* sp.? (UNCERTAIN STATUS)

HABITAT Anaerobic mud with dead shell

Classification

Situation:	Enclosed coast
Salinity:	Normal
Wave exposure:	Ultra sheltered
Tidal streams:	Very weak
Geology:	Hard
Zone/range:	Not applicable; 8 m BCD
Substratum:	Mud and shell debris

Distribution

11(2)

Extent

Likely to be very limited within the survey area where relatively shallow water occurs in areas of extreme shelter.

Description

Ultra sheltered mud with many dead oyster, *Ostrea edulis*, and scallop, *Pecten maximus*, shells; some live animals were present. The horizontal plane of soft mud was anaerobic. The surface of the sediment had patches of *Ulva* sp. with the bubble alga *Colpomenia peregrina* present. The starfish *Asterias rubens* was frequent on the surface of the sediment.

The site was adjacent to a small harbour and the large amount of dead shell material may have resulted from fishing boats discarding cultch into the water.

Species composition

Species name	Frequency of occurrence		Abundance	
	No. of records (Total 1)	%	Range	Median
Macropodia rostrata	1	100	O - O	O
Pecten maximus	1	100	R - R	R
Asterias rubens	1	100	F - F	F
Scyliorhinus canicula	1	100	R - R	R
Colpomenia peregrina	1	100	P - P	P
Ulva lactuca	1	100	F - F	F

Appendix 3: List of taxa recorded during the present survey

The sites at which each species was recorded are given. The 335 taxa are listed according to Howson (1987) except for *Esperiopsis fucorum* (previously *Amphilectus fucorum*).

Porifera	
Clathrina coriacea	2; 19
Clathrina lacunosa	20
Leucosolenia sp.	8
Leucosolenia botryoides	1; 17; 18; 19; 20; 23
Scypha ciliata	1; 2; 9; 12; 13; 14; 15; 16; 17; 19; 20; 21
Leuconia nivea	8; 20
Grantia compressa	21
Pachymatisma johnstonia	1; 2; 20
Tethya aurantium	4; 15; 18
Suberites carnosus	1; 2; 3; 4; 5; 9; 10; 11; 13; 14; 15; 16; 17; 19; 20; 23
Suberites domuncula	11; 12
Terpios fugax	8
Polymastia boletiformis	2; 4; 19; 20; 23
Polymastia mamillaris	2; 4; 11; 15; 19
Cliona celata	1; 2; 3; 4; 5; 6; 7, 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 23
Axinella infundibuliformis	19; 20
Stelligera rigida	2; 3; 4; 11; 15; 17; 20
Stelligera stuposa	1; 20; 23
Raspailia hispida	13; 15
Raspailia ramosa	4; 9; 11; 15; 23
Halichondria bowerbanki	8
Halichondria panicea	11; 14; 20
Ciocalypta penicillus	2
Hymeniacidon perleve	8; 11; 19; 21
Esperiopsis fucorum	4; 5; 11; 13; 17; 23
Myxilla incrustans	20
Iophonopsis nigricans	1
Phorbas fictitius	20
Hemimycale columella	17; 20
Ophlitaspongia seriata	8
Microciona spinarcus	1
Haliclona fistulosa	9; 11
Haliclona oculata	5
Haliclona urceolus	19; 20
Haliclona viscosa	1; 13; 19
Dysidea fragilis	10; 11; 20
Aplysilla rosea	8
Halisarca dujardini	8; 17; 21
Cnidaria	
Tubularia indivisa	19; 20
Tubularia larynx	18
Coryne muscoides	21
Bougainvillia ramosa	9; 18
Hydractinia echinata	4; 9

Halecium beanii	3; 6; 17; 18; 23
Halecium halecinum	1; 2; 4; 5; 7, 9; 10; 11; 13; 14; 15; 16; 17; 18; 20; 23
Aglaophenia kirchenpaueri	15; 17; 18
Aglaophenia pluma	1; 15; 17; 19; 20
Aglaophenia tubulifera	1; 2; 17; 18; 19; 20
Gymnangium montagui	1; 20
Thecocarpus myriophyllum	20
Antennella secundaria	9
Halopteris catharina	18; 19; 20
Kirchenpaueria pinnata	1; 2; 4; 5; 9; 11; 13; 17; 18; 19; 23
Kirchenpaueria similis	5
Nemertesia antennina	1; 2; 4; 5; 7, 9; 13; 14; 15; 16; 17; 18; 20; 23
Nemertesia ramosa	1; 2; 3; 4; 9; 13; 15; 17; 18; 20; 23
Plumularia setacea	1; 4; 6; 9; 13; 15; 17
Schizotricha frutescens	9; 17; 23
Abietinaria abietina	1; 2; 15; 16; 17; 18; 19; 23
Amphisbetia operculata	19; 20
Dynamena pumila	8; 21
Sertularella gayi	17; 23
Sertularella polyzonias	5; 9; 11; 13; 15; 16; 17; 18; 20; 23
Sertularia argentea	15
Sertularia cupressina	16
Clytia hemisphaerica	15
Obelia sp.	2; 13; 15
Obelia dichotoma	4; 5; 18
Obelia geniculata	1; 16; 20
Obelia longissima	13
Rhizocaulus verticillatus	13
Alcyonium digitatum	1; 2; 4; 6; 7; 10; 12; 13; 14; 15; 16; 17; 18; 19; 20
Alcyonium glomeratum	4; 19; 20; 23
Virgularia mirabilis	4; 9; 10
Cerianthus lloydii	3; 4; 5; 9; 13; 14; 15; 16; 23
Pachycerianthus multiplicatus	23
Epizoanthus couchii	4; 9; 11; 13; 15
Isozoanthus sulcatus	2; 3; 11; 14; 15; 23
Actinia equina	8; 21
Anemonia viridis	2; 5; 6; 8; 9; 10; 11; 13; 14; 15; 16; 18; 23
Urticina felina	1; 2; 4; 5; 6; 7; 10; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21
Urticina eques	1
Anthopleura ballii	3; 4; 5; 8; 9; 11; 14
Metridium senile	1; 3; 8; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20
Sagartia elegans	1; 2; 5; 12; 13; 15; 16; 17; 18; 19; 20
Cereus pedunculatus	11; 13; 14; 15; 16
Actinothoe sphyrodeta	1; 2; 16; 17; 18; 19; 20
Sagartiogeton laceratus	13
Sagartiogeton undatus	4; 9
Hormathia coronata	17
Adamsia carciniopados	14; 23
Corynactis viridis	1; 2; 5; 6; 7; 12; 16; 17; 18; 19; 20; 23
Caryophyllia smithii	1; 2; 3; 4; 5; 6; 7; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 23

Platyhelminthes

Prostheceraeus vittatus	5; 11; 14; 16

Annelida

Harmothoe sp.	8
Ophiodromus flexuosus	10
Chaetopterus variopedatus	1; 2; 6; 9; 12; 14; 15; 17
Arenicola marina	14
Owenia fusiformis	5
Terebellidae indet.	6; 9; 10
Lanice conchilega	2; 10; 15; 17
Bispira volutacornis	15
Megalomma vesiculosum	15; 16
Myxicola infundibulum	4; 5; 9; 10; 14
Pomatoceros triqueter	2; 3; 7; 8; 12; 16; 20
Protula tubularia	9
Spirorbidae indet.	8; 21

Crustacea (lower)

Chthamalus stellatus	21
Balanus balanus	2; 6
Balanus crenatus	2; 3; 5; 12; 15; 17

Crustacea (higher)

Amphipoda indet.	6; 8; 14; 15; 16; 17; 19
Talitridae indet.	22
Caprellidae indet.	6; 17
Idotea sp.	21
Palaemon serratus	5; 10
Pandalus montagui	19
Homarus gammarus	10; 13; 20
Upogebia deltaura	5
Palinurus elephas	19
Pagurus bernhardus	5; 9; 10; 14
Pagurus prideaux	14; 15; 23
Pisidia longicornis	8
Porcellana platycheles	8; 9
Inachus phalangium	4; 9; 11
Macropodia rostrata	9; 11; 13
Cancer pagurus	1; 2; 5; 9; 12; 17; 18; 20; 21
Liocarcinus corrugatus	9
Liocarcinus depurator	3; 4; 5; 9
Liocarcinus puber	1; 2; 3; 5; 6; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 20; 23
Carcinus maenas	4; 8; 15

Mollusca

Acanthochitona crinitus	8
Diodora graeca	8
Tectura virginea	15
Patella ulyssiponensis	1
Patella vulgata	8; 21

Monodonta lineata	8
Gibbula magus	3; 5; 6; 14; 15; 16
Gibbula cineraria	1; 2; 5; 15; 16
Gibbula umbilicalis	8
Calliostoma zizyphinum	1; 2; 3; 6; 12; 16; 17; 18; 19; 20
Littorina littorea	8
Littorina neritoides	21
Littorina mariae	8
Littorina obtusata	8; 21
Turritella communis	14; 15
Bittium reticulatum	6
Chrysallida indistincta	1
Aporrhais pespelecani	3
Simnia patula	12; 17; 18; 20
Trivia arctica	2; 5; 9; 13; 16; 20
Trivia monacha	14
Lamellaria latens	9
Nucella lapillus	8
Ocenebra erinacea	8
Hinia incrassata	6
Philine aperta	10
Akera bullata	23
Aplysia punctata	5; 9; 13; 17; 23
Pleurobranchus membranaceus	9
Tritonia plebeia	20
Lomanotus marmoratus	9
Doto sp.	5; 16
Doto fragilis	2; 15; 16
Doto hystrix	17
Doto lemchei	18; 20
Doto millbayana	15
Doto pinnatifida	9; 13; 15
Doto tuberculata	17; 23
Acanthodoris pilosa	20
Onchidoris bilamellata	2
Diaphorodoris luteocincta	6
Crimora papillata	14
Limacia clavigera	2; 15; 20
Polycera faeroensis	1; 12; 13; 15; 17; 20
Polycera quadrilineata	1
Rostanga rubra	8
Archidoris pseudoargus	4; 9; 14
Jorunna tomentosa	8; 11
Janolus cristatus	17
Flabellina pedata	17
Cuthona amoena	9
Cuthona caerulea	9
Cuthona viridis	1
Tergipes tergipes	1
Eubranchus exiguus	1
Eubranchus farrani	13; 20
Eubranchus pallidus	3; 9; 13

Eubranchus tricolor	16
Eubranchus vittatus	11; 13
Facelina sp.	20
Facelina bostoniensis	4
Favorinus branchialis	9
Aeolidiella glauca	9
Mytilus edulis	1
Chlamys varia	8
Pecten maximus	3; 4; 5; 9; 11; 13; 14; 15; 16; 23
Anomia ephippium	8
Lutraria lutraria	5; 14; 15; 16; 17
Ensis sp.	14; 15; 16
Ensis arcuatus	5; 17
Dosinia exoleta	17
Venerupis sp.	14; 15; 16

Bryozoa

Alcyonidium diaphanum	1; 2; 6; 17; 18; 20
Alcyonidium hirsutum	17
Flustrellidra hispida	21
Bowerbankia sp.	8
Pentapora foliacea	20
Parasmittina trispinosa	1; 2; 15; 17; 19; 20
Porella compressa	19
Cellepora pumicosa	12
Membranipora membranacea	1; 8; 12; 18
Electra pilosa	1; 6; 8; 12; 18; 20
Cellaria sp.	17
Scrupocellaria sp.	19
Bugula flabellata	14; 15; 17; 20
Bryozoa indet crusts	2; 8

Echinodermata

Antedon bifida	1; 3; 5; 6; 7; 10; 12; 13; 15; 16; 17; 20
Astropecten irregularis	5
Luidia ciliaris	2; 3; 5; 6; 7; 12; 15; 16; 17; 18; 20; 23
Asterina gibbosa	9
Henricia oculata	1; 2; 3; 4; 5; 12; 17; 18; 20; 23
Asterias rubens	1; 2; 3; 4; 5; 7; 8; 9; 10; 11; 12; 13; 15; 16; 17; 18; 20; 23
Leptasterias muelleri	2; 12; 15
Marthasterias glacialis	1; 2; 3; 4; 5; 9; 10; 12; 14; 15; 16; 17; 18; 20; 23
Ophiothrix fragilis	14
Amphiura chiajei	9; 10
Amphiura filiformis	9; 10
Amphipholis squamata	5
Ophiura albida	5; 13; 14; 15
Ophiura ophiura	9
Echinus esculentus	1; 2; 3; 5; 6; 7; 10; 11; 12; 15; 16; 17; 18; 19; 20; 23
Echinocyamus pusillus	17
Echinocardium flavescens	17
Holothurioidea indet.	2

Holothuria forskali	3; 7; 10; 12; 15; 18; 23
Pawsonia saxicola	6; 9; 10; 20
Aslia lefevrei	1; 5; 6; 15; 17; 18; 19; 20

Tunicata

Clavelina lepadiformis	1; 2; 5; 6; 8; 10; 12; 15; 16; 17; 18; 20; 23
Pycnoclavella aurilucens	1; 2; 12; 19; 20
Distaplia rosea	11
Polyclinum aurantium	1; 8; 19; 20
Morchellium argus	4; 11; 13; 14; 15; 20
Sidnyum turbinatum	8; 19; 20
Aplidium glabrum	20
Aplidium nordmanni	1; 13; 19; 20
Aplidium punctum	1; 2; 12; 19; 20
Didemnum maculosum	11
Diplosoma spongiforme	12; 19; 23
Lissoclinum perforatum	20
Ciona intestinalis	6
Corella parallelogramma	2; 5; 9; 12; 17
Ascidiella aspersa	4; 5; 12
Ascidia mentula	1; 2; 4; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19
Phallusia mammillata	2; 3; 4; 5; 9; 10; 11; 13; 14; 15; 17
Dendrodoa grossularia	8
Botryllus schlosseri	1; 2; 6; 8; 12; 18; 19; 20
Botrylloides leachi	1; 20; 21
Pyura tessellata	5

Chondrichthyes

Scyliorhinus canicula	11; 12; 20

Osteichthyes

Lophius piscatorius	23
Molva molva	20
Pollachius pollachius	1; 18; 20
Zeus faber	7
Taurulus bubalis	11
Centrolabrus exoletus	1
Crenilabrus melops	18
Ctenolabrus rupestris	1; 2; 5; 6; 12; 18; 19; 20
Labrus bergylta	1; 2; 3; 5; 10; 12; 18; 19; 20
Labrus mixtus	3; 18; 19
Parablennius gattorugine	5; 6; 19
Callionymus lyra	10
Callionymus reticulatus	9; 17; 23
Gobius sp.	16
Gobius niger	11
Gobiusculus flavescens	3
Lesueurigobius friesii	4
Pomatoschistus pictus	14; 15
Thorogobius ephippiatus	10

Phrynorhombus norvegicus	1; 19; 20

Mammalia

Phoca vitulina	1

Rhodophycota

Scinaia turgida	14
Bonnemaisonia asparagoides	1; 3; 14; 15; 16; 18; 20; 23
Palmaria palmata	1; 16; 21
Dilsea carnosa	1; 5; 19; 20
Dudresnaya verticillata	11
Callophyllis laciniata	1; 2; 4; 5; 13; 15; 17; 18; 19; 23
Kallymenia reniformis	1; 5; 15; 18; 19; 20; 23
Corallinaceae indet.	1; 2; 3; 7; 10; 12; 14; 17; 19; 20; 21
Corallina officinalis	1; 12; 14; 19; 20; 21
Lithothamnion corallioides	3; 15
Maerl indet.	9; 15
Phyllophora crispa	15
Schottera nicaeensis	1; 2; 19; 20
Stenogramme interrupta	9; 15; 23
Mastocarpus stellatus	8; 21
Chondrus crispus	3; 8; 16
Polyides rotundus	9
Plocamium cartilagineum	1; 6; 15; 16; 17; 18; 19; 20; 23
Furcellaria lumbricalis	5
Halarachnion ligulatum	9; 15; 20
Calliblepharis ciliata	3; 4; 5; 9; 13; 15; 23
Rhodophyllis divaricata	3; 4; 5; 13; 18; 20
Rhodymenia pseudopalmata	1; 17; 19; 20
Chylocladia verticillata	13; 17
Gastroclonium ovatum	21
Lomentaria articulata	8; 14; 21
Lomentaria clavellosa	1; 20
Ceramium sp.	1
Griffithsia flosculosa	19; 20
Pterothamnion plumula	2; 15
Acrosorium uncinatum	18; 19
Cryptopleura ramosa	1; 2; 5; 17; 18; 19; 20; 23
Delesseria sanguinea	1; 2; 3; 4; 5; 6; 7; 9; 12; 13; 14; 15; 16; 17; 18; 19; 20; 23
Hypoglossum hypoglossoides	1; 2; 3; 5; 7; 15; 17; 19; 20
Membranoptera alata	8; 21
Nitophyllum punctatum	1; 5; 13; 14; 17; 18; 19; 20; 23
Phycodrys rubens	1; 2; 5; 17; 18; 19; 20
Polyneura laciniata	1; 17; 19; 20
Heterosiphonia plumosa	1; 3; 5; 6; 16; 23
Brongniartella byssoides	1; 4; 5; 6; 13; 15; 16; 17; 18; 19; 20; 23
Chondria dasyphylla	13; 14; 16
Laurencia pinnatifida	21
Pterosiphonia parasitica	1; 5

Rhodophycota indet. (non-calc. crusts)	6
Chrysophycota	
Diatoms - film	4; 9; 10
Chromophycota	
Spermatochnus paradoxus	13
Cutleria multifida	5; 18
Dictyopteris sp.	15; 17
Dictyopteris membranacea	5; 7; 18; 19
Dictyota dichotoma	1; 2; 4; 5; 6; 7; 9; 10; 12; 13; 15; 17; 18; 19; 20; 23
Sporochnus pedunculatus	13
Desmarestia aculeata	5; 6; 13; 14; 15; 19
Desmarestia ligulata	1; 5; 13; 14; 20
Colpomenia peregrina	11
Chorda filum	9; 11; 13; 14
Laminaria sp.	8
Laminaria digitata	1; 7; 12
Laminaria hyperborea	1; 2; 6; 12; 13; 15; 16; 17; 18; 19; 20
Laminaria saccharina	11; 13; 14
Saccorhiza polyschides	1; 4; 14; 15
Alaria esculenta	1; 20
Ascophyllum nodosum	8
Fucus serratus	8; 21
Fucus spiralis	8
Fucus vesiculosus	8
Pelvetia canaliculata	8
Halidrys siliquosa	5
Chlorophycota	
Enteromorpha	21
Ulva sp.	4; 14
Ulva lactuca	14
Cladophora sp.	5; 6
Bryopsis plumosa	16
Filamentous green algae	13
Lichens	
Lecanora atra	8
Lichina confinis	21
Ochrolechia parella	8
Ramalina sp.	8
Verrucaria maura	8
Verrucaria mucosa	8
Xanthoria parietina	8

Appendix 4: List of previously studied sites

Crapp (1973)(A); Baker *et al.* (1981) (B); Myers *et al.* (1980) (C) and Cross *et al.* (1979) (D).

Site no.	Site name	Position	A	B	C	D
1	Collack	V 823 415	•	•		
2	Gerahies	V 904 450	•	•		
3	Reen Point	V 912 455	•	•		
4	Coomageragh	V 922 458	•	•		
5	Cooskeen Cove no. 2	V 948 464	•	•		
6	Cooskeen Cove no. 1	V 949 464	•	•	•	•
7	Black Rock	V 989 480	•	•		
8	Dunnamark Point	V 996 502	•	•		•
9	Gurteenroe Point	V 991 503	•	•		
10	Reenydonagan Point	V 992 515	•	•		•
11	Eagle Point	V 991 523	•	•	•	•
12	Snave Bay	V 996 537	•	•		
13	Ardnagashel East	V 987 532	•	•		
14	Ardnagashel West	V 985 527	•	•		
15	Reenavanny	V 972 508	•	•		
16	Carrigacloash	V 957 498	•	•		
17	Whiddy Point West	V 938 485	•	•		
18	Reennagough Point	V 963 525	•	•		
19	Ardaturrish	V 959 530	•	•		
20	Yellow Rock Bay	V 956 534	•	•		
21	Ardaturrish Bay	V 953 538	•	•		
22	Lion Point	V 954 535	•	•		
23	Iskanafeelna Point	V 948 538	•	•		
24	Illauncreeveen Bay	V 948 541	•	•		
25	Gun Point	V 941 541	•	•		
26	Derrycreigh	V 944 546	•	•		
27	Glengarriff Castle	V 945 554	•	•	•	•
28	Roches Point	V 941 558	•	•		
29	Corriveillaun	V 933 561	•	•		•
30	Fir Lands	V 933 556	•	•		
31	Inchintaggart	V 930 550	•	•		
32	Furkeal	V 931 539	•	•		
33	Crowdy Point	V 935 533	•	•		
34	Bocarnagh Bay	V 930 526	•	•		
35	Harris Cove	V 921 520	•	•		
36	Muccurragh Point	V 923 513	•	•		
37	Dereenacarrin	V 896 502	•	•	•	•
38	Mehal Head	V 860 483	•	•		
39	Shot Head	V 840 475	•			
40	Mizen Head	V 739 235	•	•		