JOINT NATURE CONSERVATION COMMITTEE

Marine Nature Conservation Review

Sector 14

Sealochs in the Outer Hebrides

Area summaries

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Coasts and seas of the United Kingdom

Marine Nature Conservation Review series

Area summaries

Preface

The *Marine Nature Conservation Review* (MNCR) was initiated by the Nature Conservancy Council in 1987 as the third major resource survey, following the *Nature Conservation Review* and the *Geological Conservation Review*. Since April 1991, the MNCR has been undertaken within the Support Unit of the Joint Nature Conservation Committee (JNCC). The JNCC is a forum through which the three country agencies, the Countryside Council for Wales, English Nature and Scottish Natural Heritage, deliver their special statutory responsibilities for Great Britain as a whole and internationally. These special responsibilities, known as special functions, contribute to sustaining and enriching biological diversity, enhancing geological features and sustaining natural systems.

The MNCR has drawn together information on marine ecosystems around Great Britain with the objectives of:

- extending our knowledge of benthic marine habitats, communities and species in Great Britain, particularly through description of their characteristics, distribution and extent; and
- identifying sites of nature conservation importance.

The data collected also provide information to support more general measures to minimise adverse effects of development and pollution, particularly on sites and species of nature conservation importance.

The area included in the MNCR is the coastline of England, Scotland and Wales (excluding the Isle of Man and the Channel Isles), extending on the shore from the lower limit of terrestrial flowering plants and within marine inlets from the limit of marine influence out to the limit of British territorial seas. Saline lagoons are also included. The MNCR included a major field survey programme of the shores and near-shore sublittoral zone, undertaken to standard methodology.

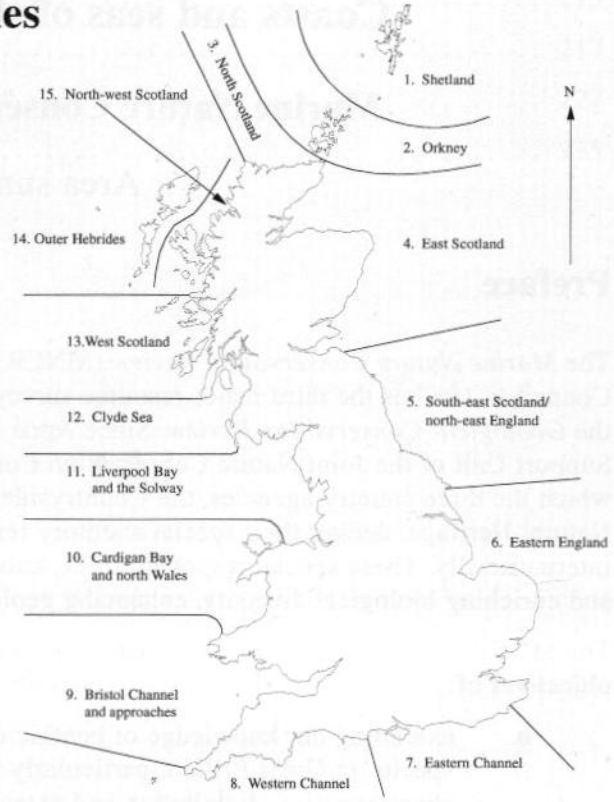
MNCR studies have been undertaken within particular coastal sectors around Britain (see map overleaf) or of major physiographic types, such as lagoons and sealochs. These studies are being presented, in the *Coasts and seas of the United Kingdom – MNCR series*, as *area summaries*, each of which provides an account of a discrete stretch of open coast, a marine inlet or a lagoon within the area of study. A list of *area summary* volumes and other major publications from the MNCR is given overleaf.

A full list of MNCR and other JNCC marine reports is available from JNCC's website – http://www.jncc.gov.uk/communications/pubcat/default.htm. JNCC publications can be purchased from NHBS Ltd, 2–3 Wills Road, Totnes, Devon TQ9 5XN (tel: 01803 865913; fax: 01803 865280; e-mail: nhbs@nhbs.co.uk). JNCC reports are available directly from JNCC (tel: 01733 562626; fax: 01733 555948).

David Connor

Joint Nature Conservation Committee

Publications in the MNCR series



MNCR coastal sectors, as used in the *Coasts and seas of the United Kingdom – MNCR series.*

Volumes published or near publication:

Sector	Title	Authors	Date
	Foundation volumes		
1–15	Rationale and methods	Hiscock, ed.	1996
1–15	Benthic marine ecosystems of Great Britain and the north-east Atlantic	Hiscock, ed.	1998
	Biotope classification		
1–15	Marine biotope classification for Britain and Ireland. Volume 1. Littoral biotopes (JNCC Report, No. 229)	Connor, Brazier, Hill & Northen	1997
1–15	Marine biotope classification for Britain and Ireland. Volume 2. Sublittoral biotopes (JNCC Report, No. 230)	Connor, Dalkin, Hill, Holt & Sanderson	1997
	Area summaries		
1	Shetland	Howson	1999
1–2	Lagoons in Shetland and Orkney	Thorpe	1998
2	Orkney	Murray, Dalkin, Fortune & Begg	1999
3, 4, 12, 13, 15	Lagoons in mainland Scotland and the Inner Hebrides	Covey, Fortune, Nichols & Thorpe	1998
5	South-east Scotland and north-east England	Brazier, Davies, Holt & Murray	1998
6	Inlets in eastern England	Hill, Emblow & Northen	1996
8	Inlets in the western English Channel	Moore, Smith & Northen	1999
9	Inlets in the Bristol Channel and approaches	Moore, Smith, Northen & Little	1998
10	Cardigan Bay and north Wales	Brazier, Holt, Murray & Nichols	1999
11	Liverpool Bay and the Solway Firth	Covey	1998
12	Sealochs in the Clyde Sea	Dipper & Beaver	1999
13	Sealochs in west Scotland	Dipper, Howson & Steele	Due 2003
14	Lagoons in the Outer Hebrides	Thorpe, Dalkin, Fortune & Nichols	1998
14	Sealochs in the Outer Hebrides	Beaver & Dipper	2002
15	Sealochs in north-west Scotland	Dipper & Johnston	Due 2003

Marine Nature Conservation Review

Sector 14

Sealochs in the Outer Hebrides

Area summaries

Synopsis

The sealochs of the Outer Hebrides (MNCR Sector 14) have been studied as part of the Marine Nature Conservation Review programme. The studies between 1988 and 1990 included field surveys of the shores and the sublittoral zone to describe the habitats and communities (together referred to as biotopes) present and to assess their marine natural heritage importance. Comparable data from other organisations or previous studies have been added to provide information on over 400 sites, and the data analysed to classify the biotopes present. Information on the designated nature conservation sites and main human influences in the sealochs has also been compiled.

The information is presented here as 26 *area summaries*:

1. West Loch Tarbert
2. Loch Resort
3. Lochs Tealasavay and Tamanavay
4. Camas Uig
5. Loch Roag
6. Broad Bay (Loch a Tuath)
7. Loch Grimshader
8. Lochs Leurbost and Erisort
9. Loch Odhairn
10. Loch Shell (Loch Sealg)
11. Loch Bhrollum
12. Loch Claidh
13. Loch Seaforth
14. East Loch Tarbert
15. Loch Stockinish
16. Loch Finsbay
17. Loch Maddy (Loch nam Madadh)
18. Loch Eport
19. Loch Uiskevagh
20. Lochs a' Laip and Kilerivagh
21. Loch Càrnan
22. Loch Sheilavaig
23. Loch Skipport
24. Loch Eynort
25. Loch Boisdale
26. North Bay

Each area is described in a standard format, giving details of its physical and biological character, the biotopes present and their distribution, current nature conservation designations, the main human influences and relevant literature. The areas surveyed and the marine biotope information are also presented in a series of maps. These *area summaries* are supported by a summary of the biotopes defined for sealochs in the Sector (from Connor *et al.* 1997a, b) and by a list of species recorded from the surveys.

References

Connor, D.W., Brazier, D.P., Hill, T.O. & Northen, K.O. 1997a. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 1. Littoral biotopes. Version 97.06. *JNCC Report*, No. 229.

Connor, D.W., Dalkin, M.J., Hill, T.O., Holt, R.H.F. & Sanderson, W.G. 1997b. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 2. Sublittoral biotopes. Version 97.06. *JNCC Report*, No. 230.

Introduction

Background

The Outer Hebrides or Western Isles (MNCR Sector 14) form the most westerly large offshore group of islands in Britain (Figure 1). They are divided roughly in two by the Sound of Harris, with the Uists, including North and South Uist, Benbecula, Barra and Mingulay, to the south, and Lewis and Harris to the north. The islands of North and South Uist are especially characterised by extensive shallow marine and fjardic sealochs and brackish-water obs (lagoons) connected to each other and to the sea by rapids, forming part of an exceptionally complex mosaic including land, islands, marine inlets, lagoons, and freshwater lochs. On Lewis and Harris, deeper fjordic sealochs are present, and hold communities similar to those of mainland Scotland sealochs. The majority of sealochs in the Outer Hebrides face east towards the Minch, although several on Lewis and Harris open directly onto the Atlantic. The entrances to the west-facing sealochs are exposed to the Atlantic swell and prevailing winds, whilst those facing into the Minch are generally more protected from strong wave action. Each sealoch exhibits a typical wave exposure gradient from exposed or very exposed at the mouth to very sheltered at the head, while the many narrow channels and rapids produce a wide range of tidal stream strengths. This range of hydrodynamic conditions, salinity regimes and mixtures of rock and sediment habitats supports a very wide range of biological communities.

Despite their relative remoteness, the marine biology of the Outer Hebrides has been reasonably well studied (Connor and Little 1998). The growth of fish farming in the 1980s led to marine biological studies under the auspices of the Nature Conservancy Council, while surveys undertaken for the MNCR programme have provided much of the more recent information for the sealochs. Further studies for Scottish Natural Heritage have focused on candidate Special Areas of Conservation, sites designated under the EC Habitats Directive. Two of the fjardic sealochs typical of the Outer Hebrides are marine candidate Special Areas of Conservation (Brown *et al.* 1997). Loch Maddy is selected to represent both 'large shallow inlets and bays' and 'coastal lagoons' (Entec 1996), while Loch Roag Lagoons represent 'coastal lagoons', a priority habitat type under the Habitats Directive. The present volume does not include lagoons; these are described by Thorpe *et al.* (1998).

Data collection and the classification of biotopes

Field surveys of the shores and the sublittoral zone of the sealochs were undertaken between 1988 and 1990 by the University Marine Biological Station, Millport as part of a major study of sealochs in Scotland for the MNCR (Howson *et al.* 1994). The surveys aimed to describe the habitats and communities (together referred to as biotopes) present and to assess their natural heritage importance. These surveys complemented other studies carried out previously or by other organisations, including the Marine Conservation Society, the Oil Pollution Research Unit (now Cordah), and the Scottish Marine Biological Association (now Scottish Association for Marine Science) and Dr Shelagh Smith. A summary of these surveys is given in Table 1. Further references to other studies are given in the individual *area summary* accounts.

During the MNCR field surveys, undertaken by the University Marine Biological Station, Millport, information on the nature of each site, together with its biotopes, was collected. Sites were selected in order to sample a wide range of substrata and different environmental conditions, such as differing wave exposure and salinity regimes in both the littoral and sublittoral zones, as well as a geographical spread. Sublittoral hard substrata were particularly well represented in these surveys. Photographs were taken of the sites, and their biotopes and species, to provide a permanent visual record of the areas surveyed.

The sites were surveyed following standard MNCR recording and infaunal-sampling techniques (Connor and Hiscock 1996). The location and physiographic characteristics of each site were recorded on a standard MNCR Site Form. The physical details of each habitat and the species present were recorded on standard MNCR Habitat Forms (Littoral or Sublittoral as appropriate). The conspicuous species present were recorded using the MNCR semi-quantitative abundance scales. Species which could not be identified *in situ* were collected for later identification in the laboratory.

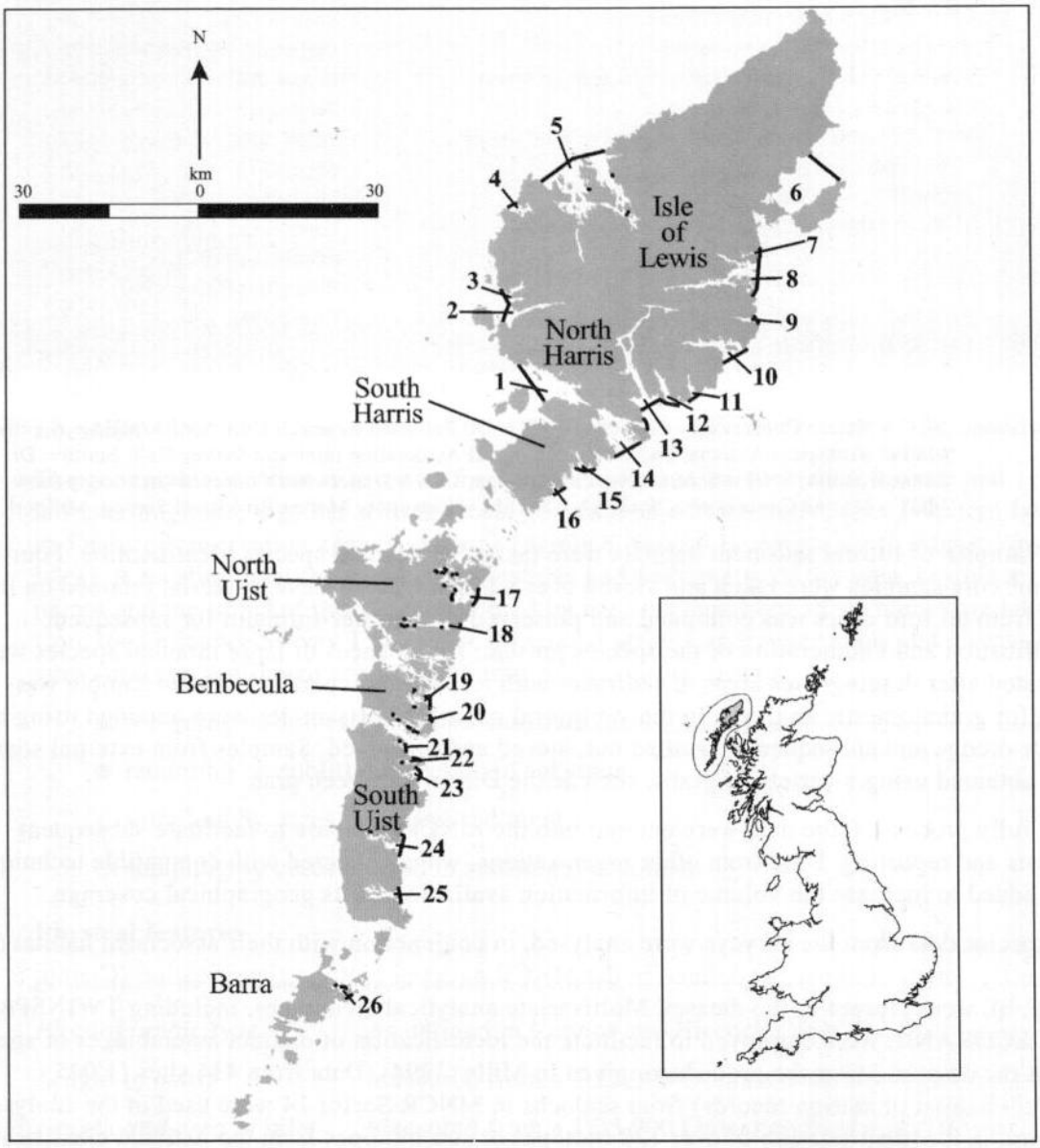


Figure 1 Location of the 26 sealoch systems in MNCR Sector 14 described in the present volume. Some systems include more than one sealoch and are covered by a single area summary.

Table 1 Sources of field survey information.

MNCR database survey no.	*Survey*	*Source*	*No. of sites*	*No. of habitats surveyed*
21	1988 UMBSM Harris and Lewis sealochs survey	Howson 1989	81	235
29	1990 UMBSM North and South Uist and Benbecula sealochs survey	Howson 1991	70	170
31	1990 UMBSM Harris and Lewis sealochs survey	Holt 1991	79	231
57	1982 UCS Loch Roag (Lewis) survey	Dipper 1983	43	80
58	1984 OPRU Western Isles sealochs survey	Rostron 1984	46	194
59	1979 NCC Uists sublittoral survey	Dipper and Mitchell 1980	28	26
64	1984 MCS Loch Eynort (South Uist) sublittoral survey	Dipper 1985	47	136
92	1982 Smith Lewis littoral survey	Smith 1983	33	31
93	1977–82 Smith Lewis and Harris littoral mollusc survey	Smith 1982	21	21
94	1978 Smith Uists rocky shore mollusc survey	Smith 1978	15	18
200	1978 NCC Loch Obisary survey	Mitchell *et al.* 1980	15	17
265	1970–80 SMBA/MBA Great Britain littoral survey	Harvey *et al.* 1980 Powell *et al.* 1979 Bishop and Holme 1980	83	64
281	1978 NCC Uists sublittoral survey	Dipper 1980	8	11
651	1995 SNH South Uist maerl bed survey		6	8
		Total	**575**	**1242**

Abbreviations: NCC = Nature Conservancy Council; OPRU = Oil Pollution Research Unit; SMBA/MBA = Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit; Smith = Dr Shelagh Smith; SNH = Scottish Natural Heritage; UCS = Underwater Conservation Society (now MCS = Marine Conservation Society); UMBSM = University Marine Biological Station, Millport.

Core samples of littoral sediment habitats were taken for infaunal species identification. Four 0.01 m^2 core samples were taken and sieved over a 0.5 mm mesh sieve. Material retained on the sieve from all four cores was combined and preserved in seawater-formalin for subsequent identification and enumeration of the species present. Abundances of large infaunal species were estimated after digging over areas of sediment with a spade. A separate sediment sample was taken for granulometric analysis. In the sublittoral most MNCR samples were obtained using an anchor dredge and subsequently washed out, sieved and preserved. Samples from external sources were obtained using a variety of grabs, such as the Day or van Veen grab.

Once fully processed, the data were entered into the MNCR database to facilitate subsequent analysis and reporting. Data from other organisations, when collected with compatible techniques, were added to increase the volume of information available and its geographical coverage.

The species data from the surveys were analysed, in conjunction with their associated habitat data, to identify which biotopes, as defined in the MNCR national biotope classification (Connor *et al.* 1997a, b), were present in the dataset. Multivariate analytical techniques, including TWINSPAN and DECORANA, were employed to facilitate the identification of distinct assemblages of species within the dataset, using the procedures given in Mills (1994). Data from 414 sites (1,045 different habitat or station records) from sealochs in MNCR Sector 14 were used in the analyses, resulting in the identification of over 130 biotopes or sub-biotopes from the national classification (Appendix A). Full descriptions of each biotope and the general approach to biotope classification are given in Connor *et al.* (1997a, b). Appendix B shows the distribution of biotopes in each area.

Species recorded from the surveys in Area 14 listed in Table 1 are given in Appendix C. Note that not all species may be included where recorded by some non-MNCR surveys.

Area summaries and their format

The coast of MNCR Sector 14 has 26 sealoch systems (see Figure 1), described in the standard MNCR *area summary* format. The 26 *area summaries* are:

1. West Loch Tarbert
2. Loch Resort
3. Lochs Tealasavay and Tamanavay
4. Camas Uig
5. Loch Roag
6. Broad Bay (Loch a Tuath)
7. Loch Grimshader
8. Lochs Leurbost and Erisort
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21. Loch Càrnan
22. Loch Sheilavaig
23. Loch Skipport
24. Loch Eynort
25. Loch Boisdale
26. North Bay

Each *area summary* contains the following sections:

Location

The geographic location is given as the central Ordnance Survey grid reference and latitude/longitude, together with the local government administrative area (Western Isles) and nature conservation agency and area (Scottish Natural Heritage, North Areas: Western Isles). A location map shows the main features and bathymetry of the area, key place names and the limits of the area considered by the *area summary*. Place names are taken from the Ordnance Survey 1:50,000 scale second series Landranger maps and charts. The sites surveyed are shown according to four main types of survey:

- ▲ recording on littoral rock/hard substrata
- ● recording on sublittoral rock/hard substrata
- △ sampling by cores in littoral sediment
- ○ sampling by cores or grab in sublittoral sediment.

Physical features

A summary of the main physical features includes:

Physiographic type	As defined in Connor and Hiscock (1996).
Length of coast	Measured from a 1:25,000 Ordnance Survey digital map.
Length and area of inlet	Measured from a 1:25,000 Ordnance Survey digital map. Inlets are measured from the mouth of the inlet to the limit of tidal influence.
Bathymetry	The maximum depth below chart datum, taken from Edwards and Sharples (1986).
Wave exposure	Taken from field observations and from Admiralty charts using categories as defined in Connor and Hiscock (1996).
Tidal streams	Taken from field observations and tidal streams atlas, using categories defined in Connor and Hiscock (1996) (1 knot ≅ 0.5 m/s).

Tidal range Figures for mean spring and mean neap tidal range, quoted for the nearest secondary port, are taken from Admiralty tide tables and charts.

Salinity The salinity range, as estimated at the time of survey (based on the species present and their known salinity tolerances and the presence of freshwater sources) or as given in available literature given according to the categories in Connor and Hiscock (1996).

All heights and depths given are corrected to chart datum.

Introduction

The overall physical characteristics of the area and significant human influences and activities are described.

Marine biology

A table lists the marine biological surveys of the shores and sublittoral zone that have been used in compiling the *area summary*, including the survey type (littoral/sublittoral), survey method, date(s) of survey and reference source (MNCR database survey number, in the case of recent MNCR surveys). These data were compiled in 1999 and any more recent studies will not be included. The distribution of survey sites is shown on the location map, and sites are listed at the end of each *area summary*.

The marine biological nature of the area is described with reference to the biotopes present and their distribution within the area, based primarily on the findings of the most recent MNCR survey but with reference to previous studies where appropriate. Heights and depths noted in the text are corrected to lowest tide level (chart datum). The biotope classification codes given in parentheses are from the MNCR national classification, as listed in Appendix A; a summary of biotopes recorded within each area is presented in Appendix B. Marine species nomenclature follows Howson and Picton (1997); that for lichens follows Purvis *et al.* (1992), and that for higher plants follows Stace (1991).

A map assembled with the aid of a Geographical Information System illustrates the distribution of the main biotopes and biotope complexes within the area; some mapped areas represent more than one biotope.

NOTE: the biotope maps give an indication of the *likely* distribution and extent of biotopes, based on the data available, including sketch maps of biotope distribution made at the time of survey, cited literature and information on Admiralty charts. In some areas data are sparse and additional data or more comprehensive survey would enable more accurate maps to be drawn. This especially applies to the littoral zone in most of the lochs.

Nature conservation

A summary of statutory and non-statutory wildlife and landscape conservation designations for the marine and coastal parts of the area is given (from Barne *et al.* 1997, where further information on the types of designation can be found, and Scottish Natural Heritage information).

Key to abbreviations used: (c = candidate; p = proposed):

ESA	Environmentally Sensitive Area
GCR	Geological Conservation Review site
MCA	Marine Consultation Area
MoD	Ministry of Defence
NCR	Nature Conservation Review site

NSA	National Scenic Area
Ramsar	Ramsar site
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

Human influences

This section describes some of the main uses and activities of the area, including urbanisation, industrial or commercial activities that have (or potentially have) an impact on the area. These can include sewage discharges, industrial effluent, development, dredging, spoil-dumping, fishing, aquaculture, recreation and shipping. Although as accurate as possible at the time of writing, readers should be aware that further developments, particularly improvements to sewage treatment and disposal, and changes in the number and location of mariculture installations, are likely to have occurred since. Further details of human influences are given in Barne *et al.* (1997).

References and further reading

Cited references and other relevant literature and information sources are listed.

Sites surveyed

A list of sites surveyed within the area from the surveys shown in Table 1 includes additional information on the location of each site (OS grid reference and latitude/ longitude), and an inventory of biotopes known to be present at the time of survey.

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The maps are based upon Admiralty charts Nos. 1794, 1795, 1796, 2720, 2721 and 2841 with the permission of the Controller of the United Kingdom Hydrographic Office (Permission number HO 756/990501/02) and upon Ordnance Survey 1:50,000 scale Landranger maps by permission of

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1 West Loch Tarbert

Location		
Position (centre)	NB 080 030	57°55'N 06°56'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

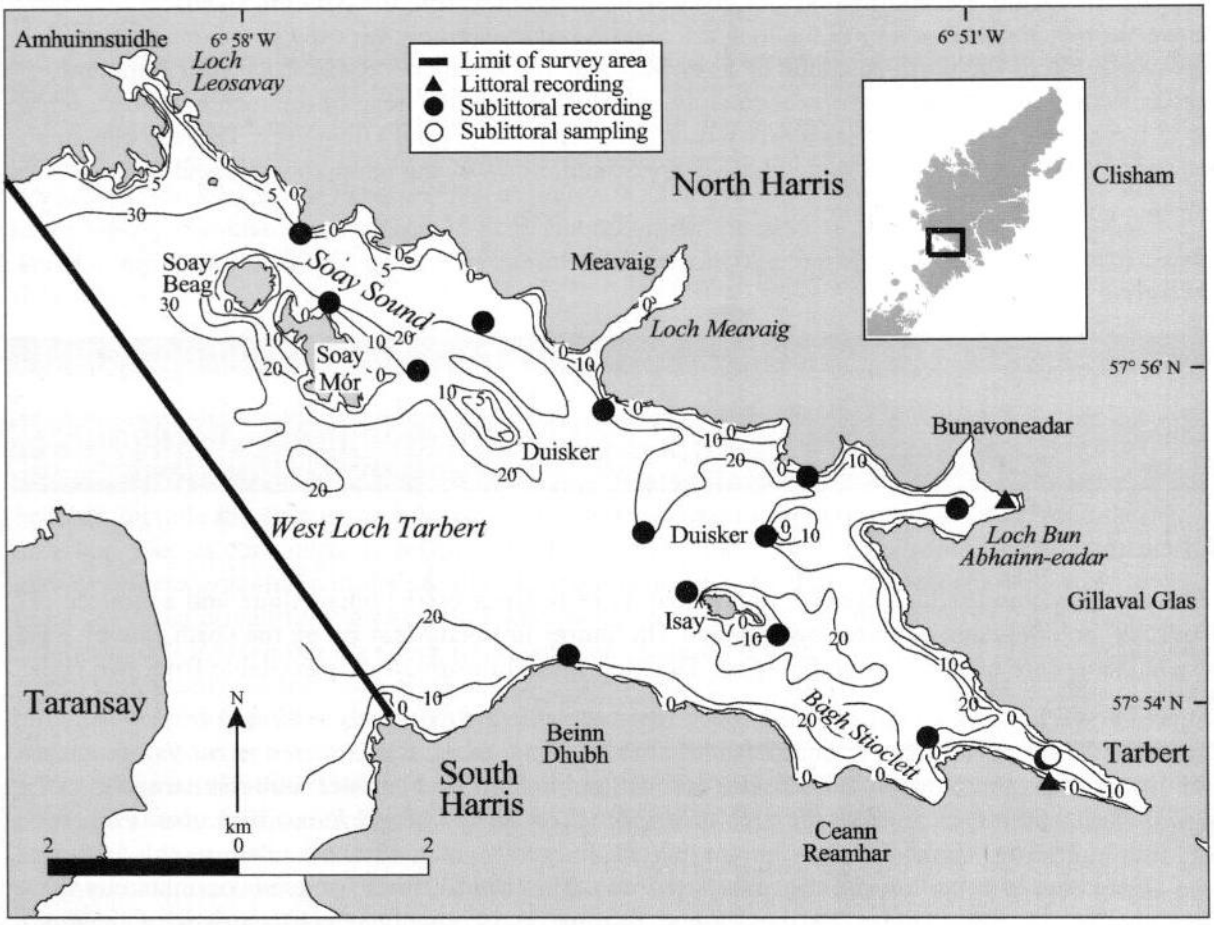

Figure 1.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Open sealoch with no sills
Length of coast	44.6 km (63.1 km including islands)
Length of inlet	8.56 km
Area of inlet	34.3 km^2 (32.8 km^2 excluding islands)
Bathymetry	30 m depth at loch entrance; maximum depth 49 m in Soay Sound
Wave exposure	Exposed to moderately exposed. Inner regions and north-east facing shores of islands sheltered to extremely sheltered
Tidal streams	Weak to moderately strong in Soay Sound; elsewhere weak to very weak
Tidal range	3.0 m (mean springs); 1.3 m (mean neaps)
Salinity	Mostly fully marine; can be lowered in Loch Bun Abhainn-eadar by river inputs

Introduction

West Loch Tarbert lies on the Atlantic side of the narrow isthmus linking South and North Harris, on which the town of Tarbert lies. To the south lie the hills of Beinn Dhubh and Ceann Reamhar, whose steep slopes extend below the water line. To the east lies the summit of Gillaval Glas, and to the north lie the hills leading up to the summit of Clisham, which at 799 m is the highest peak in the Outer Hebrides.

In contrast with the deeper sealochs with sills on the east coast, West Loch Tarbert is a large open loch with no sills and is exposed to the Atlantic waves and swell. The island of Taransay lies outside the loch to the south-west and gives some protection from the Atlantic swell. Nevertheless, most sites within the loch are exposed or moderately exposed to wave action, with the exception of the north-east side of Soay Mór and Tarbert anchorage in Loch Bun Abhainn-eadar, which are sheltered. The seabed slopes gradually from the head of the loch to a depth of 30 m at the entrance and continues westwards at this depth for several kilometres. There is one area of deeper water, reaching 49 m depth, in Soay Sound, north of the uninhabited island of Soay Beag.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	2	August 1990	Holt (1991)
Sublittoral	Recording (epibiota)	14	August 1990	Holt (1991)

Littoral

The shores within the loch consist predominantly of bedrock on the upper shore and a mixture of bedrock, boulders and cobbles lower down. The shores in Loch Meavaig on the north side of West Loch Tarbert are of shingle and boulders. Detailed littoral information is available from two sites.

Shores at the head of West Loch Tarbert on the south side are extremely sheltered from wave action and consist of bedrock, boulders and cobbles. The periwinkle *Littorina saxatilis* occurs in the littoral fringe and upper shore zones, colonising boulders and cobbles with the barnacle *Semibalanus balanoides*, while the fucoids *Ascophyllum nodosum* and *Fucus vesiculosus* inhabit the mid-eulittoral (AscX; FvesX). Serrated wrack *Fucus serratus*, with an undergrowth of foliose red algae, occurs in the lower eulittoral (Fser.Fser). The lower littoral fringe is dominated by the fucoids *Pelvetia canaliculata* (Pel) and *Fucus spiralis* (Fspi), which are characteristic of sheltered shores.

The shore at Bunavoneadar is steep and rocky and typical of shores on the north side of West Loch Tarbert, which are in general moderately exposed. This results in less fucoid cover than at the more sheltered sites at the head of the loch. Species richness is low, with the exception of the supralittoral and upper littoral fringe. Here there is a high number of lichen species and greater than 90% lichen cover, with yellow and grey lichens characterising the supralittoral (YG) and the black lichen *Verrucaria maura* characterising the upper littoral fringe (Ver.Ver). The upper eulittoral zone is dominated by *P. canaliculata* (Pel) and *F. spiralis* (Fspi) with few other species present. *A. nodosum* colonises the mid-eulittoral (Asc.VS) but is replaced by *S. balanoides* and the limpet *Patella vulgata* where the bedrock is steep or vertical (BPat.Sem), while mussels *Mytilus edulis* and *F. vesiculosus* occur at the lower limit of the mid-eulittoral zone (Fves).

Sublittoral

Bedrock and boulders extend from all shores into the sublittoral. The rock–sediment interface becomes shallower towards the head of the loch, such that in Soay Sound bedrock extends down to 24 m, while at the head it reaches only 11 m depth. On the south side in the mid-loch region

and around the islands of Duisker (east) and Isay the rock–sediment interface occurs at 12–15 m depth.

Infralittoral rock

The rocky infralittoral zone throughout West Loch Tarbert consists of heavily grazed *Laminaria hyperborea* kelp forest down to a maximum depth of about 11 m, followed by a kelp park of *L. hyperborea* and occasional sugar kelp *Laminaria saccharina* to a maximum depth of 18 m (LhypGz.Ft; LhypGz.Pk). The undergrowth of foliose algae is sparse, due to heavy grazing by the common urchin *Echinus esculentus*, and consists mainly of the brown algae *Desmarestia aculeata*, *Desmarestia viridis* and *Dictyota dichotoma*, most abundant near the lower limits of the infralittoral zone. Coralline crusts are abundant, covering the rock surfaces with a bright pink sheen. At most sites, upward-facing rock surfaces and kelp stipes are also virtually devoid of fauna, and all sites have a low species abundance, again due to grazing by *E. esculentus*. In contrast, the undersides of boulders, which are not accessible to sea urchins, are colonised by bryozoans, the keel worm *Pomatoceros triqueter*, the sea cucumber *Pawsonia saxicola* and the squat lobster *Galathea squamifera*. In Soay Sound, at the entrance to the loch, the featherstar *Antedon bifida* is sometimes present in considerable numbers, possibly due to slightly accelerated tidal streams.

Circalittoral rock

Areas of bedrock, boulders and cobbles in the circalittoral fall into two main habitat types, either scoured by sand particles, as found in the area west of the island of Isay, or silty as found in the area around Duisker (east) and on the north side of Soay Sound. Dominant species on scoured bedrock include the encrusting bryozoan *Parasmittina trispinosa* and the hydroid *Abietinaria abietina*, species considered to be tolerant of scoured conditions. The hydroids *Nemertesia ramosa* and *Sertularia argentea* and the ascidian *Ciona intestinalis* are also common (FaALC.Ab). In more sheltered circalittoral areas with higher silt deposition, beds of brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra* are found and the common urchin *E. esculentus* is more common (Oph; Oph.Oacu). At the north-west end of Soay Sound, *O. fragilis* dominated the upper circalittoral from 20–24 m depth but was replaced by *Ophiura albida* and *O. nigra* below 24 m. Relatively few other species were present at the time of the 1990 survey due to the smothering effect of the brittlestars. Those present are either mobile, such as *E. esculentus*, or rapid colonisers, such as *C. intestinalis*. The infrequently recorded viviparous anemone *Hormathia coronata* also occurs in Soay Sound, although not in large numbers. The hermit crab *Pagurus prideaux* and its commensal anemone *Adamsia carciniopados* were present in unusually high numbers to the west of Duisker (east) at the time of the 1990 survey.

Sublittoral sediments

The seabed throughout much of West Loch Tarbert consists of mixed coarse sediments resulting from the exposed nature of the loch. Coarse sand with shell-gravel, pebbles and mud forms extensive plains at 10–33 m depth. These sediments are colonised by sea cucumbers *Thyone* spp., the burrowing anemone *Cerianthus lloydii* and the tube-dwelling polychaete *Chaetopterus variopedatus* (Ven.Neo). These species are recorded over a wide range of depths and in a variety of sediment grades. East of Isay island the coarser grades support the bivalves *Ensis ensis* and *Pecten maximus*. In deeper areas where the seabed is of sand with a high proportion of silt or mud, the brittlestars *Ophiura ophiura* and *O. albida* are dominant. *Ophiura* spp. are rare or absent on the coarser sediments. Sediments consisting of fine sand or sand with mud, which include the area west of the island of Duisker (east) and the north side of the loch outside Loch Meavaig, are dominated by the burrowing brittlestar *Amphiura filiformis*.

In contrast to the rest of the loch, the seabed in Soay Sound at (13–17 m depth) and in Loch Bun Abhainn-eadar at a (depth of 10 m) consists of fine, soft mud. In both areas the opisthobranch *Philine aperta* and hermit crabs *Pagurus* sp. are common (PhiVir). The swimming crab

Liocarcinus depurator and the anemones *C. lloydii*, *Sagartiogeton undatus* and *Sagartiogeton laceratus* are also present, but sea pens have not been recorded.

Maerl *Phymatolithon calcareum* is found between the island of Soay Mór and a group of islets to the east, in depths of 14–16 m (Phy.HEc). Associated fauna include the sea cucumbers *Neopentadactyla mixta* and *Thyone fusus*, and *C. lloydii*. Another maerl species, *Lithothamnion glaciale*, is found at Tarbert anchorage at the head of the loch, forming rhodoliths ('hedgehog stones') on muddy shell-gravel and fine sand at 4–8 m depth (Lgla). Other species present include a number of silt-tolerant species such as the horse mussel *Modiolus modiolus* and associated *P. triqueter*, the barnacle *Balanus crenatus*, and sponges *Suberites* sp. (ModHo). The scavengers *Anapagurus hyndmanni*, *Pagurus bernhardus*, *P. prideaux*, *Carcinus maenas* and *Asterias rubens* are all well represented here. The only record of the native oyster *Ostrea edulis* in the sealochs of Harris and Lewis is from this site.

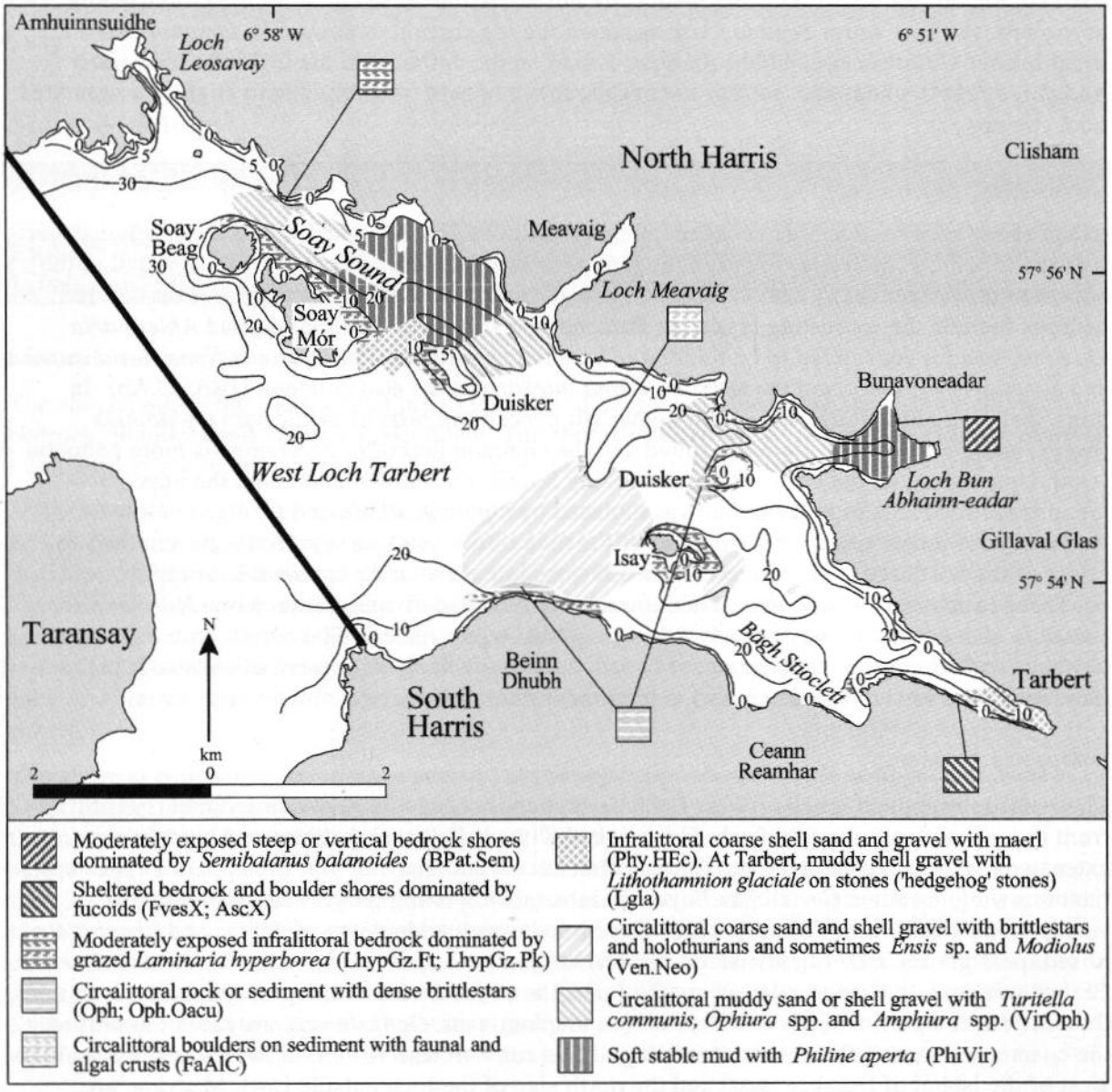

Figure 1.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 1.1, cited literature and additional field observations).

Nature conservation

Conservation sites		
Site name	*Status*	*Main features*
Luskentyre Banks and Saltings	SSSI	Botanical, geological, marine botanical, ornithological
North Harris	SSSI; cSAC	Botanical; northern Atlantic wet heaths with Erica tetralix
South Lewis, Harris and North Uist	NSA	Landscape
Luskentyre to Corran Seilebost, Harris	GCR	Coastal geomorphology

Human influences

Coastal developments and uses

The A859 and B887 roads run along the north side of West Loch Tarbert, but the area is very sparsely populated, the main settlement being Tarbert, the largest town on Harris, on the isthmus at the head of the loch. There are scattered small settlements around a few of the inlets on the north side. There is no development along the south shore. Bunavoneadar at the head of Loch Bun Abhainn-eadar is the site of a disused Norwegian-built whaling station abandoned in 1930. Sewage effluent from Tarbert is partially treated in the town, although the outlying settlements on the north side of the loch at Meavaig, Bunavoneadar and Amhuinnsuidhe use septic tanks, and sewage inputs are relatively low. Hidden in the hills north-east of Loch Leosavay there is a hydro-electric scheme which supplies most of the electricity requirements of Harris. Tourism is relatively low-level due to the remoteness of the area.

Marine developments and uses

There are two small piers at the head of West Loch Tarbert. There are relatively few fish and shellfish farms in West Loch Tarbert compared with lochs on the east coast of the islands due to the greater exposure to wave action. In March 1997 there had been six leases granted for Atlantic salmon *Salmo salar* farm sites, although four of these sites were unoccupied in 1994. Those present are sheltered behind Soay Mór and in the small bays near Bunavoneadar. The owners of one of the salmon farm sites in Soay Sound also lease the uninhabited islands of Soay Mór and Soay Beag. In addition, there have been four consents granted for the discharge of effluent from salmon-rearing cages. Salmon fishing is the main interest of tourists who come to the falls leading from Loch Leosaid to Loch Leosavay, where salmon can be seen jumping in June and July. Both salmon and trout *Salmo trutta* are plentiful in many rivers around West Loch Tarbert.

References and further reading

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Sites surveyed

Survey 31: 1990 UMBSM survey of sealochs of Harris and Lewis (Holt 1991).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
31	65	NW of Cnoc an Cloiche, West Loch Tarbert, Harris	NB 138 006	57°54.1'N 06°49.8'W	YG; Ver.Ver; Fser.Fser; FvesX; AscX; Pel; Fspi; Fves; BPat
31	72	SE Bunavoneadar, West Loch Tarbert, Harris	NB 134 035	57°55.7'N 06°50.5'W	YG; Ver.Ver; Fves; BPat.Sem; Asc.VS; Pel; Fspi

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
31	64	Tarbert anchorage, West Loch Tarbert, Harris	NB 138 008	57°54.3'N 06°49.9'W	Lgla; ModHo
31	66	W of Gob Aird Stioclett, West Loch Tarbert, Harris	NB 126 010	57°54.3'N 06°51.1'W	LhypGz.Pk
31	67	SE of Isay, West Loch Tarbert, Harris	NB 110 021	57°54.9'N 06°52.8'W	Ven.Neo; LhypGz.Pk
31	68	W of Isay, West Loch Tarbert, Harris	NB 100 025	57°55.1'N 06°53.7'W	Ven.Neo; FaAlC
31	69	W of Duisker (east), West Loch Tarbert, Harris	NB 109 031	57°55.4'N 06°53.0'W	Oph; VirOph; LhypGz.Pk
31	70	Aird Chaainish, West Loch Tarbert, Harris	NB 113 038	57°55.8'N 06°52.6'W	EchBriCC; VirOph.HAs; LhypGz.Ft
31	71	Loch Bun Abhainn-eadar, West Loch Tarbert, Harris	NB 129 034	57°55.6'N 06°51.0'W	PhiVir
31	73	S of Aird an Tolmachain, West Loch Tarbert, Harris	NB 096 032	57°55.4'N 06°54.2'W	FaAlC.Abi; Ven.Neo
31	74	SW of Aird an Tolmachain, West Loch Tarbert, Harris	NB 092 045	57°56.1'N 06°54.8'W	VirOph
31	75	N of Beinn Dhubh, West Loch Tarbert, Harris	NB 088 019	57°54.7'N 06°55.0'W	Lhyp.Pk; Lhyp.Ft; Oph
31	76	SE Soay Mór, West Loch Tarbert, Harris	NB 072 049	57°56.2'N 06°56.8'W	Phy.HEc; LhypGz.Pk
31	77	NW Bo Harainish, West Loch Tarbert, Harris	NB 079 054	57°56.5'N 06°56.1'W	PhiVir
31	78	N of Soay Mór, Soay Sound, West Loch Tarbert, Harris	NB 063 056	57°56.6'N 06°57.8'W	IGS; VirOph LhypLsac.Ft
31	79	Ard Hurnish, Soay Sound, West Loch Tarbert, Harris	NB 060 063	57°56.9'N 06°58.1'W	Oph.Oacu; VirOph; FaAlC.Abi LhypGz.Pk

Compiled by: Ruth Beaver and Frances Dipper

2 Loch Resort

Location		
Position (centre)	NB 060 170	57°55'N 06°56'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

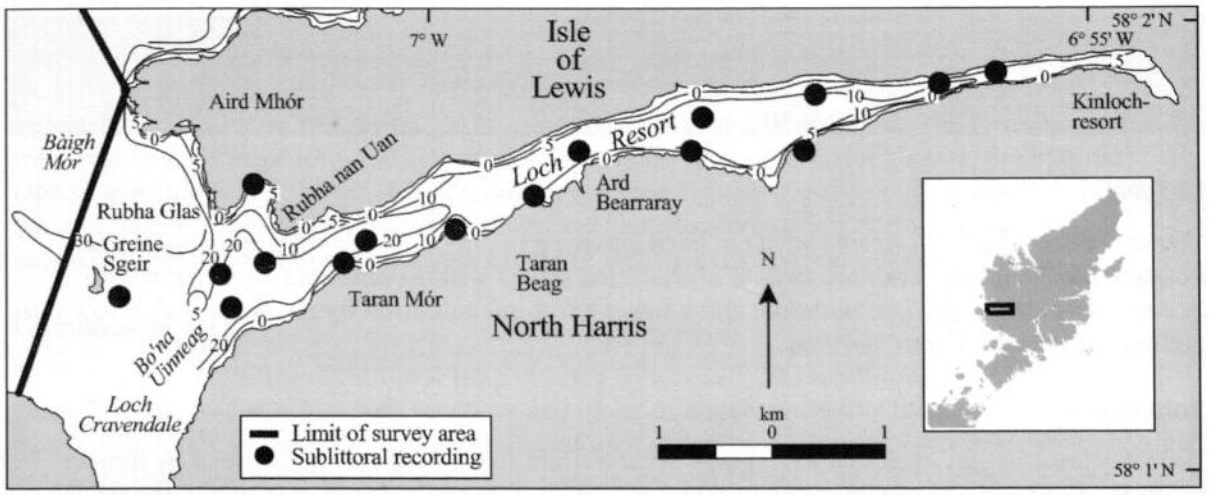

Figure 2.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Open sealoch with no sills
Length of coast	33.5 km (34.1 km including islands)
Length of inlet	10.1 km
Area of inlet	9.6 km^2 (9.59 km^2 excluding islands)
Bathymetry	Average depth 11.9 m; loch mouth has a depth of 27 m with a spit at entrance rising to 5 m
Wave exposure	Moderately exposed at the mouth; sheltered to extremely sheltered within loch
Tidal streams	Weak to very weak
Tidal range	3.0 m (mean springs); 1.3 m (mean neaps) (West Loch Tarbert)
Salinity	Fully marine except after heavy rainfall which increases the volume of freshwater input from the many rivers draining into loch, particularly on the south side

Introduction

Loch Resort, on the west coast of the Outer Hebrides, forms part of the boundary between Harris and Lewis. It is a narrow inlet relative to its length, being no more than 0.5 km at its widest point but 9 km long. Just east of its entrance, the loch widens on the north side to form a small bay measuring 0.5 km long by 0.5 km wide, enclosed by the promontories of Rubha Glas and Rubha nan Uan. Loch Resort has no sills and is therefore classified as an open sealoch by Howson, Connor & Holt (1994). However, a spit projects partially across the entrance to the loch, culminating in a shoal, Bo'na Uinneag, at 5 m depth. Although this does not completely block the entrance it restricts water exchange and provides some degree of shelter from wave exposure, giving rise to ecological features characteristic of true fjordic lochs. This feature is presumably the reason why Earll & Pagett (1984) classified Loch Resort as a fjord. The loch is also sheltered from wave action by the island of Greine Sgeir which lies just off its mouth, and the larger island of Scarp, a little further offshore, to the south-west. Freshwater input from the many rivers

draining into Loch Resort, notably the Rivers Housay and Abhainn Mhór Ceann Resort at its head, is high relative to tidal flow and flushing time.

Loch Resort is remote from habitation, being surrounded by extensive moorland to the east and open country used for sheep grazing to the south. The southern shores form the northern boundary of the North Harris SSSI and cSAC. The area is of considerable ornithological, botanical and historical importance.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Sublittoral	Recording (epibiota)	16	July–August 1988	Howson (1989)

Littoral

The shores around Loch Resort have not been surveyed in detail but consist predominantly of bedrock and boulders. They are typical of sheltered shores with a dense mid-shore growth of knotted wrack *Ascophyllum nodosum* and a lower eulittoral colonised by the mussel *Mytilus edulis* and serrated wrack *Fucus serratus*.

Sublittoral

Loch Resort provides excellent examples of marine sublittoral biotopes undisturbed by human activities and supports populations of several nationally rare or scarce species, including the fireworks anemone *Pachycerianthus multiplicatus* and the red algae *Dermocorynus montagnei*, *Tsengia bairdii* and *Schmitzia hiscockiana* (Plaza & Sanderson 1997).

Infralittoral rock

The infralittoral zone consists predominantly of short slopes of bedrock and boulders with the depth of the rock–sediment boundary becoming progressively shallower towards the head of the loch. At the loch entrance it is at a depth of 16 m, whilst at the head there is sediment at 8 m.

Moderately exposed bedrock and boulder slopes are found in the entrance and lower reaches of Loch Resort. In these areas *Laminaria hyperborea* is the dominant kelp, covering the rock to a depth of around 10 m (Lhyp.Ft). At sites just inside the mouth of the loch, a sugar kelp park of *Laminaria saccharina* occurs below the *L. hyperborea* to depths varying between 10 and 18 m (Lsac.Pk). The red algae *Phycodrys rubens*, *Cryptopleura ramosa* and *Plocamium cartilagineum* are common inhabitants of the kelp forest, although the density of epiphytes is generally low, possibly due to urchin grazing (LhypGz.Ft).

Rock surfaces in the loch mouth are less silty than sites within the loch, and in many instances rock beneath the kelp is clear of silt. Coralline, and red and brown algal crusts such as *Cutleria multifida* (*Aglaozonia*) cover much of the rock beneath the kelp canopy. Foliose algae are more frequent in the loch mouth than at sites towards the loch head. Species observed frequently are the red algae *P. cartilagineum*, *C. ramosa* and *Heterosiphonia plumosa*, while *Callophyllis laciniata*, *Lomentaria clavellosa* and *Odonthalia dentata* are occasional. The most common sessile invertebrates are the soft coral *Alcyonium digitatum*, the keel worm *Pomatoceros triqueter* and the ascidians *Clavelina lepadiformis* and *Ciona intestinalis*. The hermit crab *Pagurus bernhardus*, the topshell *Gibbula cineraria* and the echinoderms *Antedon bifida*, *Asterias rubens* and *Echinus esculentus* are also found.

East of Taran Mór the gently sloping bedrock is sheltered to extremely sheltered from wave action, and silt-covered *L. saccharina* predominates down to a depth of 8 m at the head, and 10 m in the mid-loch region (Lsac.Ft). The combined smothering effect of the dense kelp canopy and

silt means that little grows on the rock surfaces other than coralline and brown algal crusts such as *Pseudolithoderma extensum* and *C. multifida* (*Aglaozonia*). There are few foliose algae in the understorey in any one area, though each site often has a different complement of algae so that the species list for the loch as a whole is quite extensive. The red algal species most frequently recorded on the sheltered bedrock and on kelp are *P. rubens*, *Rhodomela confervoides* and *Membranoptera alata*.

In contrast to the paucity of understorey algae in most areas, foliose brown algae form a significant component of the community on the south side below Ard Bearraray mid-way down the loch. They include *C. multifida* (*Aglaozonia*), *Asperococcus turneri* and *Desmarestia viridis*. Sessile animals are most abundant on vertical surfaces, whilst many mobile species occur on the kelp fronds. The most common animals inhabiting boulders and bedrock are the ascidians *Ascidiella aspersa*, *Ascidia mentula*, *C. intestinalis* and *C. lepadiformis* and the featherstar *A. bifida*. Further down in the outer loch region near the mouth, the soft coral *A. digitatum* is frequent. Species inhabiting the kelp fronds include *G. cineraria*, *E. esculentus*, the hydroid *Obelia geniculata* and the sea mat *Membranipora membranacea*. Kelp stipes support *A. bifida* and the ascidians *C. intestinalis*, *Botryllus schlosseri* and *A. mentula*. In general, the more wave-exposed stipes support more epiphytes except in areas where *E. esculentus* is abundant.

Circalittoral rock

There is relatively little circalittoral rock in Loch Resort and the circalittoral zone is narrow, generally only 2–3 m wide, with its upper and lower boundaries varying between 6 and 15 m. Much of the rock in the very sheltered mid and upper regions is heavily silted, with the only algae being coralline and brown crusts including *Pseudolithoderma extensum*. The most abundant animals present are the ascidians *A. mentula* and *C. intestinalis*, the barnacle *Balanus crenatus* and the plumose anemone *Metridium senile* (AmenCio.Met; SubSoAs). The featherstar *Antedon petasus*, the tubeworm *Serpula vermicularis* and the sponge *Halichondria bowerbanki* are common both at the loch head and half-way down the loch.

Sublittoral sediments

The predominant sediment throughout Loch Resort is a uniform soft mud with a flocculent surface. This extends throughout the central channel from 6 m depth at the loch head to 23 m towards the mouth. The mud appears undisturbed by fishing activities or wave action, but has a highly sculptured appearance with numerous mounds, burrows and tracks. The sediment at these sites is characterised by moderate numbers of the rarely observed echiuran worm *Maxmuelleria lankesteri* which constructs large, volcano-like mounds, the anemones *Sagartiogeton undatus*, *Sagartiogeton laceratus* and *Cerianthus lloydii*, the opisthobranch *Philine aperta* and the brittlestar *Amphiura chiajei* (PhiVir).

Circalittoral muddy sediments with sea-pens are restricted in extent and only found towards the mouth of Loch Resort. *Virgularia mirabilis* is the only sea-pen recorded and is common on the north side of the loch opposite Taran Mór in a narrow zone between about 15 and 17 m (VirOph). The seabed here is composed of mixed sediments containing pebbles with coarse sand and mud. Other similar areas of circalittoral muddy sediments with shell gravel are present on the south coast between the entrance and the shore below Taran Beag, but sea-pens are not always present. The burrowing anemone *Peachia cylindrica* and the goose-foot starfish *Anseropoda placenta* are present in small numbers, the latter being restricted to areas with a higher proportion of coarser sediments (IGS). Both these species extend up into the infralittoral, and the fauna of the circalittoral and infralittoral in this area is very similar.

Mixed muddy infralittoral sediments at depths of 5–15 m are found in areas towards the loch mouth, such as the small bay between Rubha Glas and Rubha nan Uan and consist predominantly of mud with a surface layer of shell-gravel or sand. The main difference between these sediments and the circalittoral is the presence of algae attached to stones and shells. *Dictyota dichotoma*, *Sporochnus pedunculatus*, *Brongniartella byssoides*, *Ceramium tenuissimum*, *Bonnemaisonia*

hamifera (Trailliella), *Bonnemaisonia asparagoides* and *Polysiphonia stricta* are typical (IMS), as are the algal crusts *Peyssonnelia dubyi* and *Cruoria pellita*. The scallops *Pecten maximus* and *Aequipecten opercularis*, the echinoderms *A. rubens*, *Astropecten irregularis* and *Ophiura albida*, and the swimming crab *Liocarcinus depurator* are occasional to common, whilst the widely distributed *C. lloydii* and sea-oak *P. aperta* are also common. The snake pipefish *Entelurus aequoreus*, an infrequently observed species, has been recorded here amongst the large brown alga *Halidrys siliquosa*.

The spit which partially obstructs the entrance to Loch Resort down to a depth of 21 m is moderately exposed to wave action and is composed of boulders and cobbles mixed with patches of clean shell-gravel and pebbles. The substratum is similar to the mixed infralittoral sediments described above, but has a greater proportion of coarse material. The algal community on the spit has a different balance of species to that on the more stable bedrock and boulders further inside the loch with several small and more delicate species being prominent (EphR). These include *B. hamifera* (Trailliella), *Apoglossum ruscifolium*, *Hypoglossum hypoglossoides*, *Nitophyllum punctatum*, *Halarachnion ligulatum*, *Pterosiphonia parasitica* and *Schmitzia hiscockiana*. *S. hiscockiana* is considered to be nationally scarce (Sanderson 1996). The red algae *Delesseria sanguinea* and *Phycodrys rubens* and the common urchin *Echinus esculentus* are frequent.

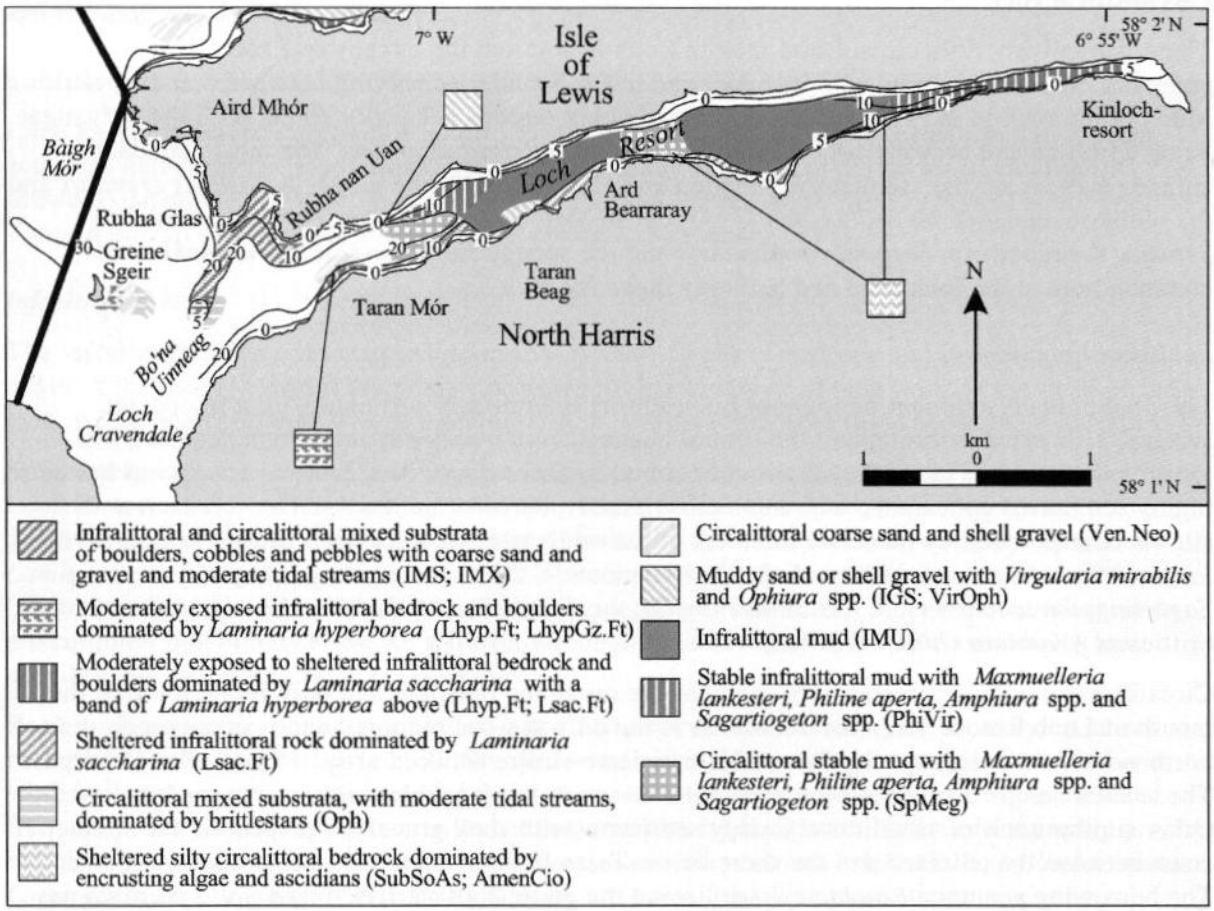

Figure 2.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 2.1, cited literature and additional field observations). Key relates to biotopes found in Loch Resort only.

Nature conservation

Conservation sites		
Site name	*Status*	*Main features*
North Harris	SSSI; cSAC	Botanical; northern Atlantic wet heaths with Erica tetralix
South Lewis, Harris and North Uist	NSA	Landscape

Human influences

Coastal developments and uses

Loch Resort is particularly remote and inaccessible, with the nearest road being the B887 to Hushinish, south-west of the loch. The only habitations in the area are a holiday cottage at Cravadale and lodges at Kinloch-resort, which are inhabited for only short periods during the year. Most of the tourists come for the excellent Atlantic salmon *Salmo salar* fishing to be had in this area. There are no sewage inputs to the loch and no industrial activities in the area.

Marine developments and uses

There are currently no mariculture activities within Loch Resort (data correct in March 1997).

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Sanderson, W.G. 1996. Rare marine benthic flora and fauna in Great Britain: the development of criteria for assessment. *JNCC Report*, No. 240.

Sites surveyed

Survey 21: 1988 UMBSM survey of sealochs of Harris and Lewis (Howson 1989).

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
21	52	Upper end of loch, Loch Resort, Harris	NB 090 175	58°03.0'N 06°56.0'W	PhiVir
21	53	Opposite Tartaonig, Loch Resort, Harris	NB 085 174	58°02.9'N 06°56.4'W	PhiVir; AmenCio.Met
21	54	Mid loch, N of Mullach Arispry, Loch Resort, Harris	NB 074 173	58°02.9'N 06°57.6'W	PhiVir
21	55	S side, W of Mullach Arispry, Loch Resort, Harris	NB 073 168	58°02.6'N 06°57.6'W	IMX; Lsac.Ft
21	56	Mid loch, opposite Creag an Fhithich, Loch Resort, Harris	NB 064 171	58°02.7'N 06°58.6'W	PhiVir
21	57	S side, below Ard Bearraray, Loch Resort, Harris	NB 063 168	58°02.5'N 06°58.6'W	SpMeg; SubSoAs
21	58	Mid loch, NW of Ard Bearraray, Loch Resort, Harris	NB 053 168	58°02.5'N 06°59.6'W	PhiVir
21	59	S side, N of Taran Beag, Loch Resort, Harris	NB 049 164	58°02.3'N 07°00.0'W	VirOph; Lhyp.Ft
21	60	S side, N of Taran Meadhoin, Loch Resort, Harris	NB 042 161	58°02.1'N 07°00.7'W	IMX; Lsac.Pk
21	61	Rubha nan Uan, Loch Resort, Harris	NB 025 158	58°01.9'N 07°02.4'W	LhypGz.Ft
21	63	Mid loch, N of Taran Mór, Loch Resort, Harris	NB 034 160	58°02.0'N 07°01.5'W	SpMeg; VirOph; Lsac.Pk
21	64	S side, N of Taran Mór, Loch Resort, Harris	NB 032 158	58°01.9'N 07°01.7'W	IGS; LhypGz.Ft
21	65	Bay E of Rubha Glas, Loch Resort, Harris	NB 024 165	58°02.2'N 07°02.6'W	IMS; LhypLsac.Ft
21	66	S of Bo'na Uinneag, entrance to loch, Loch Resort, Harris	NB 022 154	58°01.6'N 07°02.7'W	Oph; Lhyp.Ft
21	67	Sill, N of Bo'na Uinneag, Loch Resort, Harris	NB 021 157	58°01.8'N 07°02.8'W	EphR
21	84	SE Greine Sgeir, Bràigh Mór, Lewis	NB 012 155	58°01.6'N 07°03.7'W	Oph; Phy.R; VirOph; Ven.Neo; FaAlC; Lhyp.Ft; LhypLsac.Ft; LhypGz.Ft

Compiled by: Ruth Beaver and Frances Dipper

3 Lochs Tealasavay and Tamanavay

Location		
Position (centre)	NB 025 190	58°4'N 07°2'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

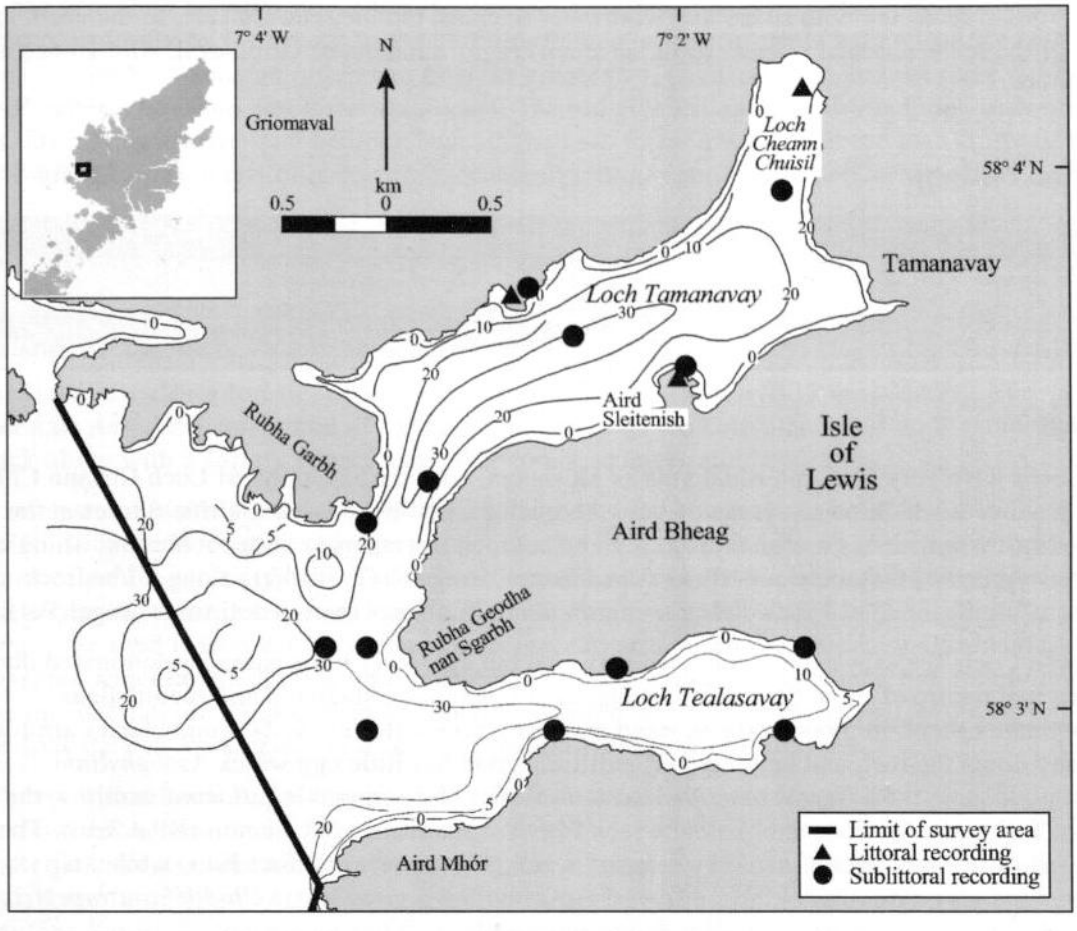

Figure 3.1 Main features of the area, showing sites surveyed.

Physical features		
	Loch Tealasavay	*Loch Tamanavay*
Physiographic type	Open sealoch	Fjordic sealoch with one sill at 9 m depth
Length of coast	21.1 km	
Length of inlet	4.1 km	
Area of inlet	5.1 km^2	
Bathymetry	Maximum depth 30 m	Maximum depth 40 m
Wave exposure	Moderately exposed throughout	Entrance moderately exposed; head very sheltered; elsewhere sheltered throughout loch
Tidal streams	Very weak	Weak to very weak
Tidal range	3.0 m (mean springs); 1.3 m (mean neaps)	(West Loch Tarbert)
Salinity	Fully marine	Fully marine

Introduction

Lochs Tealasavay and Tamanavay lie in a particularly remote area on the west coast of Lewis. The two lochs, both less than 4 km long, are separated from each other by the narrow rocky headland of Aird Bheag, and from Loch Resort (*Area summary* 2) to the south by the peninsula of Aird Mhór. The island of Scarp is situated just over 3 km south-west of Loch Tealasavay and gives some protection to the lochs from the Atlantic swell. Loch Tamanavay, which is fjordic in character, receives additional shelter from the smaller headland of Rubha Garbh, which extends part of the way across the entrance. Loch Tealasavay, in contrast, is an open sealoch with no sills and a wider entrance. To the east of the loch system the land is relatively low-lying and undulating, intersected with rivers and freshwater lochans. On the seaward side, to the north and south of the lochs the land rises to form the steep craggy summits of Griomaval, Aird Bheag and Aird Mhór.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	3	July-August 1988	Howson (1989)
Sublittoral	Recording (epibiota)	13	July-August 1988	Howson (1989)

Littoral

Both lochs have very little intertidal area as all shores, with the exception of Loch Cheann Chuisil at the head of Loch Tamanavay, are of steep bedrock backed by low-lying cliffs. Shores at the head of Loch Tamanavay are of deeply creviced bedrock interspersed with cobbles and shingle. Lichens typically inhabit the supralittoral and littoral fringe (YG; Ver.Ver) along all bedrock shores, while channelled wrack *Pelvetia canaliculata* dominates the lower littoral fringe (Pel).

Shores in Loch Tealasavay have not been surveyed but are likely to be barnacle-dominated due to the exposed nature of the loch. Loch Tamanavay is much more sheltered and fucoid algae predominate except on moderately exposed and steep promontories. Such promontories are found mid-way down the loch and here the mid-eulittoral zone has little egg wrack *Ascophyllum nodosum*. Instead the barnacle *Semibalanus balanoides*, the periwinkle *Littorina saxatilis*, the dogwhelk *Nucella lapillus* and bladder wrack *Fucus vesiculosus* are common (BPat.Sem). The lower eulittoral zone is dominated by serrated wrack *Fucus serratus* (Fser.Fser) while kelp *Laminaria digitata* dominates the sublittoral fringe with the green algae *Cladophora rupestris* and *Enteromorpha* sp. (Ldig.Ldig).

The head of Loch Tamanavay, Loch Cheann Chuisil, is very sheltered, and in contrast to the moderately exposed shores nearer the entrance, has a mid-eulittoral zone covered with a blanket of *A. nodosum* with heavy growths of the epiphytic red alga *Polysiphonia lanosa*, along with *C. rupestris*, the limpet *Patella vulgata* and the beadlet anemone *Actinia equina* (Asc.Asc). *Fucus spiralis* predominates in the upper eulittoral zone (Fspi), while *A. equina* and the red alga *Catenella caespitosa* can be found under overhangs and in crevices. The lower shore is colonised by the mussel *Mytilus edulis* and *F. serratus* with some *A. nodosum* (Fser.Fser). Patches of cobbles on the lower shore are colonised by *S. balanoides*.

Sublittoral

Loch Tealasavay

The depth of the rock–sediment interface varies throughout Loch Tealasavay, with a maximum of 30 m at the entrance, 17–22 m mid-way down the loch and 8 m at the head. On the north side the rock extends below the lower limit of the kelp as a rather impoverished circalittoral zone

(AmenCio). The open nature of the loch results in greater wave exposure throughout its length and as a result the predominant kelp is *Laminaria hyperborea*. This extends as a forest and park down to 17 m from the entrance to mid-way along the north side, and to 8 m at the head of the loch (Lhyp.Ft; Lhyp.Pk). The undergrowth beneath the kelp forest is rich in species and includes the foliose red algae *Bonnemaisonia hamifera* (Trailliella), *Plocamium cartilagineum*, *Delesseria sanguinea*, *Membranoptera alata*, *Phycodrys rubens* and *Cryptopleura ramosa*, the brown alga *Dictyota dichotoma*, the encrusting brown alga *Cutleria multifida* (*Aglaozonia*) and pink coralline crusts. There is a variety of sessile fauna inhabiting the bedrock, including the soft coral *Alcyonium digitatum* and *Caryophyllia smithii*, the keel worm *Pomatoceros triqueter* and the ascidians *Clavelina lepadiformis*, *Ciona intestinalis* and *Botryllus schlosseri*. Kelp fronds are colonised profusely by the bryozoan *Membranipora membranacea*, while kelp stipes are colonised by the echinoderms *Antedon bifida* and *Echinus esculentus*, *C. intestinalis* and the red foliose algae *P. rubens*, *M. alata* and *P. cartilagineum*. The red alga *Ptilota plumosa* is found only on kelp stipes. Overhangs and vertical bedrock beneath the kelp forest are found at the loch entrance and are colonised by a rich turf of anemones, soft coral, sponges and hydroids (CorMetAlc).

On the south shore on a small promontory about 500 m west of the head, there is a band dabberlocks *Alaria esculenta* on steep bedrock down to 7 m depth (Ala.Myt), reflecting the wave-exposed nature of Loch Tealasavay. The steep bedrock beneath the *A. esculenta* forest is rich in species with a turf of the sponges *Halichondria panicea* and *Myxilla incrustans*, theanemones *Metridium senile* and *Sagartia elegans* and the colonial ascidian *Botryllus schlosseri* (SCAn). Below the *A. esculenta* forest, *Laminaria saccharina* extends down to 17 m (Lsac.Ft). The featherstars *Antedon petasus* and *A. bifida* are abundant on the kelp plants and on the underlying bedrock along with a variety of ascidians, soft corals, sponges and bryozoans.

The coarsest sediments are found in the moderately exposed entrances to both the lochs, between about 20–40 m deep. These sediments consist of rippled, mobile sands and gravels with small amounts of mud. Species typical of mobile sediments, such as the sea cucumber *Neopentadactyla mixta*, are found at the outer sites (Ven.Neo). Other common species include the scallop *Pecten maximus*, the sand mason worm *Lanice conchilega*, the echinoderms *Ophiura ophiura* and *Astropecten irregularis* and the hermit crab *Pagurus bernhardus*. Also present, but not ubiquitous across this habitat, are the polychaetes *Sabella pavonina* and *Chaetopterus variopedatus*, the goose-foot starfish *Anseropoda placenta* and the dragonet *Callionymus lyra*.

Sediments within Loch Tealasavay are fairly uniform, consisting of mud with sand or shell gravel, and extend throughout the loch from the base of the bedrock slope to around 30 m depth. The characteristic species here are the sea-pen *Virgularia mirabilis* and the brittlestars *Amphiura chiajei*, *Amphiura filiformis*, *Ophiura albida* and *O. ophiura* (VirOph). The burrowing anemone *Cerianthus lloydii*, *L. conchilega* and *C. variopedatus* and *P. maximus* are also frequent or common in this habitat. *C. lyra*, which is characteristic of mixed muddy sediments, is also common. Species occasionally present include the echiuran *Maxmuelleria lankesteri*, the sponge *Suberites ficus* and the opisthobranch mollusc *Philine aperta*. Rather barren infralittoral muddy sand is present at the head of the loch (LsacX).

Loch Tamanavay

The depth of the rock–sediment interface varies throughout Loch Tamanavay, being about 30 m at Rubha Geodha nan Sgarbh at the entrance to the loch, 16 m mid-way down on the north side and 5 m mid-way on the south side. *L. hyperborea* kelp forest extends to around 20 m depth on both sides of the loch entrance and is also found half-way along the north side at moderately exposed promontories (Lhyp.Ft). The assemblage of species in these areas is similar to that of the same biotope in Loch Tealasavay, with a good covering of brown and red encrusting algae and a variety of foliose algae inhabiting rock surfaces and kelp stipes. A variety of colonial ascidians, the featherstar *A. bifida* and the common urchin *E. esculentus* dominate the faunal component of the community, with *A. digitatum* and the grey topshell *Gibbula cineraria* present at most sites.

The kelp thins out with increasing depth down to 21 m at Rubha Garbh close to the entrance, while the underlying bedrock supports a similar assemblage of species to that in the upper infralittoral (Lhyp.Pk). Species common here but rarer or absent in the upper infralittoral include the sponge *Myxilla fimbriata*, the bryozoan *Parasmittina trispinosa*, and the hydroids *Abietinaria abietina* and *Nemertesia antennina*.

Sheltered areas inside Loch Tamanavay have kelp forest that is either a mixture of *L. hyperborea* and *L. saccharina* or which consists of *L. saccharina* only. Inside the loch at its narrowest point on the south side, *L. saccharina* dominates the kelp forest from depths of 2–16 m (Lsac.Ft). This area has a high diversity of fauna, in particular ascidians, but no encrusting red and brown algae. Bedrock beneath the kelp forest is colonised frequently by the foliose algae *Bonnemaisonia asparagoides* and *D. dichotoma*, *A. digitatum*, *P. triqueter*, the sponge *M. incrustans* and the ascidians *B. schlosseri*, *Corella parallelogramma* and *C. intestinalis*.

Mid-way down Loch Tamanavay on the south side there is a mixture of *L. saccharina* and *L. hyperborea* (LhypLsac.Ft). Species-richness beneath the kelp, particularly of fauna, is low, comprising mainly the foliose red algae *Chondrus crispus* and *Furcellaria lumbricalis* and the urchin *E. esculentus*. The nudibranch *Facelina bostoniensis* is an ephemeral inhabitant occurring in the summer feeding on hydroids. The snakelocks anemone *Anemonia viridis* is common on *L. saccharina* fronds at depths down to 6 m. *Ptilota plumosa* and *Phycodrys rubens* grow epiphytically on the kelp stipes, while the bryozoans *Membranipora membranacea* and *Electra pilosa* are common on the kelp fronds.

Circalittoral rock is present on both sides of the entrance to Loch Tamanavay and half-way along the north side. This consists either of vertical and steep bedrock below the kelp forest or, at Rubha Geodha nan Sgarbh, of large boulders leading to pebbles and cobbles down to about 30 m depth. The rock is rather bare and most surfaces are completely covered with the encrusting brown alga *Pseudolithoderma extensum* and coralline crusts. This biotope appears heavily grazed by *E. esculentus*, with few species present in any abundance. Foliose algae are sparse and represented mostly by the red alga *Delesseria sanguinea* and the brown alga *D. dichotoma* (FaAlC; AmenCio). Rock surfaces are silt-free and generally devoid of upright and mobile species apart from occasional colonies of *A. digitatum* and the urchin *E. esculentus*. Other species present are those resistant to scour and grazing, such as the bryozoans *Porella compressa* and *P. trispinosa*, *P. triqueter*, the featherstar *A. bifida*, the cup coral *C. smithii* and the ascidians *C. intestinalis* and *Clavelina lepadiformis*. A few sponges including *Cliona celata* and *Pachymatisma johnstonia* are present but none are particularly abundant.

Sediments just inside the narrowest part of the loch near the entrance consist of mud with sand or shell gravel, extending from the base of the bedrock to approximately 24 m depth. Characteristic species include the brittlestars *O. ophiura* and *O. albida* and the sea-pen *Virgularia mirabilis* (VirOph). Also frequent are the burrowing anemone *C. lloydii*, the opisthobranch mollusc *P. aperta*, the polychaetes *Lanice conchilega* and *Chaetopterus variopedatus*, the turret shell *Turritella communis*, the scallop *P. maximus* and the dragonet *C. lyra*. The burrowing brittlestars *Amphiura chiajei* and *A. filiformis* are also frequent, but occur more commonly in deeper mud plains in the centre of the loch.

The remaining sediments throughout the sheltered centre of the loch are comprised of a fine mud characterised by an abundance of vertical burrows and volcanoes, most of which probably result from the activities of the echiuran worm *M. lankesteri* (IMU). Common species here are *A. chiajei* and *A. filiformis*, the anemones *Sagartiogeton laceratus* and *S. undatus* and the swimming crab *Liocarcinus depurator*, but there are no sea-pens. This sediment biotope is very similar to that found throughout the sheltered Loch Resort (*Area summary* 2) to the south.

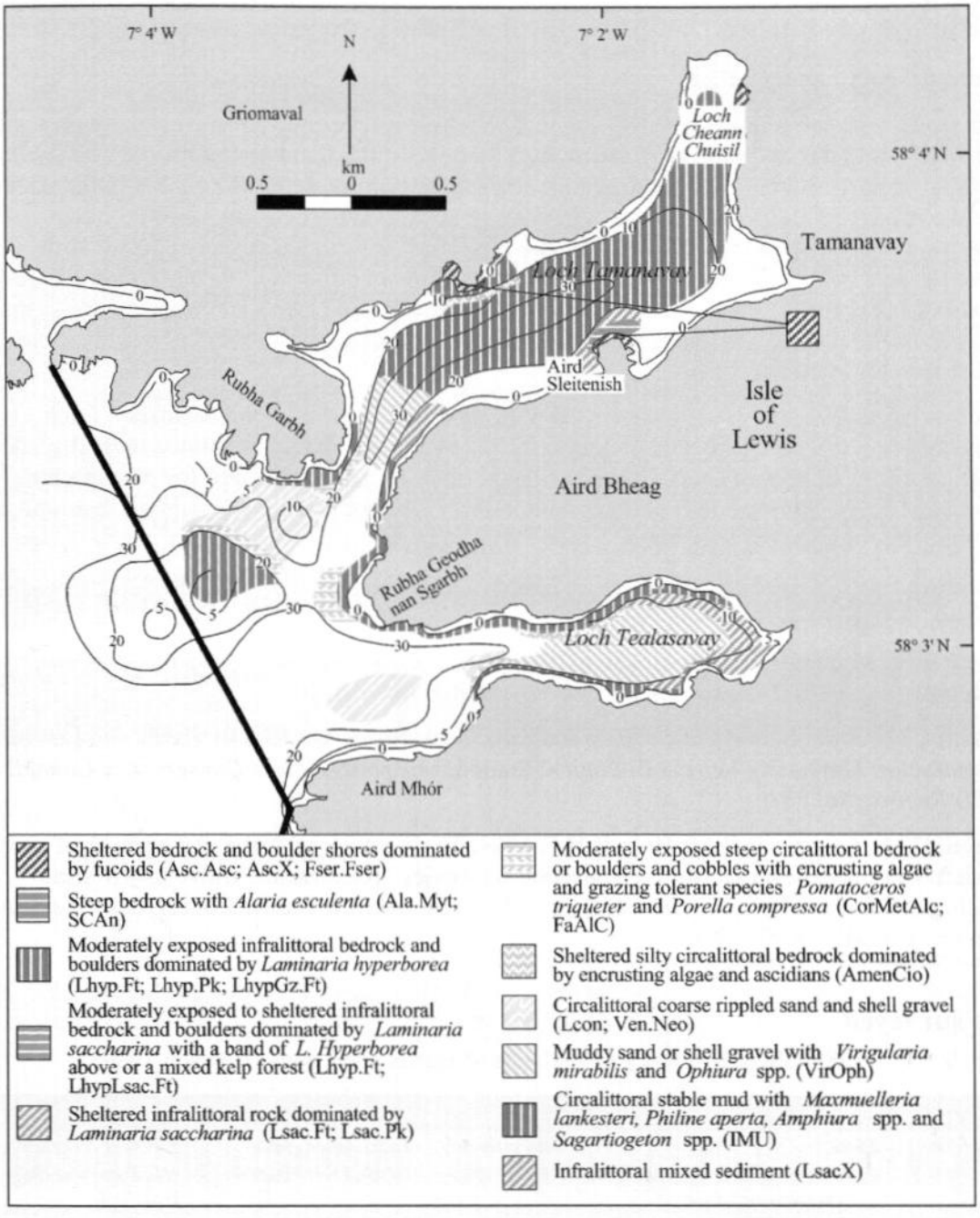

Figure 3.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 3.1, cited literature and additional field observations).

Nature conservation

Conservation sites		
Site name	***Status***	***Main features***
South Lewis, Harris and North Uist	NSA	Landscape

Human influences

Coastal developments and uses

There are no villages or roads within 7 km of Lochs Tealasavay and Tamanavay although there are a few small buildings at Tamanavay and at Aird Sleitenish which are probably used seasonally or by fish farmers. The B887 road from Tarbert stops at Hushinish on the coast 8 km to the south, while the road from the north peters out 4 km away at Mealista. There are no shore-based industries and no sewage inputs. There are two boat slips in Loch Tamanavay east of Aird Sleitenish, presumably for use by fish farmers or fishermen potting for lobsters *Homarus gammarus* and crabs.

Marine developments and uses

Due to its more open, exposed character, there is no mariculture in Loch Tealasavay. Loch Tamanavay, however, supports two mussel rafts, one Atlantic salmon farm and a mussel spat-collecting raft belonging to Comhairle nan Eilean. Loch Tamanavay is used for creeling for crabs and lobsters *H. gammarus* and is an important nursery area for herring *Clupea harengus* and a spawning site for cod *Gadus morhua*.

References and further reading

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Sites surveyed

Survey 21: 1988 UMBSM survey of sealochs of Harris and Lewis (Howson 1989).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
21	74	Point W of Gleann Sgaladal, Loch Tamanavay, Lewis	NB 022 202	58°04.2'N 07°03.0'W	YG; Fser; Ver; Pel; Bpat.Sem
21	75	Aird Sleitenish, Loch Tamanavay, Lewis	NB 030 198	58°04.0'N 07°02.2'W	Fser.Fser; Pel; BPat.Sem
21	77	E shore, Loch Cheann Chuisil, Loch Tamanavay, Lewis	NB 036 212	58°04.8'N 07°01.7'W	AscX; Ver.Ver; Fspi; Asc.Asc; Fser.Fser; Pel

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
21	69	N of Bo Thorcuil, entrance to loch, Loch Tamanavay, Lewis	NB 013 185	58°03.3'N 07°03.8'W	FaAlC; IMX; LhypGz.Ft; EphR
21	70	Dubh Sgeir, entrance to loch, Loch Tamanavay, Lewis	NB 015 185	58°03.3'N 07°03.6'W	FaAlC Lhyp.Ft; Lhyp.Pk
21	71	Rubha Garbh, Loch Tamanavay, Lewis	NB 015 191	58°03.6'N 07°03.7'W	FaAlC; CGS; Lhyp.Ft
21	72	SE side, opposite Rubha Garbh, Loch Tamanavay, Lewis	NB 018 193	58°03.7'N 07°03.4'W	VirOph Lsac.Ft
21	73	Central channel, Loch Tamanavay, Lewis	NB 025 200	58°04.1'N 07°02.7'W	SpMeg
21	74	Point W of Gleann Sgaladal, Loch Tamanavay, Lewis	NB 022 202	58°04.2'N 07°03.0'W	AmenCio; IMU; Ldig; Lhyp.Ft
21	75	Aird Sleitenish, Loch Tamanavay, Lewis	NB 030 198	58°04.0'N 07°02.2'W	IMU; Ldig.Ldig; LhypLsac.Ft; LsacX; Tra
21	76	Loch Cheann Chuisil, Loch Tamanavay, Lewis	NB 035 207	58°04.5'N 07°01.8'W	SpMeg
21	78	Bo'na Surraig, Loch Tealasavay, Lewis	NB 024 181	58°03.1'N 07°02.7'W	FaAlC; Lcon; Lhyp.Ft; CorMetAlc
21	79	E of Rubha Gleann na Curach, Loch Tealasavay, Lewis	NB 027 184	58°03.3'N 07°02.4'W	AmenCio; VirOph; Lhyp.Ft
21	80	Rubha Reinoil, Loch Tealasavay, Lewis	NB 035 181	58°03.1'N 07°01.6'W	VirOph; Ala.Myt; Lsac.Ft; SCAn
21	81	NW of Mol Tealasavay, Loch Tealasavay, Lewis	NB 036 185	58°03.3'N 07°01.5'W	Lhyp.Ft; LsacX
21	82	Centre of outer loch, Loch Tealasavay, Lewis	NB 015 181	58°03.0'N 07°03.6'W	Ven.Neo

Compiled by: Ruth Beaver & Frances Dipper

4 Camas Uig

Location		
Position (centre)	NB 040 330	58°11'N 07°2'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

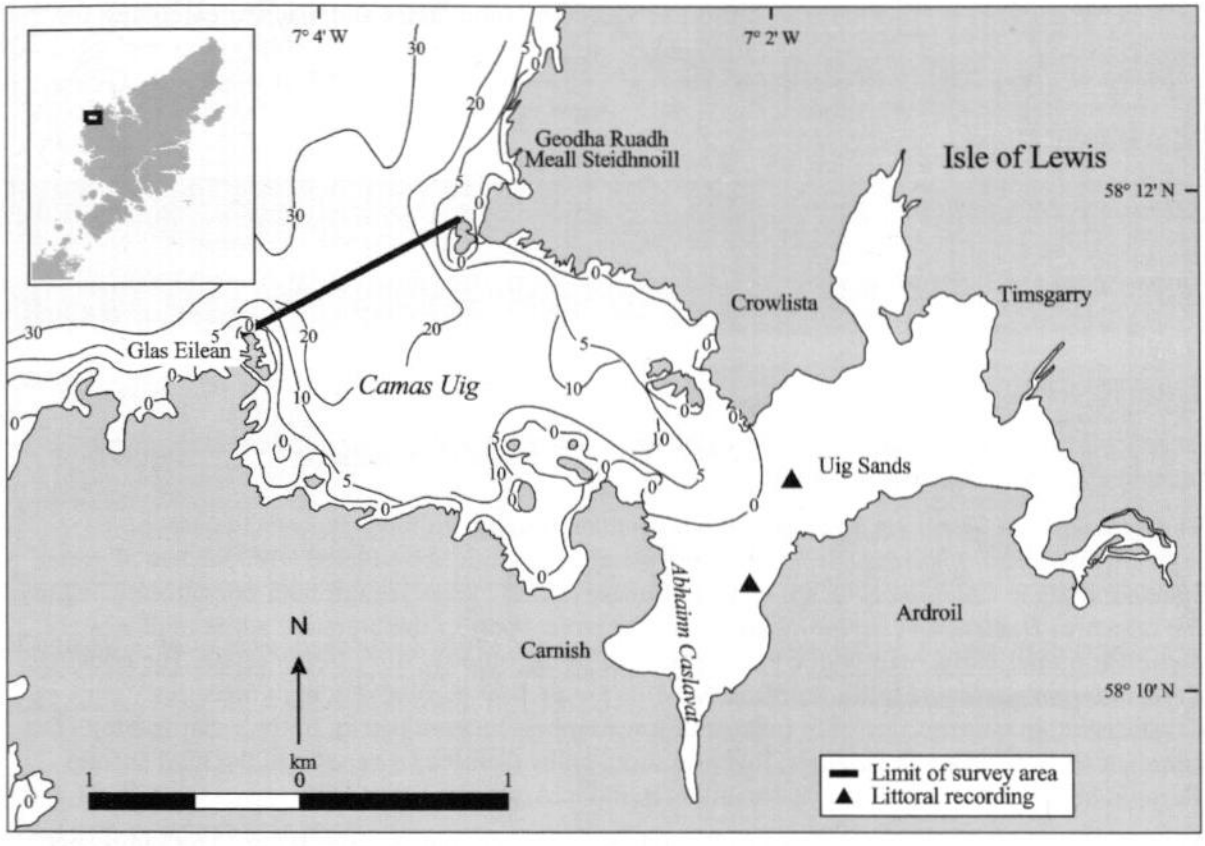

Figure 4.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Open sealoch with no sill
Length of coast	24.2 km (26.9 km including islands)
Length of inlet	4.32 km
Area of inlet	4.7 km^2 (4.6 km^2 excluding islands)
Bathymetry	Maximum depth 23 m at entrance; shallow at head with a large expanse of intertidal sand (Uig Sands)
Wave exposure	Extremely sheltered towards head; exposed at entrance
Tidal streams	Weak
Tidal range	3.8 m (mean springs); 1.5 m (mean neaps) (Little Benera)
Salinity	Fully marine

Introduction

Camas Uig is a small open sealoch, dotted with sgeirs and skerries, situated on the north-west coast of Lewis. The loch is shallow and the seabed slopes gently upwards from a depth of 23 m at the entrance to 9 m near the head. The sandy seabed then shelves further and the bay opens out into a large expanse of clean white intertidal sand, intersected by three rivers. The most southerly of these, Abhainn Caslavat, enters the sands in the south near the village of Carnish. The second river enters the bay from the north between the villages of Crowlista and Timsgarry. Between the sands and the village of Timsgarry lies an area of grazed saltmarsh. The third and largest river joins the bay close to Ardroil, bringing freshwater from Loch Suainaval, a large deep freshwater loch to the south-east. The shore at Ardroil is backed by sand dunes and machair extending for nearly 3 km.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	1	September 1982	Smith (1983)
	Recording (epibiota)	1	May 1978	Powell *et al.* (1979)

Littoral

In general the sands at Camas Uig are mobile and lower shore fauna are limited; those species present are subject to tidal scour.

The fine sands at Crowlista and Carnish are firm and pitted with the burrows and casts of lugworms *Arenicola marina*. Areas retaining water at low tide are covered with patches of green ephemeral algae *Enteromorpha* sp. Faunal biomass in these areas is high with polychaetes, mainly the ragworm *Hediste diversicolor*, making up the largest part of the biomass, while molluscs are dominant numerically, mainly due to the presence of the mud snail *Hydrobia ulvae*. The cockle *Cerastoderma edule* and tellin *Macoma balthica* are present at relatively high densities. Crustaceans, in contrast, are only present in low numbers and are patchy in their distribution. The common shrimp *Crangon vulgaris*, juvenile shore crabs *Carcinus maenas* and the mud shrimp *Corophium volutator* are the most common (HedMac.Are).

The shores at Ardroil have a flatter profile and are more exposed to wave action. The sediments are coarser than those at Crowlista and consist predominantly of medium sand. Faunal biomass is very low, with the sandhopper *Talitrus saltator* being the sole occupant of the upper shore. The mid and lower shores are dominated by the polychaetes *Nephtys cirrosa* and *Scolelepis squamata* and the isopod *Eurydice pulchra* with low numbers of the bivalves *Angulus tenuis*, *C. edule* and *Donax vittatus* (AP.P).

Sublittoral

No information is available on the sublittoral habitats, although the area is known to be important as a nursery ground for plaice *Pleuronectes platessa* and further offshore as a spawning area for cod *Gadus morhua*.

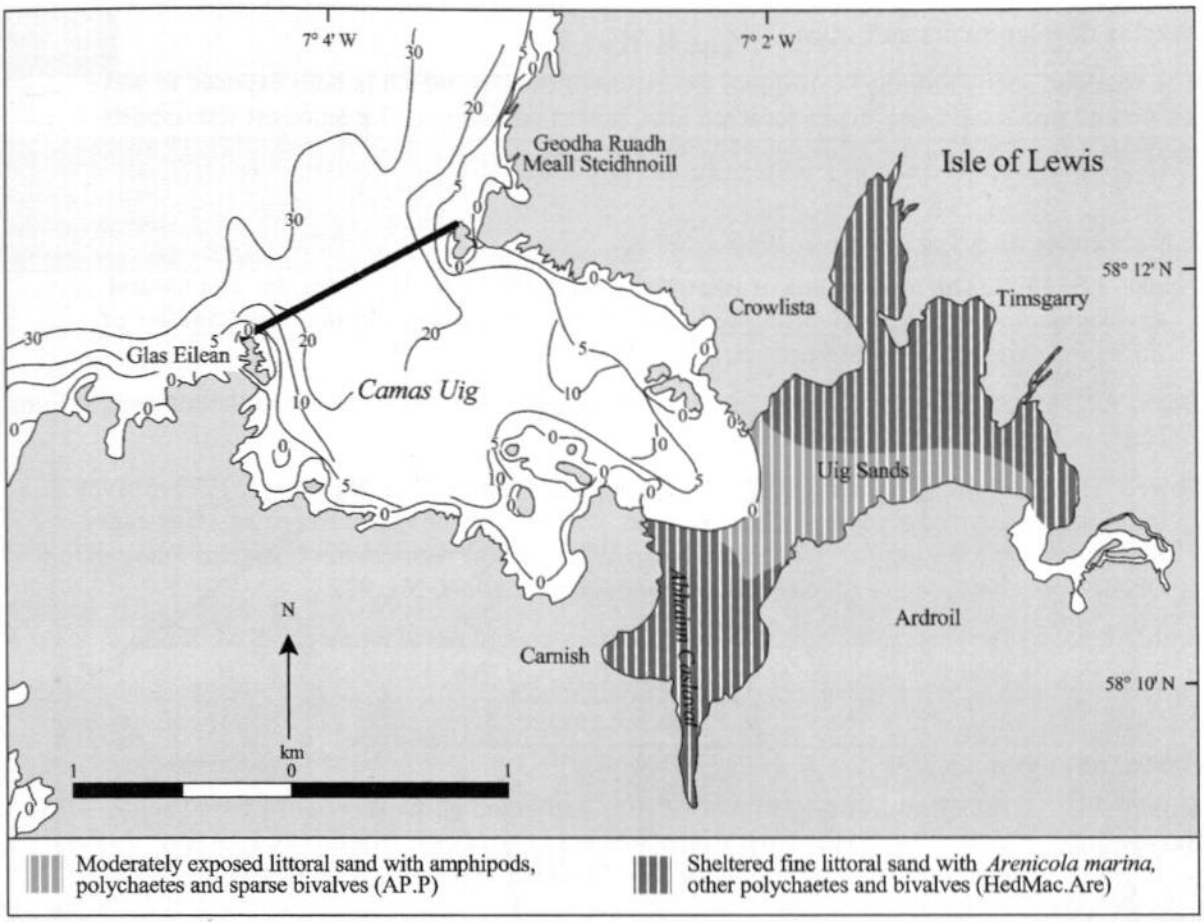

Figure 4.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 4.1, cited literature and additional field observations).

Nature conservation

Conservation sites		
Site name	***Status***	***Main features***
South Lewis, Harris and North Uist	NSA	Landscape

Human influences

Coastal developments and uses

The outer bay and the rocky coastline to the north have no road access. The coast around Uig Sands is served by minor roads passing through the small settlements of Carnish, Ardroil, Crowlista and Timsgarry. At Carnish, where the river Abhainn Caslavat opens out into Uig Sands, there is a large sand and gravel quarry. The extracted material intrudes onto the sands, creating an artificial shore, and an effluent pipe extends from the quarry into the estuary. The clean sandy beaches, wildlife and antiquities of the area attract holidaymakers, but even in summer beach recreation is not intensive and there are few developments around the bay. The sand dunes and saltmarsh are grazed by sheep.

Marine developments and uses

The shallow, gently sloping seabed and the nature of the bay, which is both exposed to wave action and protected from strong tidal streams, makes the bay popular amongst watersports enthusiasts.

References and further reading

Angus, I.S. 1979. The macrofauna of intertidal sand in the Outer Hebrides. *In*: The natural environment of the Outer Hebrides (ed. J.M. Boyd). *Proceedings of the Royal Society of Edinburgh. Series B: Biological Sciences, 77*: 155–171.

Buck, A.L. 1993. *An inventory of UK estuaries. Volume 3. North-west Britain*. Peterborough, Joint Nature Conservation Committee.

Powell, H.T., Holme, N.A., Knight, S.J.T., Harvey, R., Bishop, G. & Bartrop, J. 1979. Survey of the littoral zone of the coast of Great Britain. 3. Shores of the Outer Hebrides. (Contractor: Scottish Marine Biological Association/Marine Biological Association Intertidal Survey Unit, Oban/Plymouth.) *Nature Conservancy Council, CSD Report*, No. 272.

Smith, S.M. 1983. The shores of Lewis: marine flora and fauna. (Contractor: S.M. Smith, Edinburgh.) *Nature Conservancy Council, CSD Report*, No. 470.

Sites surveyed

Survey 92: 1983 Smith survey of marine flora and fauna of the shores of Lewis (Smith 1983).
Survey 265: 1970-1980 SMBA/MBA intertidal survey of Great Britain (Powell *et al.* 1979).
– Macrofauna of intertidal sand in the Outer Hebrides (Angus 1979).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
92	4	Ardroil, Camas Uig, Lewis	NB 038 325	58°10.9' N 07°02.4'W	LS
265	200	Uig Sands, Camas Uig, Lewis	NB 040 330	58°11.1'N 07°02.2'W	HedMac.Are; AP.P

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5 Loch Roag

Location		
Position (centre)	NB 130 340	58°12'N 06°53'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

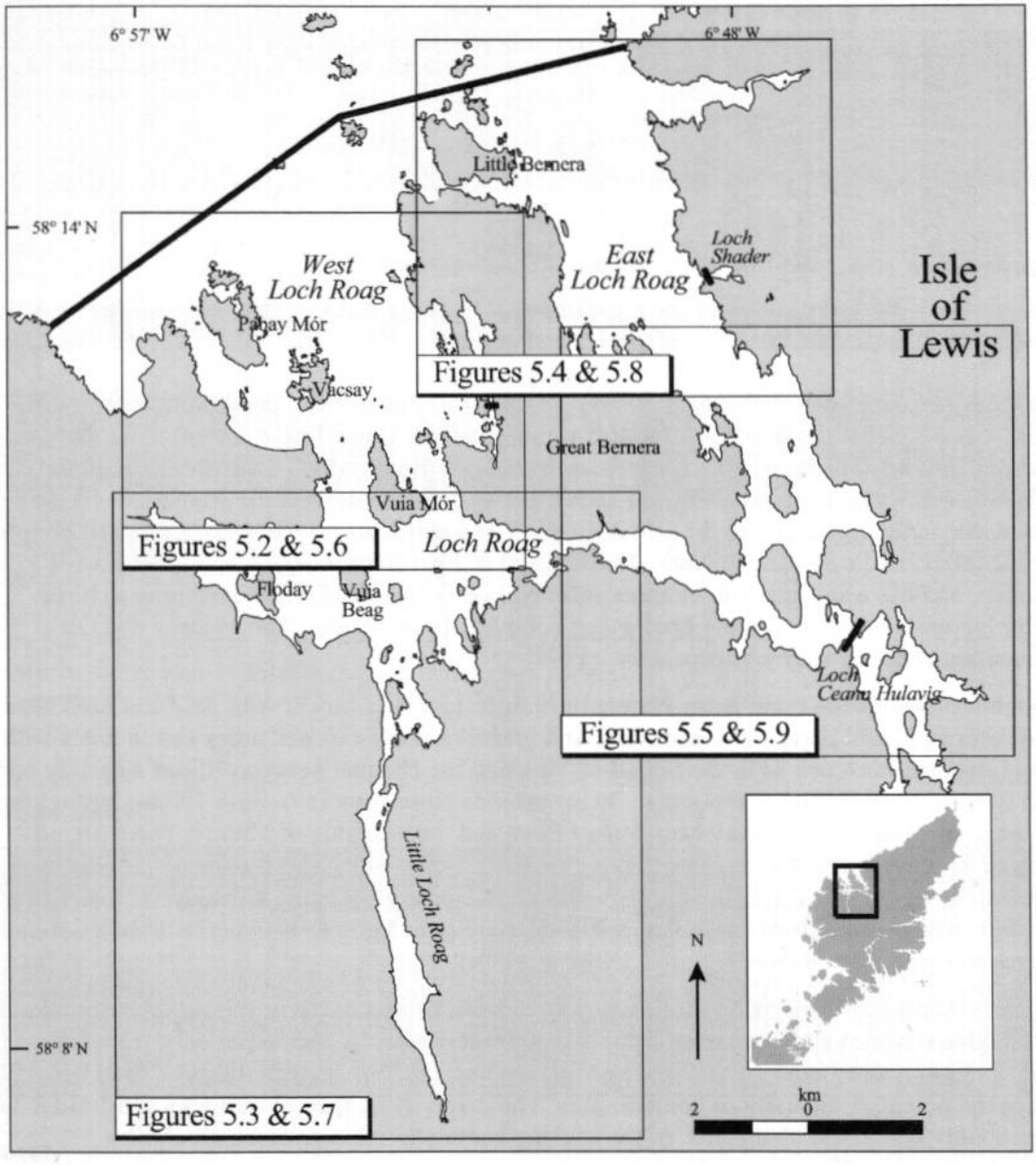

Figure 5.1 Location and main features of the area. (See Figures 5.2–5.5 for details and sites surveyed.)

Physical features	
Physiographic type	Fjordic sealoch with fjard-like features
Length of coast	123.3 km (283.5 km including islands)
Length of inlet	15.9 km
Area of inlet	99.5 km^2 (69.3 km^2 excluding islands)
Bathymetry	Maximum depths: Little Loch Roag 15 m; East and West Loch Roag 29 m; Loch Roag entrance 45 m.
Wave exposure	The north side of Pabay Mór and the islands north of Little Bernera at the entrance to the loch complex are very exposed. West Loch Roag, Kyles Vuia and the mid and upper reaches of East Loch Roag are moderately exposed to exposed. The lower reaches of East Loch Roag, Kyles of Little Bernera, Loch Roag and Little Loch Roag are very sheltered to sheltered.
Tidal streams	Very weak to weak in Loch Roag. Moderately strong in Kyles Vuia, East Loch Roag, around the islands of Pabay Mór, Vacsay, Campay, Kealasay and also at Kyles of Little Bernera and at Bernera Bridge. Strong around the east coast of Pabay Beag and in entrance channel to Little Loch Roag
Tidal range	3.8 m (mean springs); 1.5 m (mean neaps) (Little Benera)
Salinity	Fully marine; variable in Little Loch Roag

Introduction

The Loch Roag complex is one of the most important marine areas in the Western Isles. It is the largest sealoch system in the Outer Hebrides and is roughly divided into five interconnected parts: East Loch Roag, West Loch Roag, Loch Roag, Little Loch Roag and Loch Ceann Hulavig. Little Loch Roag is a long, narrow extension at the south end of the system, penetrating over 6 km inland. It is only about 500 m wide and has a long narrow sill just below low water at the entrance. This sill separates Little Loch Roag from Loch Roag, which is also very sheltered. East and West Loch Roag are separated from each other by the islands of Little Bernera and Great Bernera, the latter connected to the Isle of Lewis by a short road bridge. Loch Ceann Hulavig is a very sheltered fjardic system connected to the head of East Loch Roag by a submerged sill at Callanish, and has a reduced and variable salinity. Loch Ceann Hulavig, together with three smaller lagoonal inlets within the Loch Roag complex, Loch Shader, Tòb Valasay and Ob Cheannulag, is described by Thorpe *et al.* (1998).

Throughout most of the Loch Roag system the substratum is sediment with mud and muddy sands in the inner sheltered parts and clean sands and gravel in wave-exposed areas and in areas with strong tidal streams, such as in the Sound of Vuia and the channel between Eilean Kearstay and Great Bernera. Deep water (deeper than 30 m) extends close inshore (within 100 m) around the headlands north of Valtos, Pabay Mór, Pabay Beag and the east side of Vacsay. There are no extensive areas of circalittoral rock offshore, the rock slopes being mostly steep and meeting sediment close inshore. Tidal streams throughout the area are generally weak apart from a few areas where there are narrows resulting in rapids, such as at Bernera Bridge (Earshader) and at the entrance to Little Loch Roag.

The loch system exhibits a fairly wide diversity of habitats as a result of the complex topography and the wide range of exposure to wave action and tidal currents. Sediments vary from coarse mobile sand to muddy sand and mud. However, the lack of deep circalittoral rock somewhat reduces the potential diversity of communities. The diversity of species on rocky substrata is fairly low, probably due to the abundance of the grazing common urchin *Echinus esculentus*.

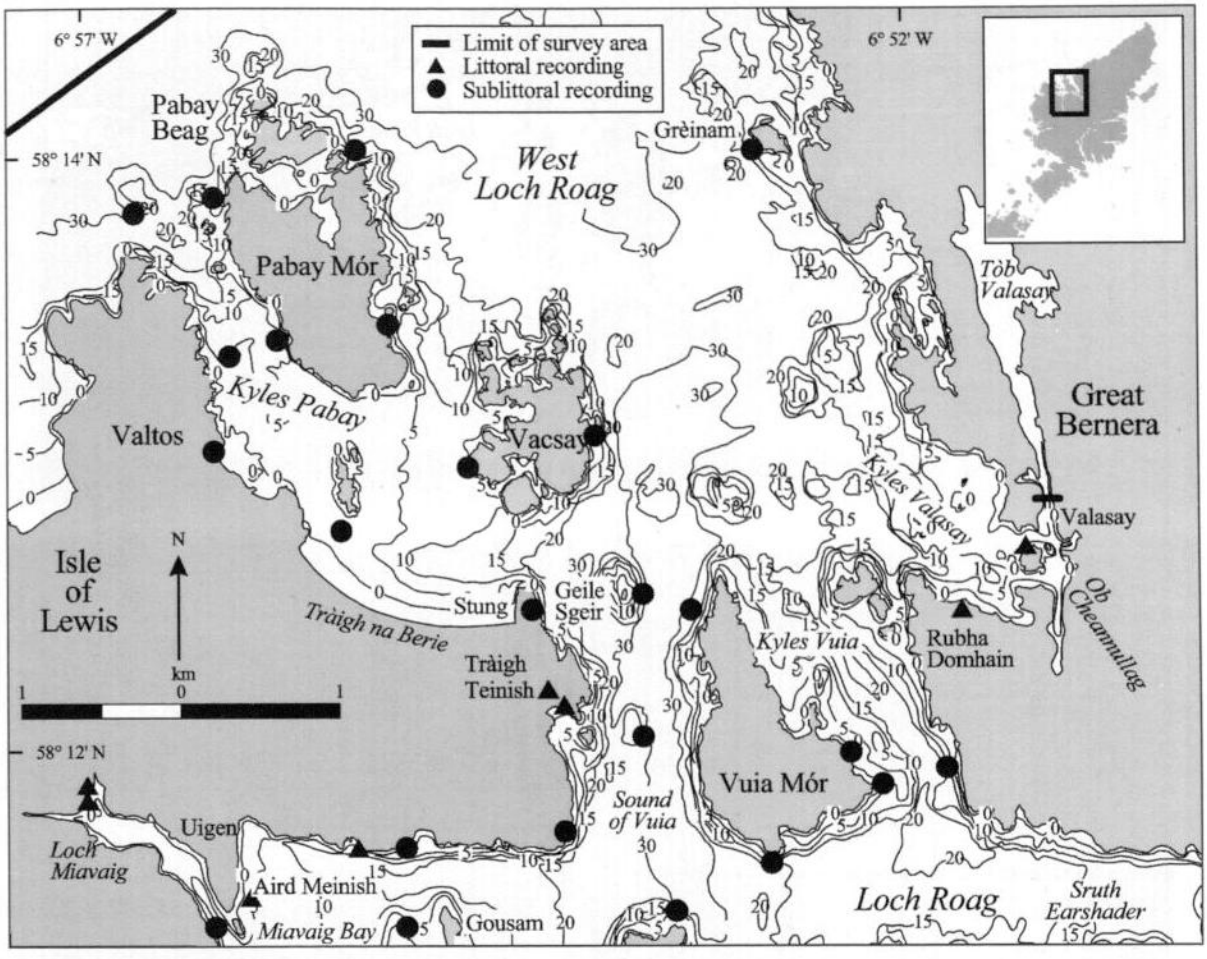

Figure 5.2 Main features of the north-west part of the complex including West Loch Roag and the north-western part of Loch Roag, showing sites surveyed.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	10	September 1982	Smith (1983)
	Recording (epibiota)	10	May 1978	Powell *et al.* (1979)
Sublittoral	Recording (epibiota)	7	July 1984	Rostron (1984)
	Recording (epibiota)	42	September 1982	Dipper (1983)
	Recording (epibiota)	1	May 1978	Dipper (1980)

Littoral

Loch Roag is a large and complex area and includes shores with every grade of wave exposure from exposed sandy beaches and steep cliffs to fully sheltered shores of mud and rock in the inner parts, with some local freshwater influence. There are also numerous tidal channels with varying tidal stream strengths from weak to very strong. The loch therefore exhibits a wide variety of shore types, particularly rocky shores, and many of these have a rich flora and fauna. However, only a relatively small number of shores have been surveyed and it is not possible to give a systematic description of the whole area. Instead, typical shores in each part of the loch are described and particularly interesting areas are highlighted.

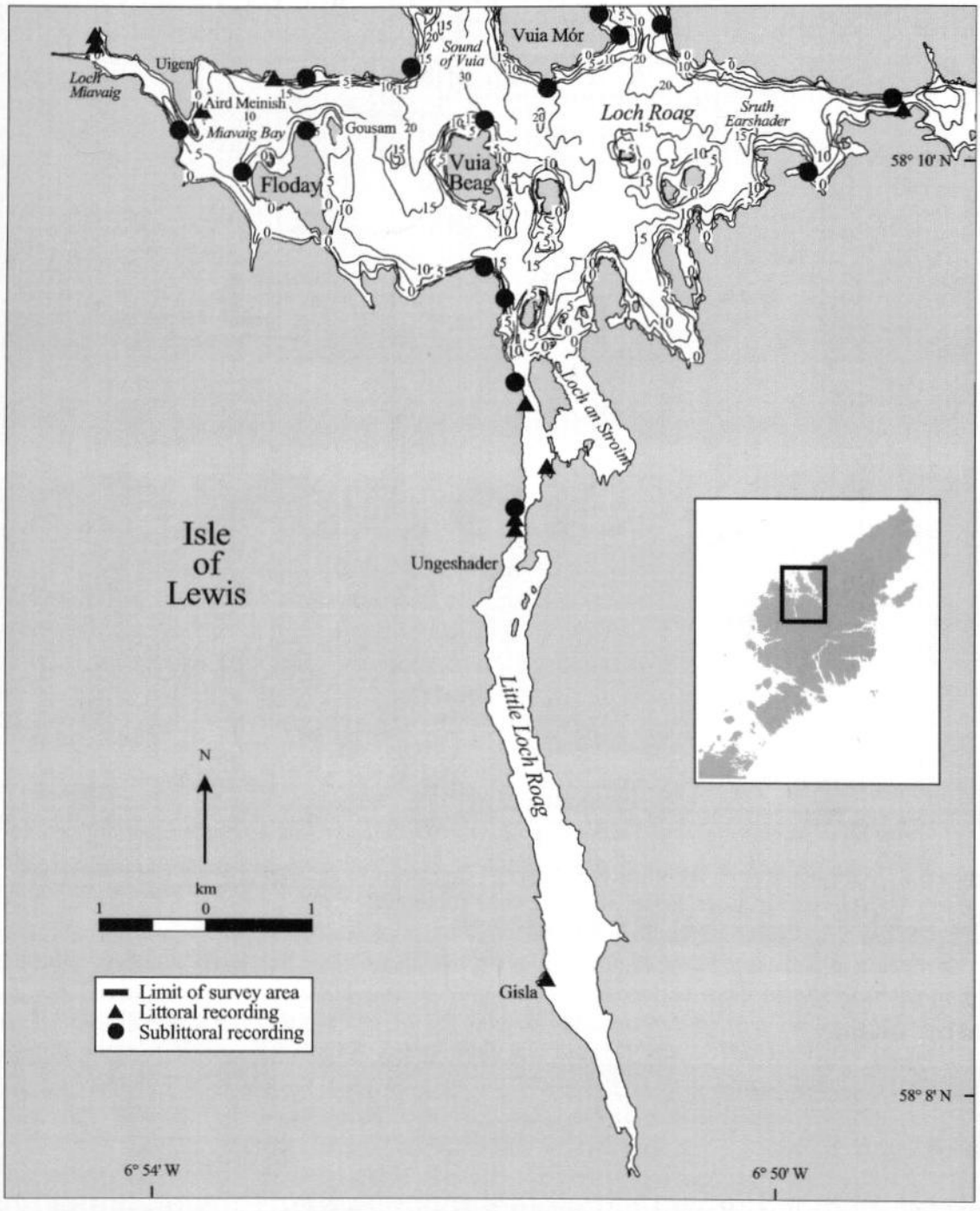

Figure 5.3 Main features of the south-west part of the complex including Little Loch Roag, showing sites surveyed.

West Loch Roag (see Figure 5.6)

The Valtos peninsula, together with the islands of Pabay Mór and Pabay Beag, is predominantly rocky and, along with the north-west side of Great Bernera, is wave-exposed and often backed by steep cliffs. No survey information is available for these shores. Pabay Mór, together with Vacsay, provides some protection to the west side of West Loch Roag. Here Tràigh na Berie, a gently

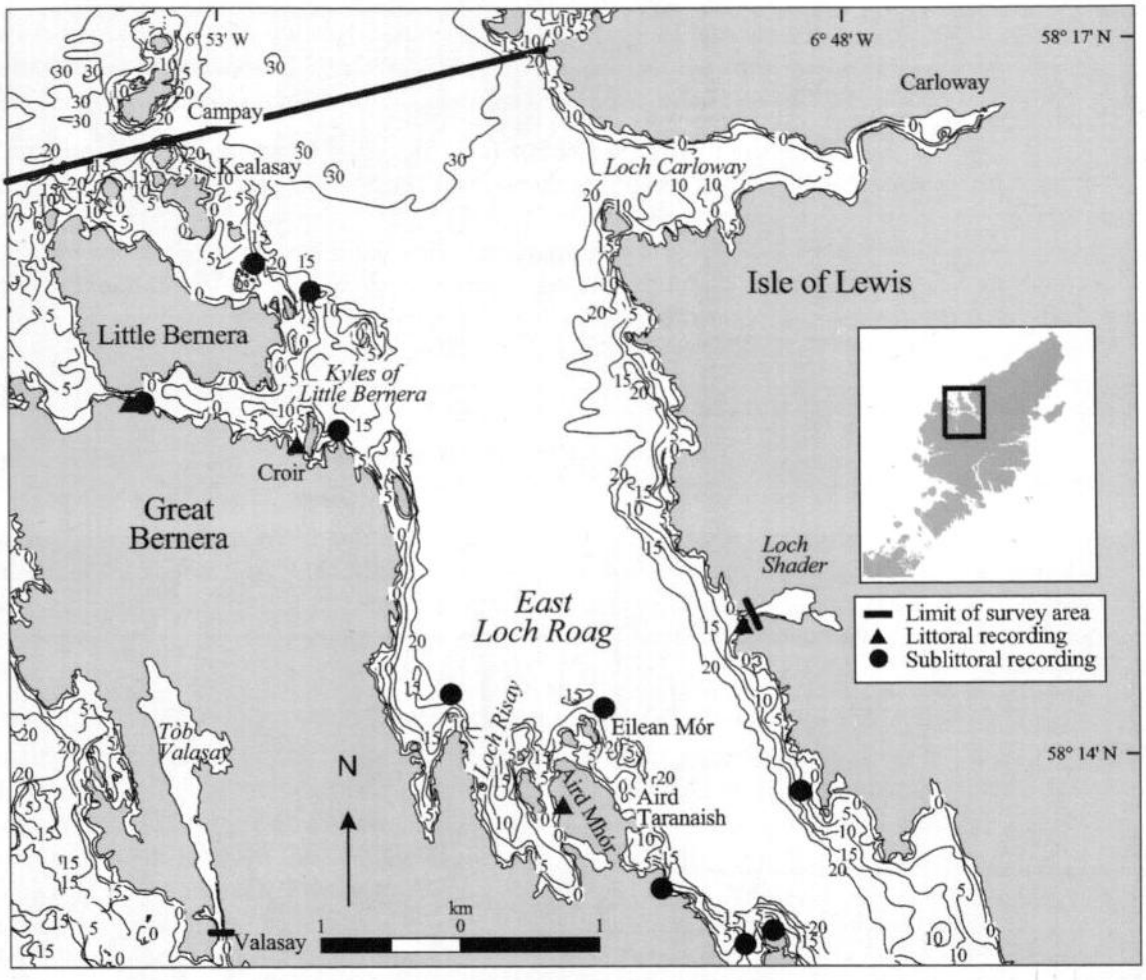

Figure 5.4 Main features of the north-east part of the complex including the northern part of East Loch Roag, showing sites surveyed.

sloping north-east-facing open sandy beach about 2 km long, lies south-east of the village of Valtos, and is backed by low sand dunes and machair. This is the only extensive sandy shore in the Loch Roag system. However, in spite of the protection afforded by the islands, it is still moderately exposed to wave action due to the funnelling effect of the wind and water through the channels between the islands. Littoral fauna are sparse, consisting of polychaetes and amphipods; sublittoral species may be stranded at high tides in rough weather. Smith (1983) considered that the shallow offshore sands are likely to support a considerable infauna, and beds of eelgrass *Zostera marina* are known to exist here (see sublittoral section).

About 1 km south of Tràigh na Berie is a small, sandy, south-facing bay called Tràigh Teinish, which is backed by sand dunes and with rocky areas at each side. The beach has a moderately sloping upper and middle shore which is well-drained and composed of coarse shell-sand overlying gravel. This gives way to a narrow zone with a muddy sandflat in the sublittoral fringe dominated by lugworm *Arenicola marina*. The infauna is rich and diverse, particularly in the lower eulittoral. Principal species include the bivalves *Mya truncata*, *Ensis arcuatus*, *Dosinia exoleta*, *Venerupis senegalensis* and *Angulus tenuis*, the sand mason worm *Lanice conchilega*, the heart urchin *Echinocardium cordatum* (mainly occurring in the muddy sandflat) and the holothurian *Leptosynapta inhaerens* (VsenMtru). Surface life appears to be species poor, with only the algae *Pilayella littoralis* and green alga *Enteromorpha* sp. present at the time of the 1978 survey (Powell *et al.* 1979). However, the composition and abundance of species may change over

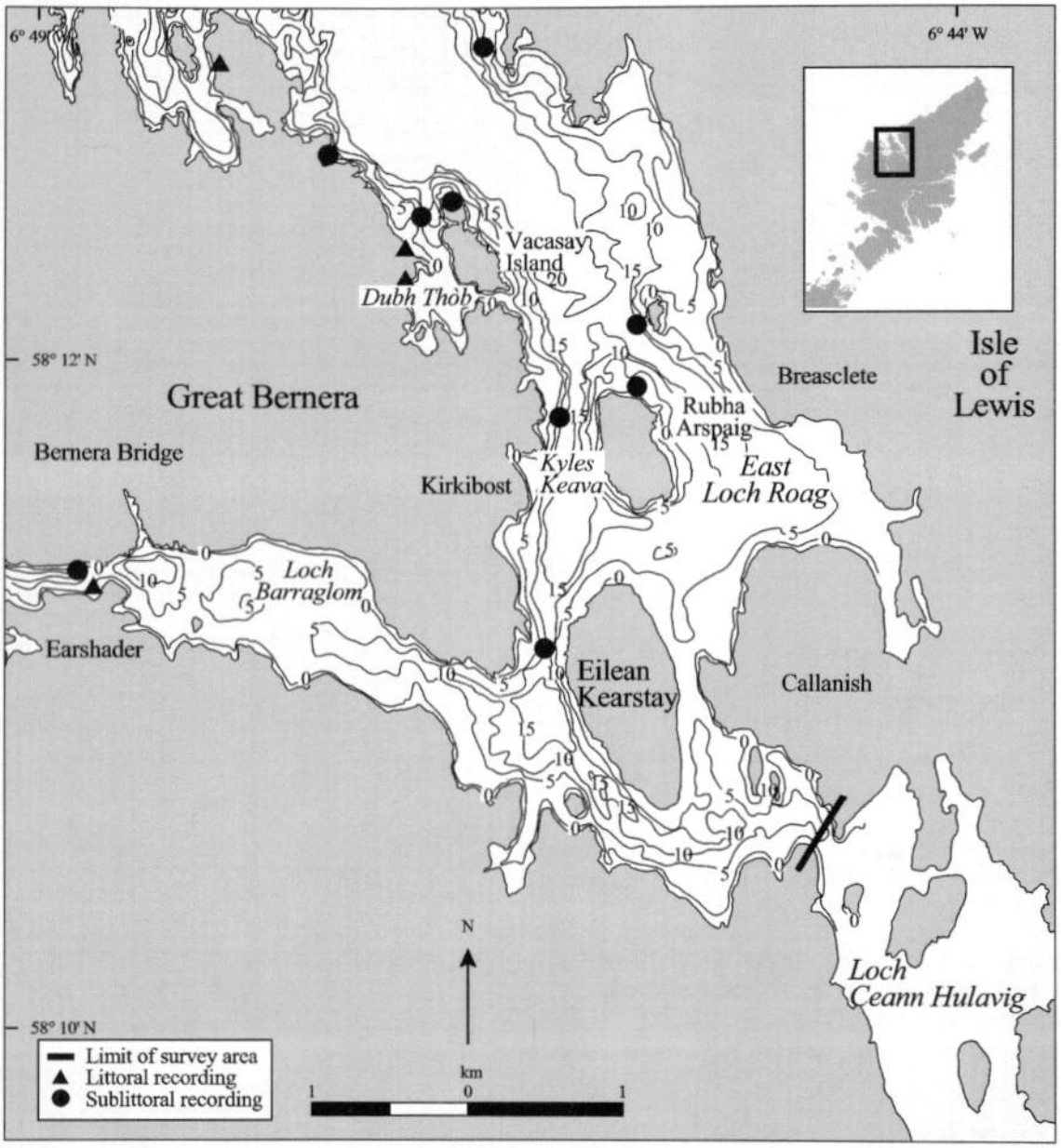

Figure 5.5 Main features of the south-east part of the complex including the southern part of East Loch Roag, showing sites surveyed, and Loch Ceann Hulavig.

time, as Smith (1983) considered that the location of the beach, just into the sheltered part of West Loch Roag, may mean that ephemeral species lodge here temporarily.

Rubha Domhain, on the west coast of Great Bernera, is north-facing but receives some shelter from offshore islands and so is moderately exposed to wave action. The shore is very gently sloping and consists of boulders with rock outcrops on the seaward side. The exposed nature of the shore is indicated by a paucity of knotted wrack *Ascophyllum nodosum* in the mid-eulittoral, and its replacement by barnacles, including *Semibalanus balanoides*, and limpets, including *Patella vulgata* (FvesB). Gastropods are abundant, particularly *Gibbula umbilicalis* and *Littorina saxatilis*. The kelps *Laminaria digitata* and *Alaria esculenta*, with a rich red algal turf of *Porphyra umbilicalis*, make up the lower shore and sublittoral fringe (Ldig.Ldig). However, the large

number of boulders on the shore increases the diversity of species and a variety of sponges colonise the undersides of boulders where they are protected from desiccation. In 1978 large numbers of the nudibranch *Aeolidia papillosa* were recorded (Powell *et al.* 1979).

Communities influenced by increased tidal streams are found around Valasay on the south-west of Great Bernera. This area is sheltered from wave action but has moderately strong tidal streams running through two channels leading to Tòb Valasay, an extensive saline lagoon (see Thorpe *et al.* 1998 for description of the lagoon). The shore consists of small boulders colonised by a variety of algae including *Furcellaria lumbricalis*, *Cystoclonium purpureum*, *P. littoralis*, *Codium* sp., *Asperococcus fistulosus* and an abundance of the *Trailliella* phase of the red alga *Bonnemaisonia hamifera*. Amongst the fauna, *A. marina*, *P. vulgata*, the ascidian *Ascidiella scabra* and the opisthobranch *Elysia viridis* are abundant.

Loch Roag (see Figures 5.6 and 5.7)

Loch Roag forms the inner sheltered part of the loch complex south of the large island of Vuia Mór. On the west side lies Loch Miavaig, a narrow, very sheltered arm which is cut off from the main part of the loch by Aird Meinish, a low peninsula with gravel and boulder shores. At the head of Loch Miavaig is a soft mudflat in estuarine conditions. The mud holds few species, mainly lugworms *A. marina*, while the bivalves *Mya arenaria* and *Cerastoderma edule* colonise muddy gravel on the lower shore (MacAre).

The shores around Aird Meinish and the small bays along the north side of Miavaig Bay are mainly composed of boulders dominated by fucoid algae (Asc.Asc; Fser.Fser.Bo; Ldig.Ldig.Bo). Bedrock areas along the north side are also dominated by fucoids, and this part of the coast is typical of the more sheltered parts of Loch Roag. The dominant fauna living under boulders in bays such as at Reef, to the north of Gousam, are ascidians, polychaetes and molluscs. The chiton *Tonicella marmorea*, the cup-coral *Caryophyllia smithii*, the polychaete *Eupolymnia nebulosa* and a variety of ascidians, particularly *Ascidia conchilega*, are common. The tiny porcelain crab *Porcellana platycheles* is also numerous underneath boulders. Uigen Bay in the north-west corner of Miavaig Bay has a pebbly upper shore and sand on the lower shore and in the sublittoral fringe. The bay is rich in large bivalves, including *Anomia ephippium* growing on the tops of pebbles and *Pododesmus patelliformis* and *Chlamys varia* which are found attached to the undersides of boulders. In the sand on the lower shore and in the sublittoral fringe there are beds of the razor clam *Ensis arcuatus* and horse mussel *Modiolus modiolus* (LMS). Clumps of two or three *M. modiolus* can be found spaced about a metre apart and form both anchorage points for *Laminaria saccharina* and a shelter for the carpet shell *V. senegalensis* (LMX) which burrows in the sand beside them.

Bernera Bridge spans the narrows, between Earshader and Great Bernera, which connect Loch Roag to East Loch Roag. At its narrowest point under the bridge, the channel is about 100 m wide and very shallow just to the west, with tidal streams of up to 2 knots. The north side of the channel is steep, with a fringe of boulders in the lower eulittoral zone. The south side has a more gentle incline with a gravel slope about 200 m long and up to 50 m wide scattered with large boulders. The area is very rich in species, particularly molluscs, bryozoans, ascidians and echinoderms. The upper eulittoral is composed of cobbles, giving way into a mid-eulittoral with fucoids *Fucus vesiculosus* and *Ascophyllum nodosum* and littorinids *Littorina* spp. (AscX). The lower shore has a rich *Fucus serratus* zone (FserX.T) followed by a very rich sublittoral fringe. The boulders support a varied and dense turf of red algae, including *Cystoclonium purpureum* and *Phycodrys rubens*. Kelps are found attached to cobbles amongst the boulders and to *M. modiolus* in the gravel. Molluscs are well represented in terms of numbers, including the gastropods *Skenea serpuloides* and *Ocenebra erinacea*, the latter at its northern limit, with a variety of nudibranchs of which *Archidoris pseudoargus*, *Onchidoris muricata*, *Cadlina laevis* and *Flabellina pellucida* can be particularly abundant. The featherstar *Antedon bifida*, normally a sublittoral species, is common, as is the snakelocks anemone *Anemonia viridis*, the polychaete *Perinereis* sp. and the pycnogonid *Nymphon gracile*.

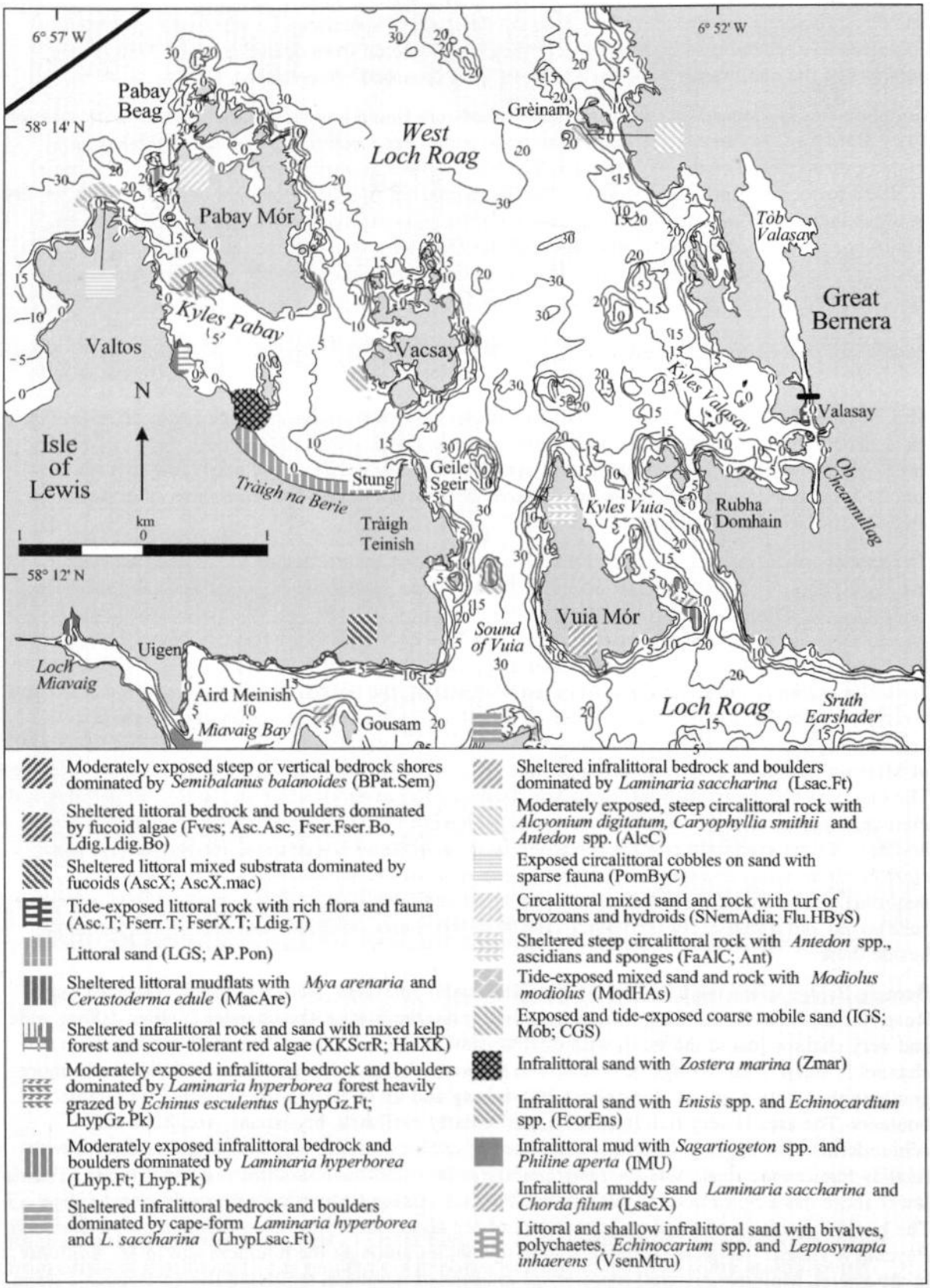

Figure 5.6 Indicative distribution of the main biotopes in the north-west part of the complex including West Loch Roag and the north-western part of Loch Roag (based on data from survey sites shown in Figure 5.2, cited literature and additional field observations).

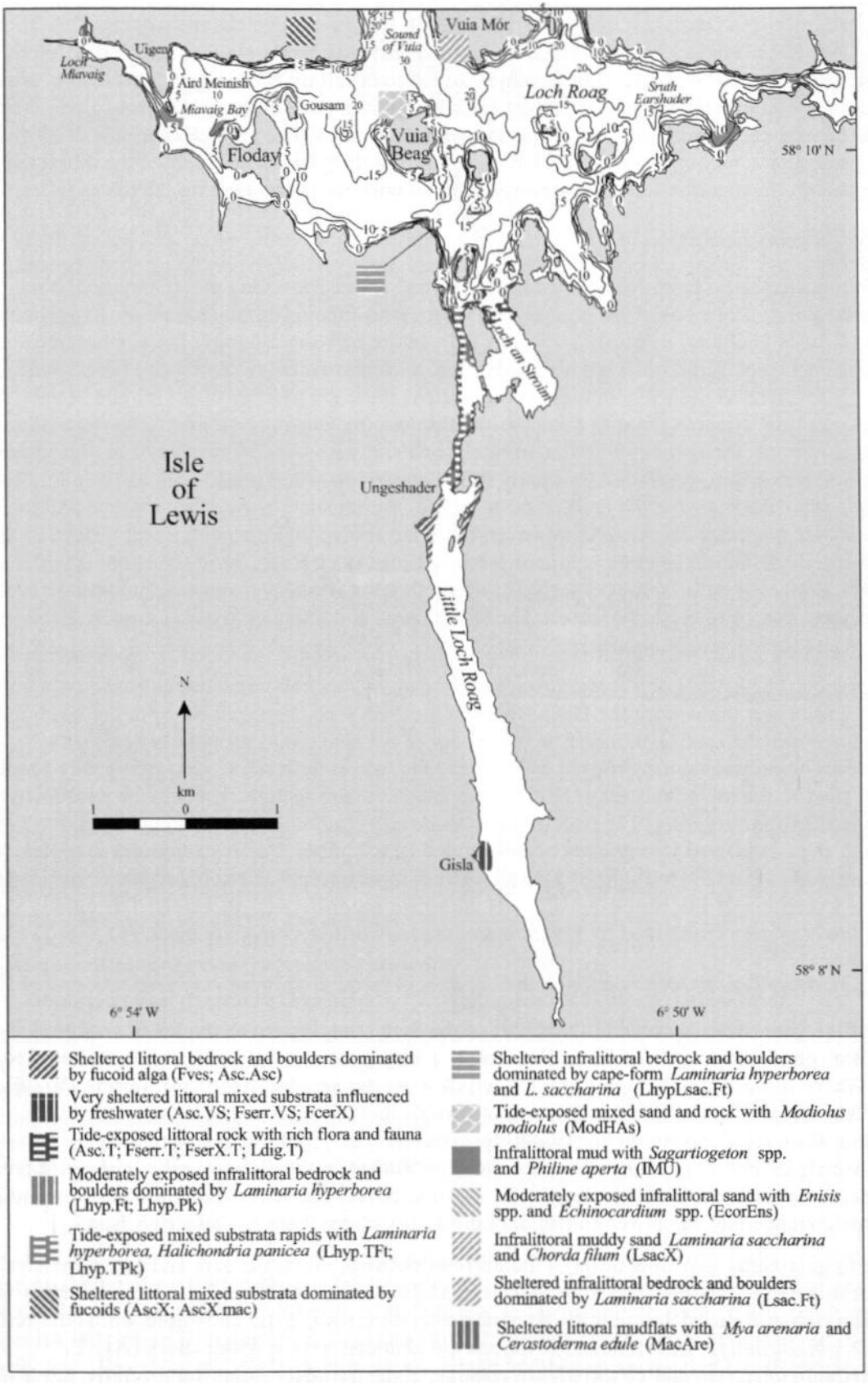

Figure 5.7 Indicative distribution of the main biotopes in the south-west part of the complex including Little Loch Roag (based on data from survey sites shown in Figure 5.3, cited literature and additional field observations).

Loch an Stroim is a small basin to the south of Loch Roag with two channels connecting with Little Loch Roag and Loch Roag. The area is sheltered, with moderately strong tidal streams running between the two lochs, and is subject to reduced salinities. The inner loch shore, which is a mixture of steep rock and large boulders leading down to sand in the sublittoral fringe, is fairly typical of very sheltered zones, but is not very rich in species. The algae *P. littoralis*, *A. fistulosus* and *A. nodosum* are common (Asc.T). Fauna inhabiting the rocky areas include the mussel *Mytilus edulis* and the featherstar *A. bifida*, while *A. marina* burrows in the sand on the lower shore.

Little Loch Roag (see Figure 5.7)

The entrance to Little Loch Roag is a narrow channel about 2 km long and 60 m wide at its narrowest point. The sides of the channel are steep, with fucoids dominant and a narrow lichen zone typical of sheltered upper loch shores (YG). In the narrowest part, at the southernmost end of the entrance channel, the walls are almost vertical with narrow ledges and loose blocks with muddy bases and overhangs, although in wider areas there are patches of gravel and boulders. Very strong tidal streams of up to 8 knots flow through the narrows. Although there are relatively few algal species, for fauna this is an extremely rich site with over 50 species of mollusc recorded. Of particular note are species not normally found above low water mark, such as the plumose anemone *Metridium senile*, the featherstar *A. bifida*, the sunstar *Crossaster papposus* and the bryozoan *Alcyonidium diaphanum*; however, there are few sponge species (Asc.T). Beyond the narrows at Ungeshader the channel opens out into Little Loch Roag. Here the shore is wider with boulders blanketed with fucoids (FserX.T); where there is freshwater run-off, fucoids are scarcer. Muddy sand occurs in the lower shore. The shore fauna is dominated by the barnacle *Balanus balanus* and the mussel *M. edulis*.

The upper part of Little Loch Roag, towards the head, is very sheltered and at times has a good deal of freshwater input from the Gisla River on the west side, Morsgail River at the head, and numerous other streams. Gisla itself, at the mouth of the river, has particularly brackish conditions. The shores are composed of boulders and gravel with some rock giving way to mud or muddy sand in the lower eulittoral. Fucoids are abundant and include *A. nodosum* with its hybrid epiphyte *Clava multicornis*. The free-living *A. nodosum* ecad *mackaii* was found by Smith (1984), although she considered it may have been stranded (AscX.mac). *Fucus ceranoides* is typically abundant due to the lowered salinity (FcerX). Other algal species and animal species are sparse with the exception of littorinids, particularly *Littorina saxatilis*, and *M. edulis*. The muddy sand on the lower shore is inhabited by bivalves and the lugworm *Arenicola marina*.

East Loch Roag (see Figures 5.8 and 5.9)

Most of the shore sites surveyed in this part of the loch complex are examples of sheltered shores. Croir Bay, on the north side of Great Bernera, is a very good example of a small, sheltered rocky shore. There is a good covering of knotted wrack *A. nodosum* (Asc.Asc) with limpets *Patella* sp., barnacles, dogwhelks *Nucella lapillus* and littorinids including *Melarhaphe neritoides* and *Littorina littorea* colonising the upper eulittoral on vertical boulder surfaces (BPat.Cht). A range of foliose algae including *Osmundea pinnatifida*, *P. littoralis* and *Polysiphonia lanosa* are present underneath the fucoids. The kelp *Laminaria digitata* covers the lower shore boulders, extending for some distance into the lower eulittoral (Ldig.Ldig) where there is also a rich fauna.

Strong tidal streams also flow through the narrows between Great Bernera and Little Bernera. The sides of this narrow channel are short and steep and are comprised mainly of large boulders which support a rich and varied community. *A. nodosum* is dominant in the mid-shore whilst the red algae *O. pinnatifida*, *P. littoralis* and *P. lanosa* are abundant on the lower shore (Asc.T). *Nitophyllum punctatum* and *Cryptopleura ramosa*, algae normally found sublittorally, are also frequent. Several faunal species which are usually found in deeper water are present, including the ascidian *Clavelina lepadiformis* and the common urchin *Echinus esculentus*. Eelgrass *Z. marina* is common just outside the narrows in the sublittoral fringe along with sea-oak *Halidrys siliquosa*.

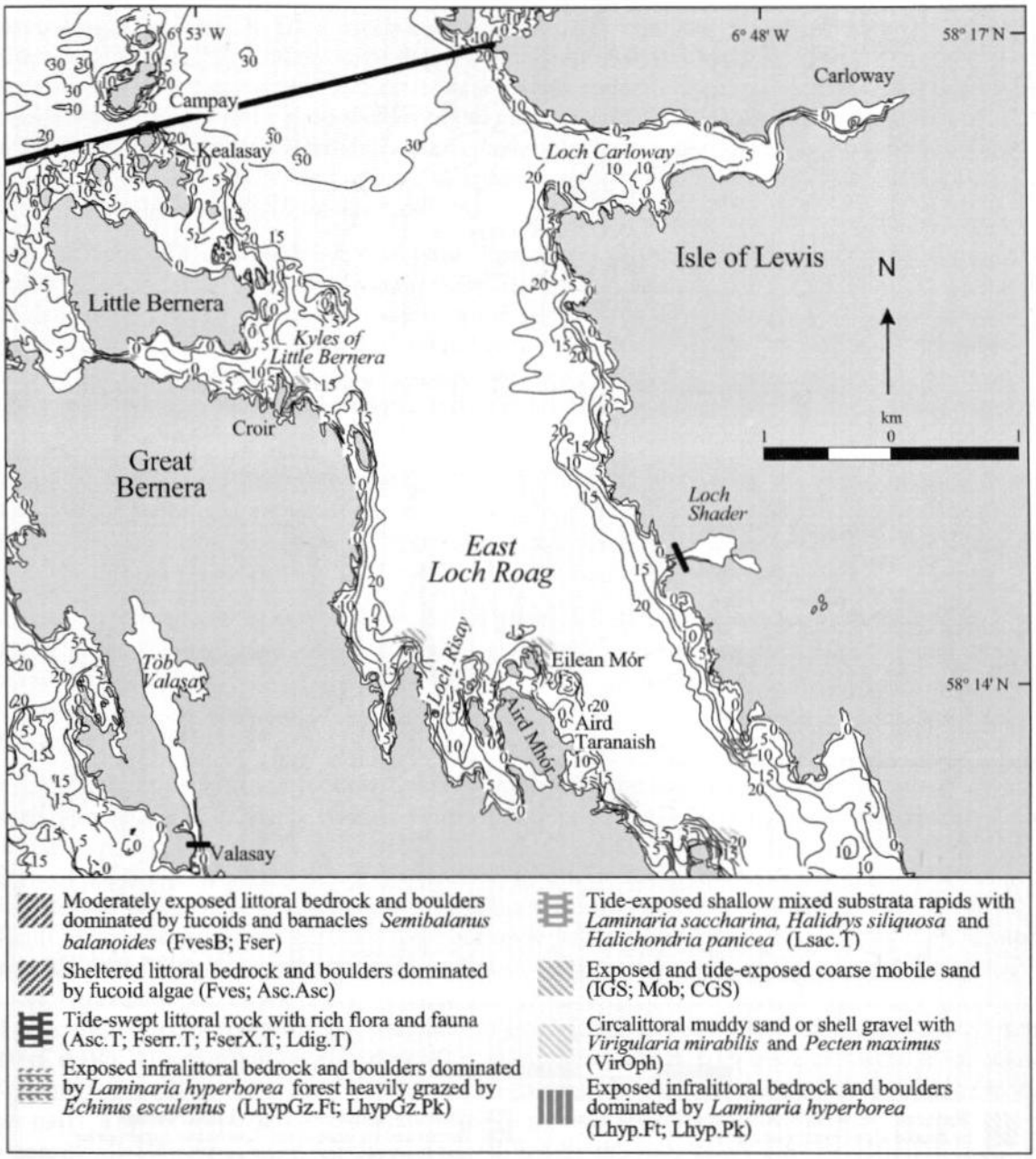

Figure 5.8 Indicative distribution of the main biotopes in the north-east part of the complex including the northern part of East Loch Roag (based on data from survey sites shown in Figure 5.4, cited literature and additional field observations).

On the east side of Great Bernera, at the entrance to Loch Risay, is a relatively large intertidal expanse of sheltered rock supporting a fairly varied community dominated by algae. The boulders, lagoons and gullies increase the diversity of the otherwise fairly smooth rock. While there are no rare species, this shore is richer in species than most Hebridean shores, although biomass is relatively low (Powell *et al.* 1979). A number of sponge and bryozoan species are abundant, along with a variety of red algae including *Mastocarpus stellatus*, *O. pinnatifida* and *Dumontia contorta*. *A. nodosum* is present only occasionally, while *L. digitata* is abundant (Ldig.Ldig).

Kirkibost harbour lies in a sheltered bay of Dubh Thòb, on the east side of Great Bernera. This area is sheltered from wave exposure by Vacasay Island. Much of the shore is rocky and heavily

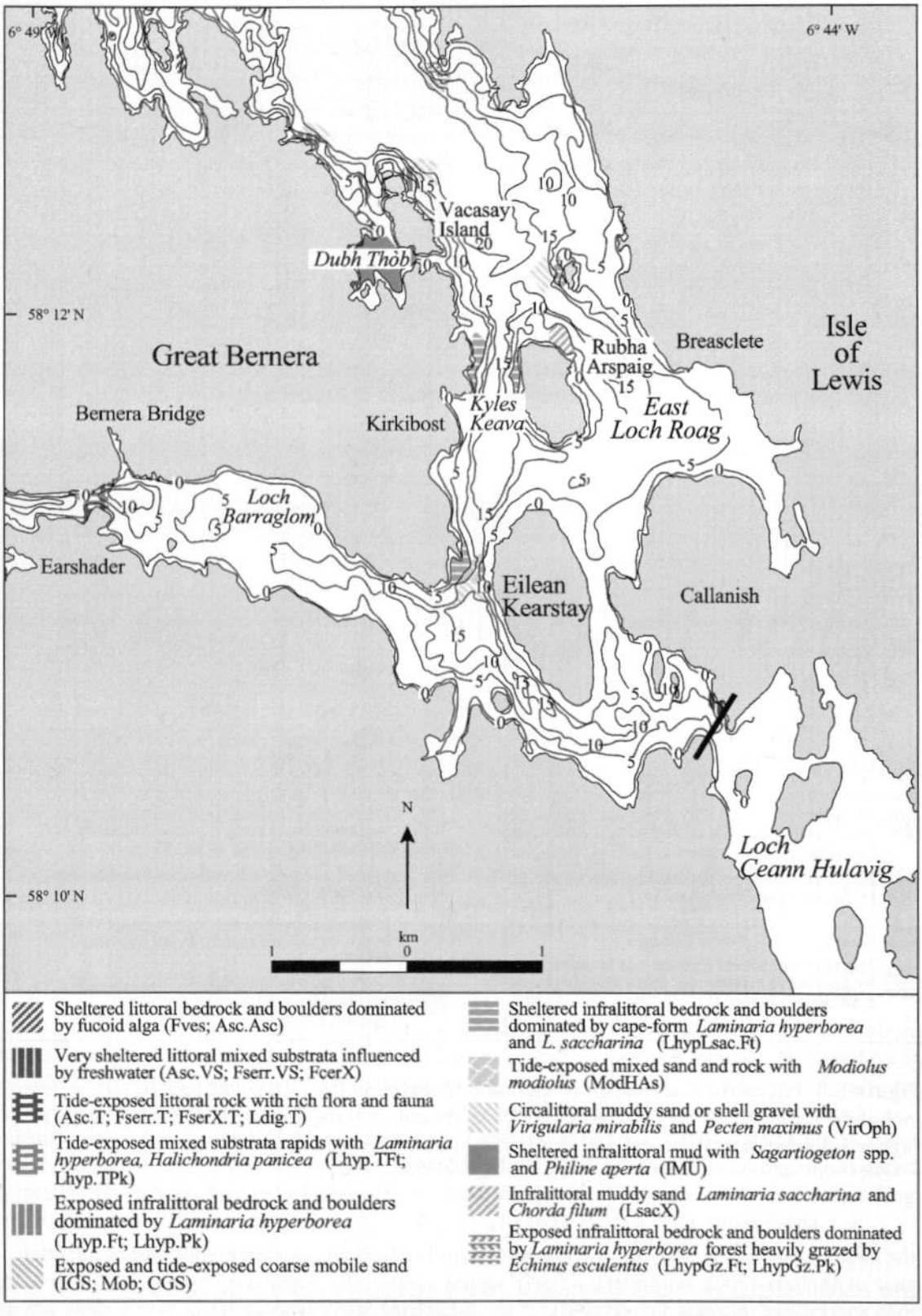

Figure 5.9 Indicative distribution of the main biotopes in the south-east part of the complex including the southern part of East Loch Roag (based on data from survey sites shown in Figure 5.5, cited literature and additional field observations).

blanketed with fucoids. The floor of the harbour is of black mud and muddy sand. Rocks and boulders are covered by *A. nodosum* in the mid-eulittoral (Asc.Asc) and by *Fucus serratus* in the lower eulittoral with some cape-form *L. digitata* and an understorey of red algae (Ldig.Ldig.Bo). Bootlace weed *Chorda filum* protrudes from the mud. Dominant fauna consist of a number of bivalves, including juvenile *Parvicardium exiguum*, polychaetes including *Eupolymnia nebulosa*, and ascidians including *C. lepadiformis*. The spider crab *Macropodia rostrata* is present, often decorated with the red alga *Ceramium rubrum*.

At the north end of Dubh Thòb is a storm beach spur which gives additional protection to Kirkibost Harbour from severe wave action. The north side of this spur is exposed and is supplied with clean water, unlike that found in the harbour, which is muddy. The area consists of irregular rocks and boulders, again dominated by fucoid algae (Asc.Asc; Fser.Fser) with small rockpools colonised by the alga *Corallina officinalis* and the bivalve *Kellia suborbicularis* (Cor). Animals are less abundant here than at Kirkibost Harbour, with dominant species including *Dynamena pumila*, *Semibalanus balanoides*, *Caprella linearis* and various littorinids.

Biotopes typical of very sheltered shores, often influenced by freshwater, are found in Loch Ceann Hulavig in the south-east corner of the loch system (see Thorpe *et al.* 1998). At Garynahine and Callanish the shores support areas of unattached *A. nodosum* ecad *mackaii* as well as *F. ceranoides* (AscX.Mac, FcerX) with areas of muddy rock and sediment.

Moderately exposed shores are found on the east side of East Loch Roag, for example at the entrance to the lagoonal Loch Shader (Thorpe *et al.* 1998). Irregular bedrock is dominated by barnacles *S. balanoides* and small tufts of fucoid algae (FvesB; MytB).

Sublittoral

The distribution of sublittoral biotopes present within the Loch Roag system can be related primarily to degree of exposure to wave action and tidal streams. Wave action is very severe in the outer parts of both East and West Loch Roag and it is here that the most extensive and dramatic cliff faces are found. Rock extends to between 20 and 30 m depth in West Loch Roag north of Vuia Mór and in the outer northern half of East Loch Roag. These exposed sites are the most difficult to survey and the deep circalittoral biotopes present here have not been fully documented. They include rich assemblages of bryozoans and hydroids not found in the inner sheltered sites. Shelter and the amount of silt present increase progressively with distance into the loch system and rock slopes become shorter. In the shelter of Loch Roag and Little Loch Roag rock extends to 5–10 m depth. The distribution of sediments is also mainly affected by wave exposure, with coarse sediments in the outer lochs, even at relatively deep depths, and fine muds and muddy sands in the inner parts. The series of rapids and areas with strong tidal streams produce further distinct biotopes, whilst algal biotopes considerably modified by the very heavy grazing action of high numbers of the common urchin *Echinus esculentus* are also present.

West Loch Roag (see Figure 5.6)

West Loch Roag is very exposed to moderately exposed throughout its length. Infralittoral rock in the outer areas is dominated by *Laminaria hyperborea* kelp forest (Lhyp.Ft; Lhyp.Pk). Understorey algae in and below these forests varies in abundance and diversity. In most inner areas the rock surfaces are heavily grazed by *E. esculentus* and have a limited variety of foliose algae either on the rock or on kelp stipes (LhypGz.Ft; LhypGz.Pk). On the north-west side of Vuia Mór grazing is so intensive that the rock supports virtually no foliose algae and appears pink because of a covering of encrusting coralline algae. Fauna are restricted to crevice-dwellers such as the sea cucumber *Pawsonia saxicola* or robust species such as the keel worm *Pomatoceros triqueter*. Widespread understorey algae in less intensively grazed areas include *Callophyllis laciniata*, *Plocamium cartilagineum*, *Odonthalia dentata*, *Dictyota dichotoma* and *Cryptopleura ramosa*. Fauna include the anemones *Urticina felina* and *Sagartia elegans*, the soft coral *Alcyonium digitatum*, the cup coral *Caryophyllia smithii*, the topshells *Calliostoma zizyphinum* and *Gibbula cineraria*, the featherstar *Antedon bifida*, the bryozoan *Parasmittina trispinosa* and

the ascidian *Clavelina lepadiformis*. Kelp stipes are colonised by the ascidian *Botryllus schlosseri* and the red alga *Phycodrys rubens*, while the fronds are typically inhabited by the bryozoan *Membranipora membranacea* and the hydroid *Obelia geniculata*. The richest understorey foliose algae are found at very exposed sites such as the small islands to the north and west of Little Bernera, where conditions are too extreme for *E. esculentus* to thrive (Lhyp).

Steep, vertical and overhanging circalittoral rock is present at outer, exposed, north or west-facing sites such as around the north end of Pabay Beag and Pabay Mór and Grèinam Island on the west side of Great Bernera. Biotopes present include those dominated by the jewel anemone *Corynactis viridis* and *A. digitatum* (CorMetAlc) and by *A. digitatum* with bryozoan and algal crusts (AlcC). Sponges such as *P. johnstonia*, *Myxilla incrustans* and *Halichondria panicea*, bryozoans and hydroids are also common in these exposed areas which to date have been inadequately surveyed. The sponges *Clathrina coriacea* and *Pachymatisma johnstonia* are particularly common in shallow caves on the east side of Pabay Mór. Circalittoral rock in moderately exposed areas further into the loch, such as around Geile Sgeir, is generally heavily grazed and supports only robust species, especially faunal and algal crusts (FaAlC).

Exposed circalittoral cobble, pebble and sand areas are present off the headland of Eala Sheadha to the west of Pabay Mór and between Pabay Mór and Lewis at depths of 20–30 m. Mobile cobbles support only *P. triqueter* (PomByC), whereas more stable areas support a variety of hydroids and the bryozoan *Flustra foliacea* (Flu.HByS).

The sediments in West Loch Roag are of coarse to fine sand or shell-sand, mostly clean but becoming muddy in the deeper southernmost part of this arm of the loch around Vuia Mór and Geile Sgeir. The northernmost, wave-exposed areas have clean sand or shell-sand below the rock slope. Very exposed sediments to the north of Pabay Mór and at Grèinam are very mobile, and consequently support few infaunal species (Mob). Coarse sand is also present in areas of increased water movement in relatively sheltered areas, such as around Bogha na Muilne to the west of Vuia Mór. Sediments in Kyles Pabay are moderately exposed and are finer and less mobile, allowing the colonisation of infaunal species. The commonest species include the polychaete topshells *Chaetopterus variopedatus*, the heart urchin *E. cordatum*, lugworm *A. marina* and the bivalve *E. arcuatus* (EcorEns). Surface fauna include the scallop *Pecten maximus*, the sand mason worm *L. conchilega* and the brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra*. Similar sediment is also present off the south-west side of Vacsay and probably extends throughout this shallow area as far south as Stung at the eastern end of the extensive sandy beach of Tràigh na Berie. Sediments offshore from Tràigh na Berie have healthy beds of eelgrass *Z. marina* (Zmar). Algal species present in this habitat include *Gracilaria verrucosa*, *Halidrys siliquosa*, *Ulva* sp. and *Cladophora rupestris*. Fauna include the brown shrimp *Crangon crangon*, the molluscs *Ensis arcuatus* and *Hinia reticulata*, *L. conchilega* and the burrowing anemone *Cerianthus lloydii*.

Deeper sediments further into the loch, to the east and west of Geile Sgeir and on the northern tip of Vuia Mór at depths of 15–22 m, are of muddy sand or muddy coarse shell sand and are dominated by *P. maximus*. Also common are the brittlestars *O. fragilis* and *Ophiura albida*, *C. variopedatus*, the ascidian *Ascidiella aspersa*, the hydroid *Nemertesia antennina*, the common whelk *Buccinum undatum* and the starfish *Asterias rubens*. These sediments and those throughout the rest of West Loch Roag have not been examined in sufficient detail to ascertain biotope distributions.

Several uncommon animals have been recorded in West Loch Roag, including the cuckoo ray *Raja naevus* and the rarely recorded nudibranch *Cuthona concinna*. This latter species is generally considered a northern species with records from only 12 sites, of which the island of Skomer (Wales) is the most southerly in the British Isles.

Loch Roag (see Figures 5.6 and 5.7)

Loch Roag forms the inner basin of the loch complex and is sheltered from wave action. Rock slopes are of boulders and silty bedrock and are short, giving way to sediment between 3 and 10 m

depth. There is therefore little, if any, circalittoral rock. Infralittoral rock is generally kelp-dominated by cape-form *L. hyperborea* with smaller amounts of *L. saccharina* and *Saccorhiza polyschides* (LhypLsac.Ft). This biotope occurs throughout much of the area, although at slightly more exposed sites such as Bogha na Muilne in the Sound of Vuia, and the south-west coast of Great Bernera, the kelp forest is dominated by normal *L. hyperborea* with smaller amounts of *L. saccharina* and *S. polyschides* (Lhyp.Ft). On unstable boulders or in more sheltered areas, such as the southern tip of Vuia Mór, *L. saccharina* predominates (Lsac.Ft). Mixed kelp forests within Loch Roag are generally silty with an abundance of red encrusting algae on the rock beneath and an understorey of foliose algae including *Chondrus crispus*, *Plocamium cartilagineum* and *Desmarestia aculeata*. Fauna on upward-facing surfaces are dominated by the ascidians *C. lepadiformis* and *A. aspersa* which are tolerant of silt. Vertical surfaces, however, which tend to be free of silt, are inhabited by the anthozoans *Urticina felina*, *C. viridis*, *M. senile* and *A. digitatum*. Similar understorey algae and animals are found in the *L. saccharina* kelp forests.

In contrast to the coarse sediments prevalent in the exposed West Loch Roag, sediments in the sheltered Loch Roag are generally of silty mud or muddy sand; large areas remain unsurveyed. The most widespread animals are the scallop *P. maximus*, which is present in most sediment types throughout the loch, the burrowing anemone *Cerianthus lloydii*, the turret shell *Turritella communis*, the queen scallop *Aequipecten opercularis*, the polychaetes *Chaetopterus variopedatus* and *Myxicola infundibulum* and the brittlestar *Ophiura albida*. Open areas of shallow sediment, such as between the islands of Floday and Gousam and to the south-east of Vuia Mór, consist of muddy sand with *L. saccharina* and bootlace weed *C. filum*, with few animal species other than hermit crabs *Pagurus* spp. (LsacX).

Very sheltered, shallow sediments in Miavaig Bay and Loch Miavaig consist of soft mud, often with burrows and 'volcano' mounds and sometimes a cover of diatoms. Species present include the opisthobranch *Philine aperta* and the anemone *Sagartiogeton* sp. (IMU). Similar mud is found at the entrance to Little Loch Roag. Areas of silty mud colonised by *M. modiolus* (ModHAs) are present to the north-east of Vuia Beag and are probably widespread. The mussel shells provide attachment for species such as the *Sabella pavonina* and *Serpula vermicularis*, hydroids and ascidians.

Little Loch Roag (see Figures 5.7)

The main interest of Little Loch Roag lies in the entrance, where tidal streams are accelerated as the water is funnelled through a long, narrow rocky channel. The edges of this channel consist of steep boulder and bedrock slopes giving way to sediment at 9–12 m depth. In the outer and wider parts of the channel, this infralittoral rock is colonised by a silty kelp forest of *L. hyperborea* and *L. saccharina* (LhypLsac.Ft). Because of the heavy silt cover, upward-facing rock surfaces under the kelp are virtually devoid of life except for red encrusting algae. The foliose algae *Plocamium cartilagineum* and *Desmarestia aculeata* colonise kelp stipes. Animals are confined to vertical rock surfaces and kelp stipes and include *A. bifida*, *E. esculentus*, the ascidians *Ascidiella aspersa* and *Ciona intestinalis* and the soft coral *A. digitatum*. Further south, where the channel narrows even further, stronger tidal streams sweep silt away and the rock sides are colonised by a clean *L. hyperborea* kelp forest. This extends out into the centre of the channel which is floored by a plain of cobbles and scattered large boulders with some patches of sand. The kelp is very tall and can only survive on the larger boulders, where it supports rich growths of the red alga *Membranoptera alata*, the sponge *Halichondria panicea* and the hydroids *Amphisbetia operculata* and *Sertularia argentea* (Lhyp.TFt). Epifauna on the boulders includes *A. digitatum*, the anemones *Sagartia elegans* and *M. senile* and the hydroid *Nemertesia ramosa*. The cobbles are colonised by barnacles, and at the time of the 1982 survey large numbers of starfish *Asterias rubens* were also present.

The centre of the channel in the less tide-swept areas at the north end consists of muddy sand, becoming a mixture of gravels, sands and shells further south as the tidal strength increases. The sediment plain is colonised by *M. modiolus*, the scallop *P. maximus*, a variety of polychaetes

including *Chaetopterus variopedatus*, the burrowing lugworm *Arenicola marina* and occasionally the anemone *C. lloydii* (ModHAs).

East Loch Roag (see Figures 5.8 and 5.9)

Only a relatively few sites have been surveyed in this arm of the loch complex and so knowledge of the distribution of biotopes is patchy. The majority of infralittoral rocky substrata within East Loch Roag are colonised by kelp forest dominated by *L. hyperborea* to depths of 12–17 m. As in the similarly exposed West Loch Roag, algal populations beneath the kelp forest are sparse due to heavy grazing by *E. esculentus*, in some cases to such an extent that virtually no foliaceous algae survive, leaving the rock surface entirely dominated by *Lithothamnion* sp. (LhypGz.Ft; LhypGz.Pk). Sponges, anthozoans and ascidians are common inhabitants of the kelp forests and *A. bifida* is particularly abundant throughout this area. Very exposed sites at the entrance to East Loch Roag around Little Bernera support kelp forests of *L. hyperborea*, *Alaria esculenta* and *S. polyschides* which extend down to 20 m as a result of the increase in water clarity, with an understorey dominated by the red alga *Odonthalia dentata* (Lhyp.Ft). As in West Loch Roag, these more exposed and often tide-swept areas are less favourable habitats for grazing sea urchins and tend to have a greater variety and profusion of foliose seaweeds, including *Callophyllis laciniata*, *Plocamium cartilagineum*, *D. dichotoma* and *D. aculeata* (Lhyp.TFt; LhypR.Ft) as well as a greater variety of didemnid ascidians and sponges including *Halichondria panicea* and *Myxilla incrustans*.

In the more sheltered southern parts, such as in Kyles Keava, *L. hyperborea* is present in its cape form with wide, undivided fronds heavily encrusted with epiphytic bryozoans and ascidians (LhypLsac.Ft). These kelp forests are silty with a relatively low diversity of species and a predominance of ascidians. The infrequently recorded nudibranch *Janolus hyalinus*, which is difficult to spot due to its cryptic coloration, was observed at the entrance to Dubh Thòb.

Loch Roag is separated from East Loch Roag by the narrows at Bernera Bridge (Earshader). Tidal streams are greatly accelerated here, giving rise to a flora and fauna typical of rapids. The shallowest and narrowest part lies under the bridge and is only 1 m or less in depth, dropping off to around 10 m depth a short distance to either side. Within the channel, boulders provide attachment for a thick *L. hyperborea* kelp forest. The plants are heavily encrusted with the bryozoan *Membranipora membranacea* and the stipes with large masses of breadcrumb sponge *H. panicea* (Lhyp.TPk). Anemones including *S. elegans* and *M. senile* are common on rocks and pier pilings and there is a wide variety of small bryozoans, hydroids and ascidians. The smaller rapids at Kyles of Little Bernera in the north have a mixed kelp forest with *L. saccharina*, *L. hyperborea* and sea-oak *H. siliquosa* on boulders similarly encrusted with sponges and hydroids (Lsac.T).

Sediments in East Loch Roag, as with West Loch Roag, have not been surveyed in any detail. They range from very clean, barren shell sands and coarse sands in the exposed entrance, to muddy sands in the mid-loch region and mud plains in the most sheltered embayments or south-facing shores. On the east side of Great Bernera, as far south as Eilean Mór, sediments at the bottom of rock slopes consist of very clean shell-sand or coarse sand with little or no conspicuous epifauna or infauna (IGS; CGS). These sediments are very mobile and subject to severe wave exposure to a depth of around 30 m. It is likely that most of the seabed in the outer half of East Loch Roag is composed of coarse to medium sand. Where wave exposure is less severe, species present include *O. albida* and *O. nigra*, *C. variopedatus* and *L. conchilega*, various terebellids and the heart urchin *E. cordatum*. Mobile species include the spider crabs *Inachus dorsettensis* and *Inachus phalangium* and the whelk *Buccinum undatum*. The nationally rare bryozoan *Bugula purpurotincta* occurs on the east side of Campay attached to shells and rock (Plaza & Sanderson 1997).

Sediments in the moderately exposed mid-loch region, from Aird Taranaish and Loch Risay on Great Bernera south to Eilean Kearstay, are of muddy sand and muddy shell-sand in circalittoral areas. Fauna include *C. variopedatus*, *O. albida*, molluscs including *P. maximus*, *E. arcuatus*, *Mya truncata* and *B. undatum* and the sea-pen *V. mirabilis* (VirOph). Infralittoral muddy sand, with *L.*

saccharina and other algae, is present in shallow areas such as the north-east of Keava (LsacX). The sheltered, shallow sediments found in Dubh Thòb behind Vacsay Island are soft mud with a rather species-poor fauna (IMU).

The channel between Eilean Kearstay and Great Bernera experiences some tidal flow and is particularly interesting with a wide variety of habitats. The east side of the channel at Eilean Kearstay consists mainly of sheer cliff faces from 6–16 m depth covered in a wide variety of hydroids, anthozoans and ascidians (CorMetAlc). Horizontal rocky ridges above the cliffs are covered in shell-sand and support mixed kelp forest (LhypLsac.Ft). Towards the south where the channel widens the cliffs become less steep. The sand is inhabited mainly by *P. maximus* and is obviously very mobile, being frequently thrown up into banks in some areas. On the west side of the channel there are no cliffs. Inshore the substratum is of boulder and bedrock patches surrounded by muddy sand with a lot of shell debris. Further out into the channel is a large *M. modiolus* bed on coarse sand which forms a hard substratum for the attachment of a wide variety of algae and animals, mainly *P. cartilagineum*, *Ascidiella aspersa*, *A. bifida* and large hydroids (ModHAs). In less tide-swept areas on the west side there is a dense bed of *V. mirabilis* (VirOph).

Nature conservation

Conservation sites

Site name	*Status*	*Main features*
Loch Roag	cSAC	Coastal lagoons
South Lewis, Harris and North Uist	NSA	Landscape (West Loch Roag, SW Loch Roag, Little Loch Roag)
Loch Roag	SSSI	Botanical, marine botanical and ornithological
Valley Bog, Little Loch Roag	SSSI	
Glen Valtos	SSSI; GCR	Geological
Tràigh na Berie, West Loch Roag	GCR	Geomorphological: beach complexes and machair
Loch Roag	MCA	Marine biological

Human influences

Coastal developments and uses

The Loch Roag complex, particularly East Loch Roag, is relatively highly populated, with housing centred around the harbours at Kirkibost on Great Bernera and at Valtos in West Loch Roag, and around the villages of Callanish, Breasclete and Carloway on the shores of East Loch Roag. Most of the loch, including the island of Great Bernera, is well served by roads, although the whole south-east shore of Loch Roag and most of the east shore of Little Loch Roag are remote and uninhabited.

There are numerous piers, jetties and slipways at Breasclete, Valtos, Uigen and Carloway used mostly by fishermen and fish farmers, and several anchorages used by yachts. There is a caravan and camping park at Tràigh na Berie.

There is a factory in Breasclete at Rubha Arspaig which manufactures pharmaceutical grade oils from fish and other natural products. The supplies of fish are brought in from Stornoway. There is a hydro-electric power station at Gisla near the head of Little Loch Roag.

Amongst a number of archaeological sites in the area is the second-largest prehistoric stone circle in Britain, at Callanish on the shore of Loch Ceann Hulavig; it is one of the major visitor attractions in the Outer Hebrides.

Marine developments and uses

The whole of Loch Roag is an important nursery ground for herring *Clupea harengus*, sprat *Sprattus sprattus* and plaice *Pleuronectes platessa*, and a spawning ground for cod *Gadus morhua*. The whole Loch Roag complex is protected by a full-year closure prohibiting the use of mobile

fishing-gear under the Inshore Fishing (Prohibition of Fishing and Fishing Methods) Order 1989. Creeling for lobsters *Homarus gammarus* and crabs and diving for scallops takes place. Great Bernera is a lobster fishing centre with a processing plant based at Kirkibost which was established in 1972.

Due to its sheltered nature and extensive road system, the area has attracted many fish and shellfish farmers. At the time of writing (1999), five Atlantic salmon farm leases had been granted in West Loch Roag, four leases for sites in Loch Roag (due to expire between 2002 and 2012) and 18 leases for a total of 23 sites in East Loch Roag, including some fish cages in the Kyles of Little Bernera close to Sgeir a Chaolais.

In addition, five shellfish farming leases had been granted for a total of nine sites in Loch Roag, two leases for sites at the entrance to and near the head of Little Loch Roag, and five leases for a total of ten sites in East Loch Roag. There is also a mussel production area in Loch Carloway.

A total of 16 licences have been granted for the discharge of effluent from salmon cages directly into the loch complex: one for West Loch Roag, ten for East Loch Roag and five for Loch Roag. One licence has also been granted for the discharge of effluent from a net washer situated at Loch Miavaig.

There are fish hatcheries at Breasclete and at Kirkibost on Great Bernera with licenses to discharge effluent into West Loch Roag and East Loch Roag.

The freshwater lochans and rivers surrounding Loch Roag attract visitors for salmon *Salmo salar* and trout *Salmo trutta* angling; in particular Abhainn Grimersta, which flows from the freshwater Loch Langavat in the south to Loch Ceann Hulavig, is considered one of the best salmon rivers in Europe.

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Survey 58: 1984 OPRU Western Isles sealochs survey (Rostron 1984).
Survey 57: 1982 UCS sublittoral survey of Loch Roag (Dipper 1983).
Survey 265: 1970-1980 SMBA/MBA intertidal survey of Great Britain (Powell *et al.* 1979).
Survey 281: 1978 NCC Uists sublittoral survey (Dipper 1980).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
92	7	Tràigh Teinish, West Loch Roag, Lewis	NB 116 354	58°12.7'N 06°54.6'W	LR
92	8	Reef, Loch Roag	NB 104 344	58°12.2'N 06°55.8'W	Fspi; Asc.Asc; Pel; Fser.Fser.Bo; Ldig.Ldig.Bo
92	9	Uigean Bay, Loch Roag, Lewis	NB 097 340	58°12.0'N 06r°56.5'W	
92	10	Miavaig, Loch Roag, Lewis	NB 087 347	58°12.2'N 06°57.5'W	
92	11	Roag narrows, Little Loch Roag	NB 127 301	58°09.9'N 06°53.1'W	FserX.T; BPat.Lic; YG; Asc.T; Ver; Pel
92	12	Gisla, Little Loch Roag	NB 130 258	58°07.6'N 06°52.5'W	AscX.mac; FcerX
92	13	Bernera Bridge, Loch Roag	NB 164 341	58°12.2'N 06°49.7'W	AscX; FserX.T; IMX
92	15	Kirkibost Harbour, East Loch Roag	NB 184 361	58°13.4'N 06°47.8'W	Asc.Asc; Fser.Fser.Bo; Pel; Ldig.Ldig.Bo
92	16	Dubh Thòb (Outer), East Loch Roag	NB 184 363	58°13.5'N 06°47.8'W	Cor; YG; Asc.Asc; Fser.Fser; Ldig.Ldig; Ver; Pel
92	20	Tolstachaolais: Ob Shader, East Loch Roag	NB 185 388	58°14.8'N 06°47.9'W	Him; YG; Pel; MytB; FvesB; Fser.R; Ala.Ldig

Littoral sites – continued

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
265	133	Croir, Great Bernera, East Loch Roag, Lewis	NB 153 401	58°15.4'N 06°51.2'W	Asc.Asc; Ldig.Ldig; BPat.Cht
265	150	Little Bernera Narrows, West Loch Roag, Lewis	NB 141 404	58°15.5'N 06°52.5'W	Asc.T Lgla
265	151	Entrance, Little Loch Roag, Lewis	NB 128 313	58°10.6'N 06°53.1'W	YG; Ldig.T
265	152	Narrows, Little Loch Roag, Lewis	NB 127 302	58°10.0'N 06°53.1'W	
265	153	Loch an Stroim, Loch Roag, Lewis	NB 130 307	58°10.3'N 06°52.9'W	Asc.T; Fserr.T; Pel
265	155	Loch Risay E, Great Bernera, East Loch Roag, Lewis	NB 172 375	58°14.1'N 06°49.1'W	FveFves;Ldig.Ldig
265	161	Miavaig, Loch Roag, Lewis	NB 087 348	58°12.3'N 06°57.5'W	MacAre
265	180	Rubha Domhain, West Loch Roag, Lewis	NB 142 359	58°13.1'N 06°52.0'W	BPat.Lic; YG; Fser; FvesB; Ldig.Ldig
265	191	Teinish, West Loch Roag, Lewis	NB 117 353	58°12.7'N 06°54.5'W	AP.Pon VsenMtru
265	201	W of Valasay, Great Bernera, West Loch	NB 146 363	58°13.3'N 06°51.7'W	Ldig.T

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
		WEST LOCH ROAG			
57	1	Eala Sheadha, West Loch Roag, Lewis	NB 090 384	58°14.2'N 06°57.5'W	PomByC; Mob
57	2	NW Pabay Mór, West Loch Roag, Lewis	NB 095 385	58°14.3'N 06°57.0'W	Flu.HByS; Lhyp.Ft; CorMetAlc
57	3	SE Pabay Mór, West Loch Roag, Lewis	NB 106 377	58°13.9'N 06°55.8'W	Lhyp.Ft
57	4	Tearbasco, Vacsay, West Loch Roag, Lewis	NB 111 368	58°13.5'N 06°55.3'W	EcorEns; Lhyp.Ft; Lhyp.Pk; CorMetAlc; LhypGz.Ft; XKScrR
57	5	Bogha na Muilne, West Loch Roag, Lewis	NB 122 351	58°12.6'N 06°54.0'W	Flu.HByS; IGS; Lhyp.Ft
57	6	N Vuia Mór, West Loch Roag, Lewis	NB 125 359	58°13.0'N 06°53.8'W	Lhyp.Ft; LhypGz.Ft; LhypGz.Pk
57	7	Iola Sgeir, West Loch Roag, Lewis	NB 096 375	58°13.8'N 06°56.8'W	EcorEns; Lhyp.Ft
57	8	W Pabay Mór, West Loch Roag, Lewis	NB 099 376	58°13.8'N 06°56.5'W	FaSwV; Lhyp.Ft; FaAlC
57	9	Valtos Harbour, West Loch Roag, Lewis	NB 095 369	58°13.5'N 06°56.9'W	XKScrR
57	10	Liacam, Vacsay, West Loch Roag, Lewis	NB 119 370	58°13.6'N 06°54.5'W	Lhyp; Ant
57	11	Geile Sgeir, West Loch Roag, Lewis	NB 122 360	58°13.1'N 06°54.1'W	FaAlC; LhypGz.Pk
57	12	Kyles Pabay, West Loch Roag, Lewis	NB 103 364	58°13.2'N 06°56.0'W	Zmar
57	13	Stung, West Loch Roag, Lewis	NB 115 359	58°13.0'N 06°54.8'W	EcorEns; Lhyp.Ft; LhypGz.Ft
57	23	Sgeir na h-Adaig, Vuia Mór, West Loch Roag, Lewis	NB 137 348	58°12.5'N 06°52.5'W	Lhyp.Ft
57	24	Knock Dibick, Vuia Mór, West Loch Roag, Lewis	NB 135 350	58°12.6'N 06°52.7'W	LsacX
57	25	SW Great Bernera, West Loch Roag, Lewis	NB 141 349	58°12.6'N 06°52.1'W	Lhyp.Ft
57	35	Bernera Bridge, West Loch Roag, Lewis	NB 163 342	58°12.3'N 06°49.8'W	SIR; Lhyp.TPk
57	41	Little Bernera narrows, West Loch Roag, Lewis	NB 142 404	58°15.5'N 06°52.4'W	Lsac.T
57	42	NE Pabay Mór, West Loch Roag, Lewis	NB 104 388	58°14.5'N 06°56.1'W	

Sublittoral sites – continued

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
57	43	Pabay lagoon, West Loch Roag, Lewis	NB 102 385	58°14.3'N 06°56.3'W	
58	122	W Grèinam, West Loch Roag, Lewis	NB 129 388	58°14.6'N 06°53.6'W	LhypR.Ft; CGS; AlcC; LhypGz.Pk
57	14	Rubha na Mòine, Vuia Mór, Loch Roag, Lewis	NB 130 343	58°12.2'N 06°53.1'W	Lsac.Ft
57	15	Rubha nan Sìdhean, Vuia Beag, Loch Roag, Lewis	NB 124 340	58°12.0'N 06°53.7'W	IMS; ModHAs
57	16	North Floday, Loch Roag, Lewis	NB 107 339	58°11.9'N 06°55.4'W	LsacX
57	17	Reef beach, Loch Roag, Lewis	NB 107 344	58°12.2'N 06°55.5'W	IGS
57	21	Gob Sgrithir, Loch Roag, Lewis	NB 124 326	58°11.3'N 06°53.6'W	IMU
57	22	Linish Point, Loch Roag, Lewis	NB 117 345	58°12.3'N 06°54.5'W	SubSoAs; EcorEns; Lhyp.Ft
58	8/1	Miavaig, Loch Roag, Loch Miavaig, Lewis	NB 095 339	58°11.8'N 06°56.7'W	Beg
58	8/2	Miavaig, Loch Roag, Loch Miavaig, Lewis	NB 101 335	58°11.7'N 06°56.0'W	IMU; PhiVir; Beg
		LITTLE LOCH ROAG			
57	18	Entrance, Little Loch Roag, Lewis	NB 126 323	58°11.1'N 06°53.4'W	LhypLsac.Ft
57	19	Aird Orasay, Little Loch Roag, Lewis	NB 127 315	58°10.7'N 06°53.2'W	Lhyp.TFt
57	20	Narrows, Little Loch Roag, Lewis	NB 127 303	58°10.0'N 06°53.1'W	Lsac.T
		EAST LOCH ROAG			
57	26	Vacasay Island E, East Loch Roag, Lewis	NB 187 366	58°13.7'N 06°47.5'W	FaAlC.Abi; CMS; Lhyp.Pk
57	27	Mol an Droighinn, East Loch Roag, Lewis	NB 179 369	58°13.8'N 06°48.3'W	AmenCio; VirOph; Lhyp.Ft
57	28	Vacasay Island W, East Loch Roag, Lewis	NB 185 365	58°13.6'N 06°47.7'W	Lhyp.Ft; Lhyp.Pk
57	29	Sgeir a'Mhurain, Little Bernera, East Loch Roag, Lewis	NB 150 414	58°16.1'N 06°51.6'W	Lhyp.TFt; LhypGz.Pk; Lhyp.TPk
57	30	Gaisgeir, Little Bernera, East Loch, Lewis	NB 154 412	58°16.0'N 06°51.2'W	Lhyp.TPk
57	31	Grèinam, East Loch Roag, Lewis	NB 199 358	58°13.3'N 06°46.2'W	LhypLsac.Ft
57	32	Eilean Blianish, East Loch Roag, Lewis	NB 189 376	58°14.2'N 06°47.4'W	Lhyp.Ft; LhypGz.Ft
57	33	Sgeir Bhan, Great Bernera, East Loch Roag, Lewis	NB 164 383	58°14.5'N 06°50.0'W	LhypGz.FtLhypGz.Pk
57	34	Eilean Mór, Great Bernera, East Loch Roag, Lewis	NB 175 382	58°14.5'N 06°48.8'W	LhypGz.Pk
57	36	Eilean Kearstay Channel, East Loch Roag, Lewis	NB 193 337	58°12.1'N 06°46.7'W	VirOph; ModHAs; LhypLsac.Ft; CorMetAlc
57	37	Kyles Keava, East Loch Roag, Lewis	NB 194 352	58°12.9'N 06°46.7'W	LhypLsac.Ft
57	40	Rubha Thorab, Croir, East Loch Roag, Lewis	NB 156 402	58°15.5'N 06°50.9'W	IGS; Lhyp.Ft; LhypGz.Pk; XKScrR
58	9/1	Earshader, Loch Roag, East Loch Roag, Lewis	NB 155 335	58°11.9'N 06°50.5'W	Beg
58	9/2	Earshader, Loch Roag, East Loch Roag, Lewis.	NB 155 335	58°11.9'N 06°50.5'W	IMU
281	S9	NE Keava, East Loch Roag, Lewis	NB 199 354	58°13.1'N 06°46.2'W	

Compiled by: Ruth Beaver and Frances Dipper

6 Broad Bay (Loch a Tuath)

Location		
Position (centre)	NB 500 370	58E12'N 06E16'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

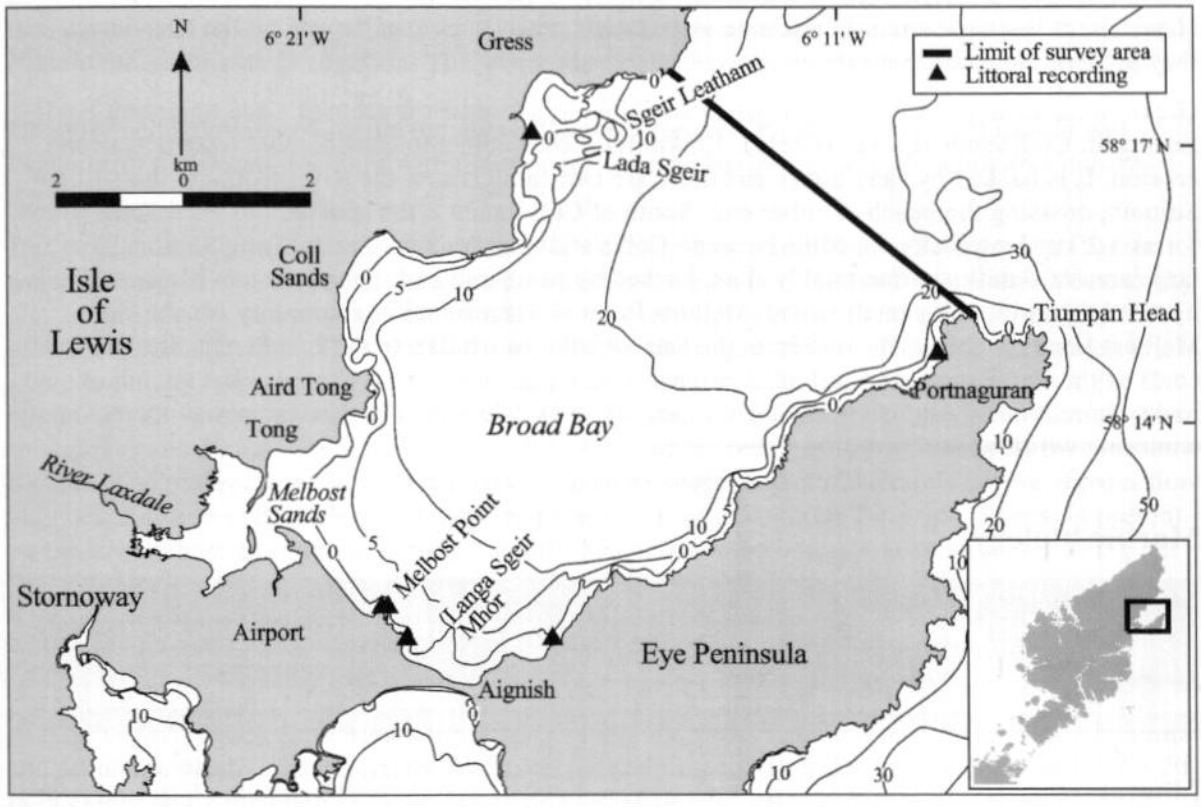

Figure 6.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Open sealoch
Length of coast	50.5 km (51.9 km including islands)
Length of inlet	9.9 km
Area of inlet	60.1 km^2 (60.0 km^2 excluding islands)
Bathymetry	Maximum depth 24 m at mouth
Wave exposure	Moderately exposed to exposed
Tidal streams	Weak
Tidal range	4.1 m (mean springs); 1.7 m (mean neaps) (Stornoway)
Salinity	Fully marine

Introduction

Broad Bay, or Loch a Tuath, is situated on the east coast of Lewis to the north-east of Stornoway. A narrow isthmus joins the Eye Peninsula with the mainland and forms the head of a

semi-enclosed area of sea surrounded on three sides by land. This large expanse of sea measuring 6 km across the entrance has more characteristics in common with the open coast than with an enclosed sealoch. The bay's innermost reaches form the estuary of two rivers, the River Laxdale and Abhainn a'Ghlinne Dhuibh, with one of the largest areas of tidal flats and saltmarsh in the Outer Hebrides (Buck 1993).

Broad Bay is unique within the Outer Hebridean coastline, as it includes sedimentary rock formations composed of Torridonian sandstone and grit. There are several extensive rocky shores and four sandy areas: the large bays of Gress and Coll Sands; the Melbost area – an extensive complex of sand, sand-spits, muddy sand and saltmarsh; and the linear beach between Melbost and Aignish on the north side of the narrow isthmus. Although all these sandy beaches are to some extent sheltered from the extreme wave action sometimes experienced on the open coast, they are still moderately exposed.

Gress Sands lie at the north end of Broad Bay. Just offshore lie the reefs of Lada Sgeir and Sgeir Leathann. Coll Sands is a sandy beach 1.6 km long and subject to considerable wave action and erosion. It is backed by sand dunes and there are two small rivers, the River Coll and the Allt an-Sniomh, crossing the beach at either end. South of Coll Sands is the headland of Aird Tong which forms a 2 km-long rocky coastline between Coll Sands and Melbost Sands. Tong Saltings is a large area of semi-estuarine muddy sand, backed by saltmarsh and separated from Melbost Sands by two long spits and a small island. Melbost Point is a small rocky promontory separating Melbost Sands to the north-west from the narrow isthmus leading to the Eye Peninsula. The west coast of the Eye Peninsula consists of extensive rock platforms and rockpools. The stretch of rocky shore around Aignish is frequently used by seals, while the Laxdale estuary supports wintering wildfowl and breeding terns.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	2	September 1982	Smith (1983)
	Recording (epibiota)	4	May 1978	Powell *et al.* (1979)

Littoral

Rocky shores

The rocky shores around Broad Bay are exposed or moderately exposed and do not have the thick growths of knotted wrack *Ascophyllum nodosum* so typical of many of the other more sheltered sealochs in the Outer Hebrides. Instead thick growths of various red algae, barnacles and mussels predominate. The rocky peninsula of Aird Tong consists of bedrock with many rockpools colonised by dense growths of the calcareous red alga *Corallina officinalis* (Cor). These rockpools harbour a large number of polychaete species amongst the branches of *C. officinalis* and under pebbles on the bottom. The accumulation of sediment and detritus amongst the closely packed branches of *C. officinalis* favour the presence of both deposit-feeding and scavenging and predatory polychaetes. Polychaetes found here include *Ehlersia cornuta*, *Odontosyllis ctenostoma*, *Sphaerosyllis hystrix*, *Brania pusilla*, *Polydora caeca*, *Malacoceros fuliginosus*, *Cirratulus cirratus* and *Fabricia sabella*. Polychacte species found under stones and amongst sand at the bottom of rockpools included *Eulalia viridis*, *Nephtys cirrosa* and *Capitella capitata*.

The east side of Melbost Point is of steeply sloping conglomerate cut into a rock platform which is about 1 km long and extends at low water over 500 m seawards. This area is stepped and cut by gullies and linear pools which on their upper side are often bordered by overhangs up to 1 m high. The shore is covered with dense turfs of red algae including *Ahnfeltia plicata*. Fucoid algae are scarce except on the upper shore where a marked black zone of the lichen *Verrucaria maura* (Ver)

is present above *Fucus spiralis* and *Pelvetia canaliculata*. The upper shore is dominated by the barnacle *Semibalanus balanoides* (BPat.Sem). Below this is a narrow zone dominated by the alga *Osmundea pinnatifida*. Small mussels *Mytilus edulis* cover the mid-shore together with the red algae *Dumontia contorta*, *Mastocarpus stellatus* and *Ceramium* spp. (MytB). A few plants of dabberlocks *Alaria esculenta* occur at low water (Ala.Ldig) and below this is an extensive sublittoral *Laminaria hyperborea* kelp forest.

The west side of Melbost Point is different, being composed of hummocked conglomerate with gullies and pools. This side is less exposed than the east side and although mussels are present they are less predominant. A broad zone of *Fucus serratus* is present together with the red algae *D. contorta*, *M. stellatus*, *O. pinnatifida* and *Ceramium* spp. which occur in greater abundance than on the east side of the point (Fser.R). Some stunted *A. nodosum* can be found and thongweed *Himanthalia elongata* is common. This shore provides a good example of zonation patterns in moderately exposed conditions. A gully leads to a natural arch above a shingle beach, the walls of the gully being dominated by the red algae *Plumaria elegans*, *Rhodothamniella floridula* and *Lomentaria articulata*, together with the sponges *Grantia compressa* and *Halichondria panicea* (Ov).

The gently sloping rocky shore at Aignish is about 2 km long and 200 m wide from high to low water. The upper shore beneath the sandstone cliff is covered by sand for 20 m. Below this a rocky platform continues to low water. Small ridges run roughly parallel with the coast formed by the seaward dip of the strata. Thus the landward faces of the ridges are steeper and more sheltered. There are many long pools lying between ridges and these contain large amounts of the algae *C. officinalis*, *D. contorta*, *Furcellaria lumbricalis*, *Dictyota dichotoma*, *O. pinnatifida*, *Cladostephus spongiosus* and *Halidrys siliquosa* (Rkp; Cor). The mid-shore is generally dominated by dense fucoids. The presence of *Fucus vesiculosus* f. *linearis* suggests that moderately severe wave action may occur at times (BPat.Fvesl). A large population of the periwinkle *Littorina littorea* is present on the lower shore near a small sewage outfall. Sand covers the bedrock at some points along the low water mark and here the sand-binding red alga *R. floridula* is present in abundance, together with *Trailliella* spp. (Rho). Some of the lower rockpools contain a moderately rich fauna of sponges, ascidians and echinoderms including the green urchin *Psammechinus miliaris*.

Portnaguran, at the tip of the Eye Peninsula, consists of a small sandy patch behind a breakwater or pier, beyond which is an irregular platform of angular rocks and boulders made of gneiss. Flora and fauna are patchy and dominated by barnacles and limpets (Bpat.Lic). A shallow pool, 10 × 20 m in extent and with a pebble floor, has thick clumps of encrusting coralline algae and *C. officinalis* (Cor). Dense strands of the ephemeral green alga *Enteromorpha* sp. occur in the upper shore while *Cladophora rupestris* occurs in the lower shore. Below the sublittoral fringe the rock gives way to sand.

Sediment shores

With the exception of the semi-estuarine area behind Melbost sands, all the sediment shores in Broad Bay are moderately exposed and consist of fine sand.

Gress Sands is an east-facing beach situated on the open coast near the north end of Broad Bay. The Gress River flows over the beach and probably affects the salinity locally. The beach is backed by sand dunes 5–10 m high in places, behind which is saltmarsh. Below the sand dunes a cobble beach of moderate slope exists with a sparse cover of the fucoids *Fucus spiralis* and into *Fucus vesiculosus*. A very gently sloping shore of fine, clean sand then extends for approximately 500 m down to the sublittoral zone. Offshore reefs afford local shelter and the main beach extends in a small spit in the lee of these rocks. Epifauna is absent from the beach. The infaunal community of bivalves and polychaetes is dominated by the tellin *Angulus tenuis* (AP.P; AP.Pon). The sands, which are poorly drained at low tide, stay wet enough for this species to extend up to mid-shore level. Associated fauna include the lugworm *Arenicola marina*, the sand mason worm *Lanice conchilega*, bristleworms *Nephtys cirrosa* and *Nephtys hombergii*, the heart urchin *Echinocardium cordatum* and the razor clam *Ensis siliqua* (EcorEns).

At Coll Sands the incline is gentle, giving rise to an intertidal beach of about 300 m width. The shore is of clean sand and has a similar community to Gress sands, with dense *A. tenuis*. Associated fauna include *N. cirrosa* and *N. hombergii*, the striped venus shell *Venus striatula* and occasionally *E. cordatum*. At extreme low water mark and in shallow water offshore there are populations of *E. cordatum* and *E. siliqua* (EcorEns). These species are typical inhabitants of clean or slightly muddy lower shore sand.

In contrast to Gress and Coll Sands, the marine beach of Melbost Sands supports a similar although impoverished infaunal community, including the bonded wedge shell *Donax vittatus* and polychaetes *Nephtys* spp. and *L. conchilega*. Tong Saltings, the semi-estuarine area of muddy sand behind the marine beach, is dominated by *A. marina* and capitellid polychaetes with the bivalves *Scrobicularia plana* and *Macoma balthica* also present. *A. marina* occurs throughout the littoral zone where it inhabits a wide range of sediment grades ranging from almost pure mud to clean sand, although populations attain their optimum development under intermediate conditions of muddy sand.

The linear beach at Branahuie between the rocky shores of Melbost and Aignish is divided by the conglomerate reef of Langa Sgeir Mhór which extends from the sublittoral up to the mid-shore. The shore is moderately exposed and is very open to swell from the north-east. This shore also supports a moderately developed community of *A. tenuis* up to the mid-shore, with high densities of *D. vittatus*.

Sublittoral

There is no information available on the sublittoral of Broad Bay.

Nature conservation

Conservation sites

Site name	*Status*	*Main features*
Tong Saltings	SSSI	Marine botanical; ornithological; wet heaths, saltmarsh and tidal flats
Gress Saltings	SSSI	Marine botanical; ornithological (includes intertidal sands north of the river, dunes, machair and saltings)
Stornoway (N of airport)	MoD	Rock, sand

Human influences

Coastal developments and uses

Broad Bay lies in the most populous part of the Outer Hebrides. Stornoway (population 8,600) is the islands' capital, largest town, major port, industrial centre and communications centre, although the main focus of the town is southwards away from Broad Bay, towards Stornoway Harbour. The area is well served by roads: the A866 runs eastwards from Stornoway to the end of the Eye Peninsula, while the B895 runs northwards from Stornoway to Tolsta about 5 km north of Broad Bay; both roads support linear development, with side roads leading to the many small villages along the coast.

The major development on the shores of Broad Bay is Stornoway Airport. Land-claim for an extension to the airport in 1983 (protected by rock-armour coastal defences) removed an area of intertidal flats, thereby altering the coastal configuration and changing sediment distribution. As a result, the sand-spit of Teanga Tunga is growing northwards but eroding at its southern end (Buck 1993). There have been proposals for planting of marram *Ammophila arenaria* to stabilise the dunes near the airport.

The Laxdale estuary supports a variety of recreational activities, while all the sandy beaches in Broad Bay are relatively heavily used in summer by holidaymakers. As a result of the many

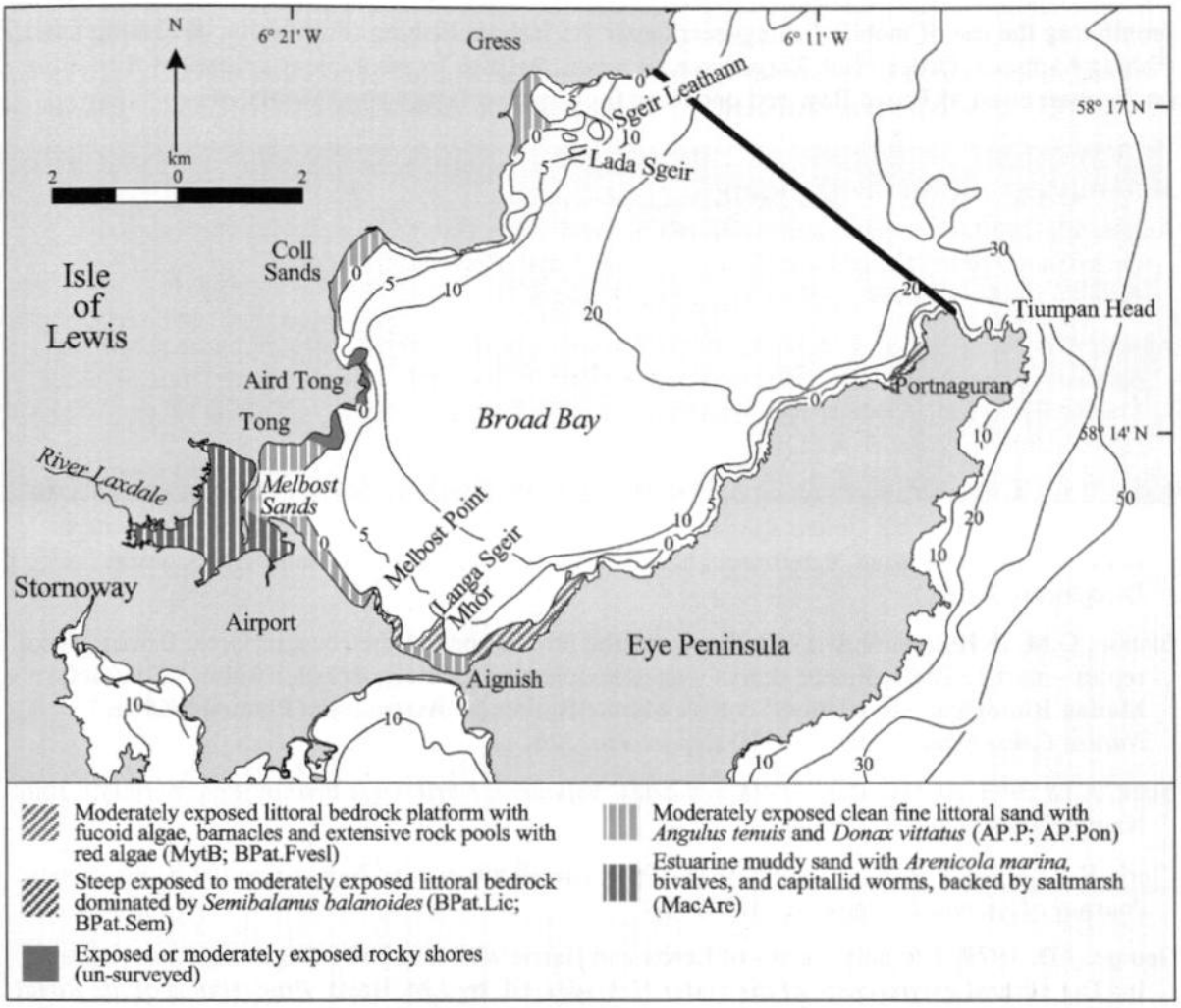

Figure 6.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 6.1, cited literature and additional field observations).

holidaymakers using the beach at Gress Sands, the dunes behind the beach have been subject to considerable erosion. Other land uses include light grazing of the saltmarshes and sand dunes and turf-cutting on the saltmarshes.

Marine developments and uses

There are many heavily used slips and moorings at Gress, Vatisker and Portnaguran and a pier at Portnaguran. At Coll, where there is no slip, the beach is used as a landing place for small boats. There are sewage outfalls on the coast at Gress Sands, Coll Sands, Aignish and Garrabost (all receiving at least primary screening); sewage from Stornoway and Melbost is discharged to the south of Area 6, outside Broad Bay.

The whole of Broad Bay is used extensively for lobster *Homarus gammarus* and crab potting, but buoys marking fleets are particularly abundant at Vatisker, Aignish and Portnaguran. Fixed fishing nets are in operation at the northern end of Gress Sands and at Coll Sands. The rocky areas at Aignish are popular for sea-angling, and mussels *Mytilus edulis* in the Laxdale estuary are collected for bait.

Broad Bay is a cod *Gadus morhua* and whiting *Merlangius merlangus* spawning ground, and a plaice *Pleuronectes platessa* nursery ground. The Bay is protected by a full-year closure

prohibiting the use of mobile fishing-gear under the Inshore Fishing (Prohibition of Fishing and Fishing Methods) Order 1989. There have been two shellfish farming leases granted at Aird Tong on the west coast of Broad Bay, and one lease for a salmon farm east of Griais.

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Survey 265: 1970-1980 SMBA/MBA intertidal survey of Great Britain (Powell *et al.* 1979).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
92	29	Melbost Point, Broad Bay, Lewis	NB 473 330	58°12.8'N 06°18.1'W	MytB; BPat.Sem; Fser.R; Ala.Ldig; Pel; Ov
92	30	Portnaguran, Broad Bay, Lewis	NB 557 375	58°15.5'N 06°09.9'W	BPat.Lic; Cor; G; YG
265	121	Aignish, Broad Bay, Lewis	NB 496 330	58°12.8'N 06°15.8'W	Rkp; Cor; Rho; BPat.Fvesl
265	140	Gress Sands, Broad Bay, Lewis	NB 493 410	58°17.1'N 06°16.6'W	EcorEns; AP.P; AP.Pon
265	158	Melbost N, Broad Bay, Lewis	NB 469 335	58°13.0'N 06°18.6'W	Ver; BPat.Cht; Fspi; Lsac.Ldig
265	159	Melbost Point, Broad Bay, Lewis	NB 470 335	58°13.0'N 06°18.5'W	MytB; BPat.Cht; Ala.Ldig; Ldig.Ldig

Compiled by: Ruth Beaver and Frances Dipper

7 Loch Grimshader

Location		
Position (centre)	NB 410 256	58°08'N 06°24'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

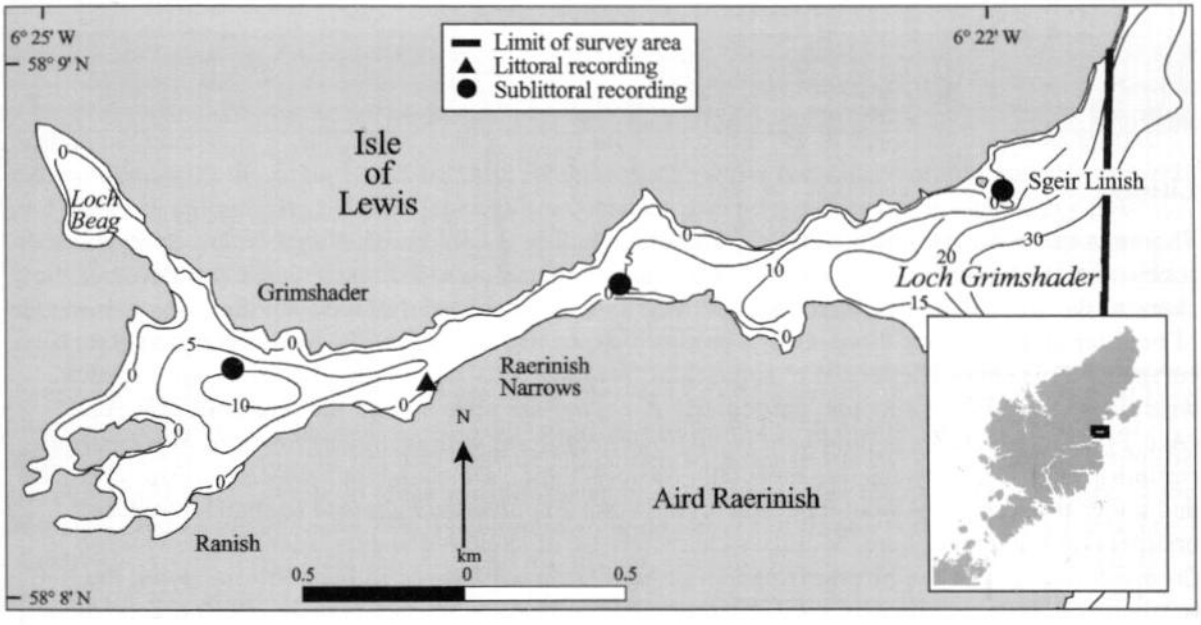

Figure 7.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Fjordic sealoch
Length of coast	10.5 km (11.4 km including islands)
Length of inlet	3.4 km
Area of inlet	1.18 km^2 (1.15 km^2 excluding islands)
Bathymetry	Loch mouth (30 m) and basin (14 m) separated by a long sill at 2–6 m depth
Wave exposure	Exposed at mouth to extremely sheltered in loch basin
Tidal streams	Moderately strong in entrance channel to very weak within loch
Tidal range	4.1 m (mean springs); 1.7 m (mean neaps) (Stornoway)
Salinity	Fully marine; variable within Loch Beag

Introduction

Loch Grimshader is a small sealoch on the east coast of Lewis. It lies to the north of Loch Erisort and Loch Leurbost (*Area summary* 8) and is separated from them by the narrow, steep headland of Aird Raerinish. The mouth of the loch is open to the east and is flanked by steep rocky headlands. It gradually narrows to form a channel, Raerinish Narrows, 300 m long and 2–6 m deep, which separates the mouth area from an inner small basin with a maximum depth of 14 m. The channel is surrounded by high ground and is therefore extremely sheltered from wave action. It is swept by tidal streams of between 1 and 3 knots due to its narrow width and shallow seabed. A small shallow tongue of the loch, Loch Beag, branches northward from the main inner basin and also has a narrow entrance with some enhanced tidal flow. Loch Grimshader was classified as a fjord

by Howson, Connor & Holt (1994); however Earll & Pagett (1984) classified the loch as an ob, probably due to the enclosed nature of Loch Beag which might be considered as a second basin. Loch Grimshader is heavily used for fish and shellfish farming due to the sheltered nature of its inner basin and, as a result, large areas of the seabed within the main basin show signs of anoxia associated with excessive nutrient loading. The sheltered nature of Loch Beag makes it a good anchorage.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	1	March 1982	Smith (1982)
Sublittoral	Recording (epibiota)	3	August 1990	Holt (1991)

Littoral

Shores in the outer parts of Loch Grimshader, including the Raerinish Narrows, are steep and rocky, and the high headlands flanking the loch entrance descend directly to the sea. Most of the shore to the west of Raerinish Narrows is of gravel. Near the head of the loch there are small areas of boulder and sediment shore. Only one shore, at the east end of the Raerinish Narrows, has been surveyed. This shore is exposed to some tidal flow and consists of silted boulders and bedrock with a dense growth of fucoids, particularly *Ascophyllum nodosum*, in the mid-eulittoral zone (Asc.T). *Fucus serratus* is dominant in the lower eulittoral with an undergrowth of *Mastocarpus stellatus* (Fserr.T). Polychaetes, especially *Spirorbis* spp., are abundant both on *F. serratus* fronds and under the less-silted boulders. The bristleworm *Eupolymnia nebulosa* is abundant under boulders on the upper shore. Molluscs characteristic of sheltered waters, such as periwinkles *Littorina saxatilis* in the littoral fringe and rough *Littorina littorea* in the eulittoral zone, the topshells *Gibbula umbilicalis* and *Gibbula cineraria*, and the mussel *Mytilus edulis* are abundant. The scallop *Chlamys distorta*, usually a sublittoral species, is present in the mid-eulittoral zone.

Sublittoral

Very steep bedrock slopes extend to at least 25 m depth at Sgeir Linish in the mouth of Loch Grimshader, making this a very scenic area. Similar bedrock slopes probably extend for some distance inside the mouth, but only this site, one in the narrows and one in the inner basin have been surveyed. Sublittoral areas throughout the narrows and the inner basin are predominantly sediment habitats.

Infralittoral rock

At Sgeir Linish, where exposure to wave action is moderate, a dense kelp forest of tall *Laminaria hyperborea* extends down to 11 m depth (LhypR.Ft) followed by a kelp park of *L. hyperborea* with some *Laminaria saccharina* down to 16 m (LhypR.Pk). A reasonably diverse understorey of foliose algae and sessile fauna is present. The red algae *Cryptopleura ramosa*, *Palmaria palmata* and *Membranoptera alata* and the soft coral *Alcyonium digitatum* are common on the kelp stipes in the upper infralittoral, while the hydroid *Obelia geniculata* and the stalked jellyfish *Lucernariopsis campanulata* are found on kelp fronds. *Delesseria sanguinea* is the dominant alga in the understorey of the upper infralittoral zone, growing profusely over encrusting coralline algae but becoming less common in the lower infralittoral. The algae *Dictyota dichotoma* and *Bonnemaisonia hamifera (Trailliella)* are present in both the infralittoral and circalittoral but decrease in abundance with increasing depth. The jewel anemone *Corynactis viridis* colonises the undersides of overhangs, while *Caryophyllia smithii* and *Urticina felina*, the rock-boring sponge *Cliona celata* and the featherstar *Antedon bifida* are frequent on steep bedrock within the infralittoral, increasing in abundance on the deeper circalittoral rock.

Circalittoral rock

Steep circalittoral rock below the kelp forest at Sgeir Linish extends to depths of 16–25 m. Large areas of the rock are dominated by pink coralline algal crusts along with the keel worm *Pomatoceros triqueter* and the encrusting bryozoan *Parasmittina trispinosa* (FaAlC). The common urchin *Echinus esculentus* is frequent here in the shelter of the deeper water and is probably responsible for the scarcity of all but the most grazing-resistant species, such as *C. smithii* and *A. bifida*. At this site the bedrock is rugged and bisected by fissures which provide refuges for additional species, including the sea cucumber *Thyone roscovita*, the squat lobster *Galathea strigosa* and the lobster *Homarus gammarus*.

Sublittoral sediments

The inner basin at the head of Loch Grimshader is extremely sheltered from wave action and the seabed here consists of soft, flocculent mud. At the time of survey in 1990 the mud was anoxic and covered with the filamentous bacteria *Beggiatoa* sp., while the water column above was turbid and milky in colour (Beg). These features are considered to be typical of areas with very poor water circulation and high nutrient loading from nearby salmon cages. Very few other species were found in this area, except for occasional anemones *Sagartiogeton laceratus* and *Cerianthus lloydii*. However, the presence of numbers of empty bivalve and crustacean shells suggest that the sediments once supported a much larger and more diverse community.

Sediments in the Raerinish Narrows are much coarser as a consequence of the increased tidal flow through the channel. The seabed here consists of medium sand with pebbles and some mud at depths between 2–7 m. The pebbles provide attachments for dense stands of sugar kelp *Laminaria saccharina* (LsacX), while in areas with fewer pebbles *Trailliella*, the tetrasporophyte stage of the red alga *Bonnemaisonia hamifera*, is common. A wide variety of brown and red algae, including *Asperococcus turneri*, *D. dichotoma*, *Scinaia turgida*, *Halarachnion ligulatum* and *Rhodophyllis divaricata* are frequent. Molluscs are well represented in this area, particularly the razor clam *Ensis arcuatus* and the scallop *Pecten maximus*, which are frequent in patches of sand (EcorEns). Echinoderms and ascidians, which are common in mixed sediment habitats not exposed to tidal streams, are very poorly represented in the channel, with the exception of the seven-armed starfish *Luidia ciliaris*, which was frequent.

Sediments extend downwards from the base of the rock slope at about 20–25 m in the outer mouth area, as a gently-sloping muddy sand plain. In 1990 the area showed signs of scallop dredging which may account in part for the poor species diversity, which was much lower than that found in other sealoch sites with the same habitat type. The only species frequently observed were the sea-pen *Pennatula phosphorea*, the burrowing anemone *C. lloydii* and *P. maximus* (VirOph).

Nature conservation

There are no designated conservation sites in the area at present.

Human influences

Coastal developments and uses

Two minor roads run along the sides of the loch from the west through the villages of Grimshader to the north and Ranish to the south, both ending about 1 km from the loch mouth. Both Ranish and Grimshader are relatively large villages in comparison with other settlements around the sealochs of Harris and Lewis, having a school, a church and a post office.

Marine developments and uses

Loch Grimshader is little used other than by fish farmers, although there is an anchorage at Loch Beag and moorings north of Ranish. There have been leases granted for one salmon farm and

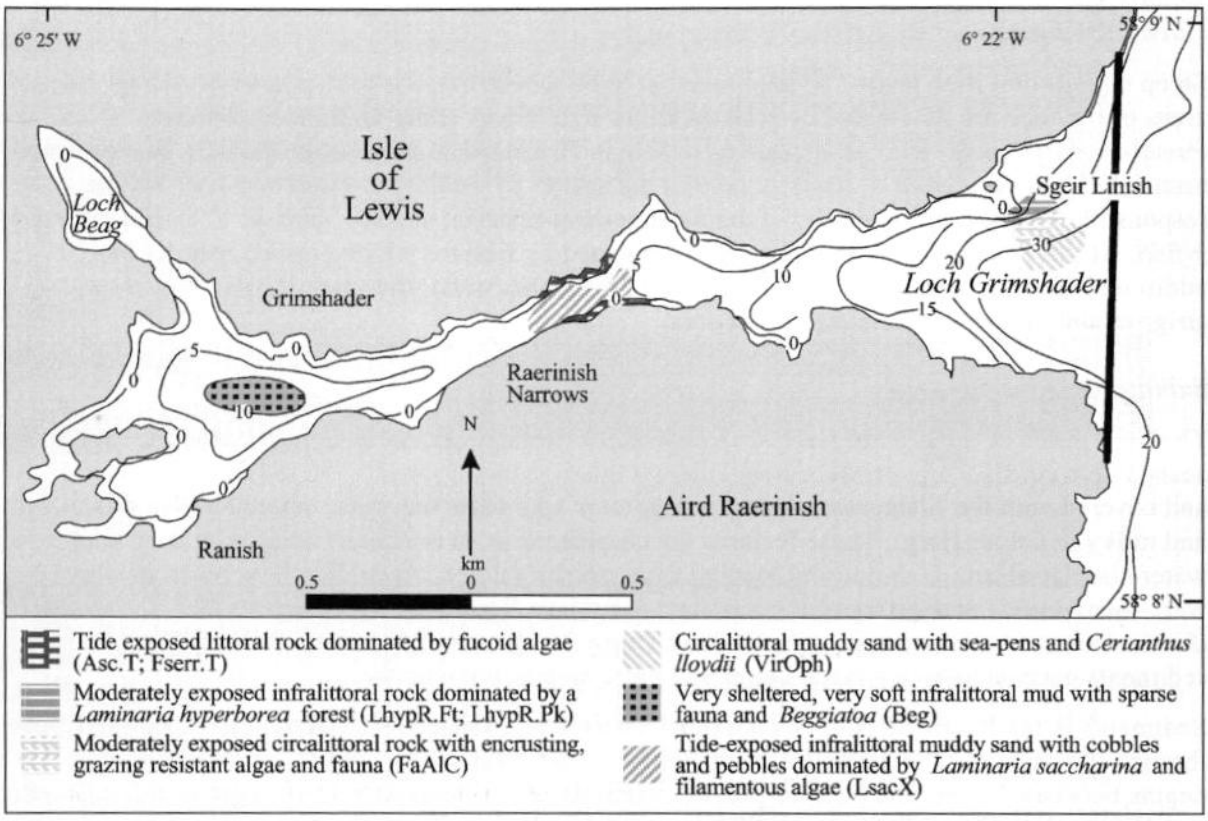

Figure 7.2 Indicative distribution of the main biotopes in the area (based on data from survey sites shown in Figure 7.1, cited literature and additional field observations).

three shellfish farms, although not all the shellfish sites are being used, and one licence for the discharge of effluent from salmon rearing cages (data correct at 10 March 1997). In the 1980s, a mussel raft (since moved) was sited in Loch Beag.

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Smith, S.M. 1984. Scottish saline lagoons with emphasis on the Mollusca. (Contractor: S.M. Smith, Edinburgh.) *Nature Conservancy Council, CSD Report*, No. 526.

Sites surveyed

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Survey 31: 1990 UMBSM survey of sealochs of Harris and Lewis (Holt 1991).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
93	1	Raerinish Narrows	NB 416254	58°08.5'N 06°24.2'W	Fserr.T; Asc.T

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
31	61	Anchorage, Loch Grimshader, Lewis	NB 404 258	58°08.7'N 06°24.7'W	Beg
31	62	Entrance channel, Loch Grimshader, Lewis	NB 416 257	58°08.6'N 06°23.5'W	EcorEns; LsacX
31	63	Sgeir Linish, Loch Grimshader, Lewis	NB 427 259	58°08.8'N 06°22.3'W	LhypR.Ft; FaAlC; VirOph; LhypR.Pk

Compiled by: Ruth Beaver and Frances Dipper

8 Lochs Leurbost and Erisort

Location		
Position (centre)	NB 340 220	58°06'N 06°30'W
Administrative area	Western Isles	
Conservation agency/area	Scottish Natural Heritage	North Areas (Western Isles)

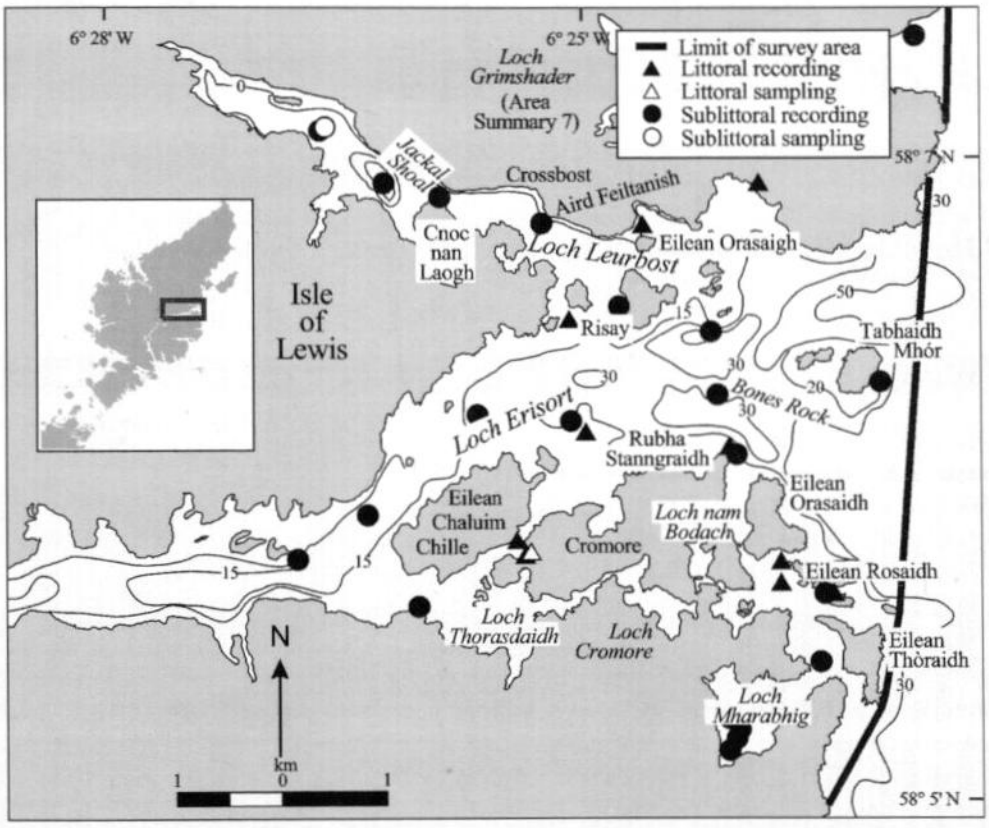

Figure 8.1a Main features of the area (eastern part), showing sites surveyed.

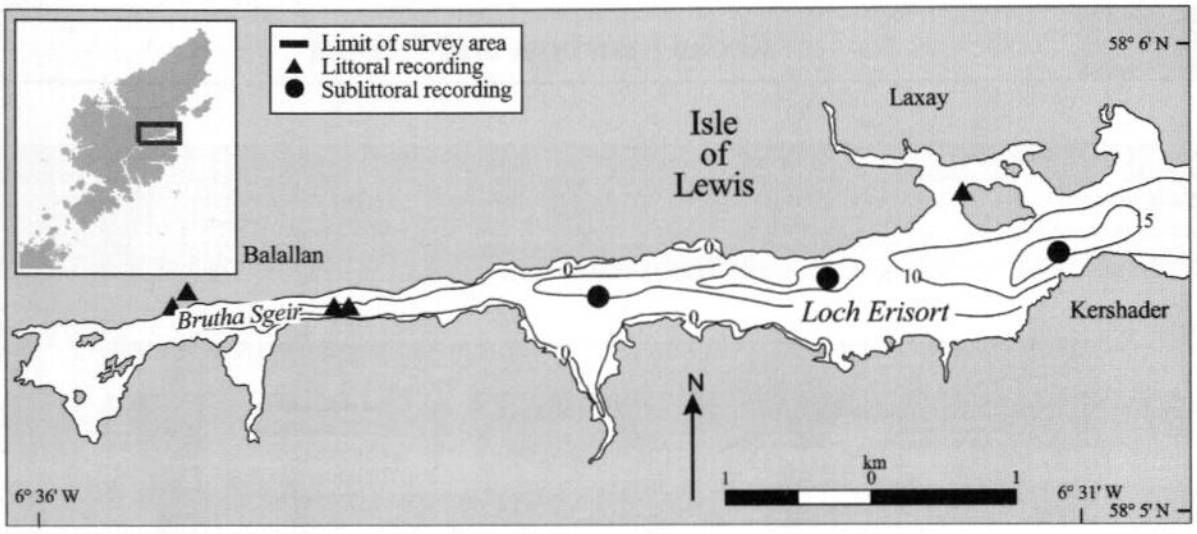

Figure 8.1b Main features of the area (western part), showing sites surveyed.

Physical features		
	Loch Erisort	***Loch Leurbost***
Physiographic type	Fjordic sealoch with two sills	Fjordic sealoch with one sill
Length of coast	86.7 km (121.8 km including islands)	
Length of inlet	16 km	
Area of inlet	25.7 km^2 (23.4 km^2 excluding islands)	
Bathymetry	Maximum depth 56 m at mouth; mostly less than 22 m	Maximum depth 20 m
Wave exposure	Moderately exposed at mouth; sheltered to extremely sheltered west of outer sill and in Loch Mharabhig	Sheltered to extremely sheltered
Tidal streams	Very weak to weak at entrance; moderately strong at Brutha Sgeir	Very weak; moderately strong at narrowest part
Tidal range	4.1 m (mean springs); 1.7 m (mean neaps) (Stornoway)	4.1 m (mean springs); 1.7 m (mean neaps) (Stornoway)
Salinity	Fully marine; can be variable where rivers enter	Fully marine

Introduction

Loch Erisort, situated mid-way along the east coast of Lewis, is the second-longest sealoch in the Outer Hebrides. To the south-west lies the uninhabited 23,000 ha estate of Park, or Pairc, which is moorland used for sheep grazing.

Loch Erisort has both fjordic and fjardic characteristics since it is long and narrow with two ill-defined sills, but is relatively shallow with many small islands around the entrance and in the inner loch. The largest island is Eilean Chaluim Chille, and the first sill runs from here to the north side of the loch. The island provides shelter behind it to a small arm of the loch, Loch Thorasdaidh. Other large islands include Eilean Thòraidh which faces east directly into the Minch, and Eilean Mór Laxay situated half-way down Loch Erisort. The second sill runs across the inner loch near Laxay. On the south side of the entrance, the islands of Orasaidh, Rosaidh and Thòraidh provide shelter to other small arms of the loch, including Loch Mharabhig which is extremely sheltered, and Loch nam Bodach which forms an ob with a restricted entrance linking it to Loch Erisort (Thorpe *et al.* 1998). A tidal waterfall runs out from Loch nam Bodach. A second, larger lagoon, Loch Cromore, which is brackish, connects with Loch Thorasdaidh and is also described by Thorpe *et al.* (1998). Loch Leurbost is a small branch of Loch Erisort extending north-westwards for 4 km from the main loch mouth. It has fjord-like characteristics with a single sill at

7 m depth and a single basin reaching 20 m deep. It also has a relatively high percentage (30%) of intertidal area.

Loch Erisort is mostly shallow, rarely exceeding 20 m in depth, although there are deeper areas reaching 56 m in the mouth. The loch system as a whole has a wide range of littoral and sublittoral habitats, including a large expanse of mudflats at the head of the loch. Tidal streams within the loch are mostly very weak, but moderately strong tidal streams flow through the narrows at Balallan 2 km from the loch head and through the narrowest part of Loch Leurbost at Cnoc nan Laogh.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	7	August 1990	Holt (1991)
	Recording (epibiota)	5	April–May 1978	Powell *et al.* (1979)
	Recording (epidiota)	8	May 1977–March 1982	Smith (1982)
	Infaunal sampling (cores)	1	August 1990	Holt (1991)
Sublittoral	Recording (epibiota)	20	August 1990	Holt (1991)
	Recording; infaunal sampling (cores)	5	July 1984	Rostron (1984)
	Infaunal sampling (suction sampling)	1	August 1990	Holt (1991)

Littoral

Shores in the outer part of this loch system, east of the sill at Eilean Chaluim Chille, are short, steep and rocky with bedrock extending into the sublittoral. This includes the islands in and to the south of the entrance. Within the main body of Loch Erisort, shores are either of bedrock or of boulders and cobbles. Narrow channels between the various islands and the loch shores form areas of restricted water passage and extreme shelter and are made up of boulders and cobbles with muddy sediments. At the head of Loch Erisort, mud-flats extend along the sides of the channel for several kilometres and there are smaller areas of flats behind Eilean Mór Laxay. The head of Loch Leurbost has not been surveyed, but appears from the charts to consist of mud and pebble flats with some freshwater influence.

Littoral rock

East-facing shores of the mainland and the islands at the mouth of Lochs Erisort and Leurbost, from sites at Risay to Eilean Rosaidh, are exposed or moderately exposed wave action and support barnacle-dominated biotopes typical of shores at the entrances to many Hebridean sealochs. The upper littoral fringe on these shores occurs higher up the shore and forms a broader zone than that on sheltered shores towards the head of the loch, occurring between 6 and 4.5 m above chart datum, in contrast to between 4.9 and 4.7 m at sheltered sites. This zone is typically characterised by a broad band of the black lichen *Verrucaria maura* (Ver.Ver) with many small cryptic periwinkles *Melarhaphe neritoides* and *Littorina saxatilis*. At some sites, the barnacle *Chthamalus montagui* colonises the lower littoral fringe (Ver.B) and the upper eulittoral zone (BPat.Cht). The upper eulittoral is marked by the appearance of channelled wrack *Pelvetia canaliculata*, the barnacle *Semibalanus balanoides* and an increasing number of the periwinkles *Littorina littorea*, *M. neritoides* and *L. saxatilis* (PelB). In this zone, fucoid cover is low in comparison with sheltered shores. The main part of the shore, the mid-eulittoral zone, is dominated by dense *S. balanoides*, with numerous limpets *Patella vulgata* and dogwhelks *Nucella lapillus* (BPat.Sem). *Fucus vesiculosus* is restricted to small patches, and mussels *Mytilus edulis* tend to be small and confined to cracks and crevices, along with the beadlet anemone *Actinia equina*. Knotted wrack *Ascophyllum nodosum*, abundant at more sheltered sites in the mid-eulittoral, is occasional or

absent in these moderately exposed areas. Red algae, including *Membranoptera alata*, *Chondrus crispus* and *Osmundea pinnatifida*, are frequent.

Lower eulittoral exposed bedrock is dominated by the algae *Fucus serratus* and *Mastocarpus stellatus* with some *S. balanoides*, *P. vulgata* and *N. lapillus* (Fser.R). The barnacle *Balanus crenatus* is found in moderate numbers, increasing in density towards the sublittoral zone. The sublittoral fringe is often well developed and characterised by kelps *Laminaria digitata*, *Alaria esculenta* and foliose red algae including *Palmaria palmata*, *C. crispus*, *O. pinnatifida* and *M. stellatus* (Ldig.Ldig). Fauna include *P. vulgata* and the ascidians *Dendrodoa grossularia* and *Botryllus schlosseri*. Smith (1982) recorded the carpet shell *Tapes decussatus* in the rocky mid-shore region of Eilean Orasaigh at the entrance to Loch Leurbost. This species is seldom recorded in Scotland and has been found only in Loch Sween, Loch Scridain and at one site in Shetland.

All shores west of and including Eilean Chaluim Chille are very sheltered from wave action and, with the exception of very steep areas, are dominated by fucoid algae. The most interesting of these shores are those exposed to tidal streams. Near the head of the loch at Balallan is an area of mixed littoral rock, Brutha Sgeir, which forms the north side of the narrowest part of the loch. Here mid-channel tidal streams flow at approximately 3 knots. The south shore is backed by vertical cliff 10 m in height, with large angular boulders forming a steep slope down to the sublittoral. This area was considered by Smith (1984) to be the richest intertidal area in Lewis in terms of its mollusc species. She recorded large numbers and a high diversity of mollusc species, in particular nudibranchs. The increased tidal flow results in zones of rich growths of fucoid algae *A. nodosum* and *F. serratus* on the boulders and bedrock of the south shore (Asc.T, Fserr.T) and mainly *F. vesiculosus* and *F. serratus* on the cobbles, pebbles and boulders of the north shore (FvesX, FserX). *P. vulgata* and barnacles *S. balanoides* cover the tops and sides of some boulders. A variety of red and green algae, molluscs and ascidians, especially *D. grossularia*, *Ascidiella scabra* and *Ascidia conchilega*, grow on and under the fucoids and boulders on the lower shore on both sides of the channel, the ascidians often in dense aggregations. The barnacle *Verruca stroemia* is also common under boulders. The channel itself has a mixed substratum of boulders, cobbles and pebbles with lush growths of *L. digitata* (Ldig.T).

A few kilometres east of Balallan is another narrow channel between the west side of Eilean Mór Laxay and the north shore of Loch Erisort. Here the river Laxay joins the loch and salinity can be variable. The shores of this channel are again dominated by fucoid algae, mainly *A. nodosum* (Asc.VS), but tidal currents are weak and there is no associated rich lower shore fauna and flora. *P. vulgata*, which is sensitive to freshwater runoff, is abundant in mid and lower eulittoral bedrock shores at Balallan, but is absent from this channel. Small patches of cotton *Fucus muscoides*, characteristically found at the tops of very sheltered shores and saltmarshes, are frequent in the littoral fringe at this site but absent from the narrows at Balallan. *S. balanoides*, which is found with increasing abundance towards the lower eulittoral zone at Balallan, is absent from the lower eulittoral at Eilean Mór Laxay and is replaced by *B. crenatus* and *M. edulis* with *F. vesiculosus* (FvesX).

A third interesting channel lies between the south shore of Loch Erisort and Eilean Chaluim Chille. Here again the sublittoral fringe has a rich fauna of ascidians and sponges, this time within a *Laminaria saccharina* kelp forest on muddy sand and shell gravel overlain by pebbles (Lsac.T). At low tide, the area is an intertidal causeway extremely sheltered from wave action. The mixed substrata of bedrock, boulders, cobble and various grades of sediment produces a wide variety of biotopes within this relatively small area. Sparse fucoids colonise the rocky areas, including *P. canaliculata* in the upper eulittoral zone (Pel), with *F. serratus* and *A. nodosum* lower down (AscX, FserX). The normally sublittoral barnacle *Balanus balanus* extends up the shore into the eulittoral zone and the strawberry anemone *Actinia fragacea*, generally a southern species, was also recorded in this area. The sandier areas in the lower eulittoral zone are inhabited by the sand mason worm *Lanice conchilega* (Lan), while in areas of predominantly soft mud, the lugworm *Arenicola marina* and the opisthobranch *Philine aperta* are dominant (MacAre). Smith (1982)

reported the presence of large numbers of dead bivalves *Modiolus modiolus*, *Ensis arcuatus* and *Mya truncata* and evidence of recent damage caused by digging for the razor clam *E. arcuatus*.

Littoral sediments

Loch Erisort narrows gradually towards the head and eventually culminates in a large expanse of mudflats colonised by *A. marina* and very large furrow shells *Scrobicularia plana*.

Sublittoral

Sublittoral rock, extending as far as the circalittoral, is only present in the outer, exposed parts of Loch Erisort. The rock–sediment interface within the loch system becomes progressively shallower towards the head of the lochs. Rock extends to 27 m at Bones Rock, a submerged pinnacle in the middle of the loch entrance, but to only 16 m at the headland of Stanngraidh, just south of Bones Rock. Around Eilean Chaluim Chille, and Aird Feiltanish in the mouth of Loch Leurbost, the rock extends to only 5–6 m. Within the main basin of Loch Erisort, beyond the sill at Eilean Chaluim Chille and in the upper half of Loch Leurbost west of Jackal Shoal, there is very little sublittoral rock, with muddy sediments extending to within 1–3 m of the surface.

Infralittoral rock

In the loch entrance around the headland of Stanngraidh and including the islands to the south, the shallow infralittoral zone consists of moderately exposed bedrock and boulders colonised by *Laminaria hyperborea* kelp forest down to around 6 m (LhypGz.Ft). In most areas there are few foliose algae or fauna either on the kelp stipes or on the underlying bedrock, with the exception of the occasional red algae *Phycodrys rubens* and *Cryptopleura ramosa* and the featherstar *Antedon bifida*. This paucity of species is probably due to heavy grazing by common urchin *Echinus esculentus*. This band is usually followed by a kelp park or forest of *L. saccharina* with occasional *Saccorhiza polyschides* (Lsac.Ft; Lsac.Pk) below which the rock surfaces are colonised by encrusting algae and the cup coral *Caryophyllia smithii* (EchBriCC). Overhanging rock and small cliff faces within these kelp forests are colonised by the jewel anemone *Corynactis viridis* (CorMetAlc). Where boulders are present the species richness is increased by an under-boulder fauna that includes the holothurian *Pawsonia saxicola* and the brachiopod *Neocrania anomala*. The only site where a relatively species-rich *L. hyperborea* forest (Lhyp.Ft) was found is on Bones Rock, where there is a reasonable understorey of foliose and filamentous red algae. The greater exposure of this site to wave action means there are fewer *E. esculentus* grazing the rocks.

The shallow, sheltered infralittoral rock within the main bodies of both Lochs Erisort and Leurbost are characterised by a heavily silted kelp forest of cape form *L. saccharina* to 5 m depth, sometimes with a narrow band of *L. hyperborea* above it (Lsac.Ft; LhypLsac.Ft). This type of kelp forest is also typical of similarly sheltered areas behind Eilean Thòraidh and neighbouring islands on the south side of the loch entrance. Encrusting coralline algae colonise the underlying bedrock along with occasional *C. smithii* and ascidians *Ascidia mentula*, *A. conchilega*, *A. scabra* and *Ascidiella aspersa*, but, on the whole, these areas are sparsely populated and heavily grazed by *E. esculentus* (EchBriCC). Numbers of epifauna are greater where the bedrock is steep or overhanging.

Circalittoral rock

This loch system does not appear to have any extensive areas of circalittoral rock. At Bones Rock in the middle of the outer loch, a slope of large boulders extends from 22–28 m depth. These are characterised by the northern sea-fan *Swiftia pallida* (ErSSwi). However, much of the rock surface is covered by the ascidian *Ciona intestinalis*. The hydroids *Nemertesia antennina* and *Nemertesia ramosa*, the cup coral *Caryophyllia smithii* and the featherstar *Leptometra celtica* are also common. This biotope is common at the entrances to many sealochs in the Outer Hebrides but is not well developed in Loch Erisort.

Sublittoral sediment

There is a wide range of sediment habitats within Loch Erisort and a correspondingly wide diversity of species, including some rarely recorded in Scotland or elsewhere in the British Isles. Areas with a mixture of rock and sediments, such as the outer sill across Loch Erisort, support the greatest diversity of species.

Coarse sediments are only present at shallow depths in the mouth of the loch, where wave exposure is greatest. Coarse shell-gravel with sand occurs at a depth of about 20 m south-east of the island of Tabhaidh Mhór in the loch mouth. The sediment supports a fairly sparse fauna that includes the razor clam *Ensis ensis*, the burrowing anemone *Cerianthus lloydii* and the sand mason worm *L. conchilega* (Ven).

Much of the seabed at moderate depths throughout the outer parts of both Loch Leurbost and Loch Erisort consists of shelly sand or mud with dense stands of the sea-pen *Virgularia mirabilis*, along with *C. lloydii* and the brittlestars *Ophiura albida* and *Ophiura ophiura* (VirOph). This type of sediment, which is very common in Scottish sealochs, extends into the mid regions of Loch Erisort and is also found at the entrance to Loch Mharabhig. The diversity of species in this habitat is increased where cobbles, pebbles and shells are present to act as a substratum for sessile epifaunal species. A good example of this in Loch Erisort occurs at the sill which runs north-west from Eilean Chaluim Chille. Mixed into the muddy sediment and shelly gravel are scattered cobbles and boulders at 13–22 m depth. In addition to the sea-pens and ophiuroids characteristic of this type of sediment, the hard surfaces support many other species, especially hydroids, *C. smithii* and *L. celtica* (VirOph.HAs). More uncommon species in this area include the stalked barnacle *Scalpellum scalpellum* and the molluscs *Erato voluta*, *Hero formosa* and *Akera bullata*, which are rarely recorded in Scotland. The tube-dwelling polychaetes *L. conchilega*, *Chaetopterus variopedatus*, *Sabella pavonina* and *Myxicola infundibulum* are also occasional in this sediment.

With increasing depth, the sediment becomes finer and the sea-pens *Funiculina quadrangularis* and *Pennatula phosphorea* replace *V. mirabilis* (SpMeg.Fun). This sediment type also supports the brittlestars *Amphiura chiajei* and *Amphiura filiformis* and is the favoured habitat of the dragonet *Callionymus lyra*, which is found in depths between 2 and 40 m. Due to the generally shallow nature of this loch system this biotope is only found in deep pockets in the loch entrance.

Circalittoral sediment, where there is some increase in tidal flow, may be dominated by the brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra* (Oph). This biotope is present on soft mud and shell-gravel in the narrowest part of Loch Leurbost at Cnoc nan Laogh.

At many sites in the middle parts of the lochs, infralittoral sediments of muddy sand with shells and pebbles occur in places shallower than the VirOph biotope; for example, to the east of Eilean Cheois (which is to the east of Eilean Chaluim Chille) in Loch Erisort and at several sites in Loch Leurbost. The sediment is dominated by algae, mainly *L. saccharina*, *Chorda filum*, *Asperococcus turneri*, *Dictyota dichotoma*, *Desmarestia aculeata* and *Bonnemaisonia hamifera* (LsacX). Habitats with fewer pebbles and shells cannot support *L. saccharina*, and are dominated by the *Trailliella* phase of *Bonnemaisonia hamifera* (Tra). Fauna common at all sites are *O. albida*, the topshell *Gibbula magus*, the swimming crab *Liocarcinus depurator* and the hermit crab *Pagurus bernhardus*. Species present in small numbers at most sites are the scallop *Pecten maximus*, the opisthobranch *Philine aperta*, the pelican's foot *Aporrhais pespelecani* and the bivalve *Mya truncata*.

Soft, fine mud in less than 10 m depth is found in the very sheltered inner parts of Lochs Erisort, Leurbost and Loch Thorasdaidh where tidal streams are weak or very weak. These infralittoral muds are characterised by *V. mirabilis* and *P. aperta* (PhiVir). In addition, *C. lloydii* and the brittlestars *O. ophiura* and *O. albida* are occasional to common in these areas. Colonies of the sponge *Suberites ficus*, often reaching 1 m across, occur sporadically on the sediment surface. Although this species is not uncommonly recorded in Scotland, these colonies are unusual because of their very large size. This habitat also attracts the thornback ray *Raja clavata*. *M. truncata*, recorded occasionally in Loch Erisort, is particularly abundant in Loch Leurbost.

Muds in slightly deeper water east of Eilean Mór Laxay, at the time of the 1990 MNCR survey, supported an aggregation of the holothurian *Ocnus planci* in densities of up to 800 individuals per m^2 (Ocn). This unusual aggregation extended for over 500 m of seabed. Other species common or frequent in this habitat are the gastropod *Melanella alba* (which parasitises *O. planci*), *P. aperta*, *O. ophiura* and *O. albida* and the gastropod *Euspira catena*. *P. maximus*, *V. mirabilis* and *M. infundibulum* are occasional.

Extremely sheltered sediments occur in Loch Mharabhig. The mud in the deeper areas is very soft with a top anoxic layer covered with the bacterium *Beggiatoa* sp. (Beg). At the time of survey in August 1990 the mud emitted hydrogen sulphide gas when touched. This habitat is typical of areas in very sheltered, enclosed bays with poor water circulation, and is particularly common in the vicinity of fish farms where nutrient enrichment from fish-food pellets and excreta leads to deoxygenation of the sediments. No other flora or fauna, with the exception of the occasional sand goby *Pomatoschistus minutus*, were present at this depth. One hundred metres from the site of a mussel raft first set up in the 1980s, the seabed, at a depth of 10–12 m, was a featureless silt and mud plain with empty *Abra abra* and *M. edulis* shells and patches of recently dead bristleworms *Pectinaria* sp. At a depth of 3 m at the entrance to Loch Mharabhig, the mud was still very impoverished, with few species except for rare occurrences of the brittlestar *O. albida* and the *Trailliella* phase of *Bonnemaisonia hamifera* (Tra).

Nature conservation

There are no designated conservation sites in the area at present.

Human influences

Coastal developments and uses

Being relatively close to Stornoway, the area is well served by roads: the A859 between Tarbert and Stornoway runs just to the north of Loch Erisort through the linear villages of Balallan and Laxay, with a minor road to the smaller loch-side settlement of Keose where, until the late 1980s, there was a seaweed-drying plant. The B8060 runs along the south side of the loch through the villages of Habost, Kershader and Garyvard. Minor roads run to Cromore in outer Loch Erisort and the linear villages of Leurbost and Crossbost, on the north side of Loch Leurbost. The south coast of Loch Leurbost is uninhabited, with no road access.

Marine developments and uses

Lochs Leurbost, Mharabhig and Erisort are heavily used for fin-fish and shellfish farming. In 1993 there were 18 salmon farm leases granted for 20 sites, and 11 shellfish farm leases granted for 12 sites. There is also a large hatchery on the River Laxay which flows into Loch Erisort. In addition, five licences were granted between 1993 and 1996 for the discharge of effluent from salmon-rearing cages, and one licence was granted for the discharge of effluent from a net-washer at Keose Pier. Periwinkles *Littorina littorea* are collected at Balallan, while the narrows at Eilean Chaluim Chille have suffered considerable damage through bait-digging for lugworms *Arenicola marina* and collection of razor clams *Ensis arcuatus*. Yachts and steamers regularly use Loch Erisort, but Loch Leurbost is little used other than by fish farmers. The entrances to Loch Erisort and Loch Leurbost are extensively used for shellfish creeling, especially along the headland around Risay. The area is important as a nursery for herring *Clupea harengus* and sprat *Sprattus sprattus* and as a spawning ground for cod *Gadus morhua* and whiting *Merlangius merlangus*.

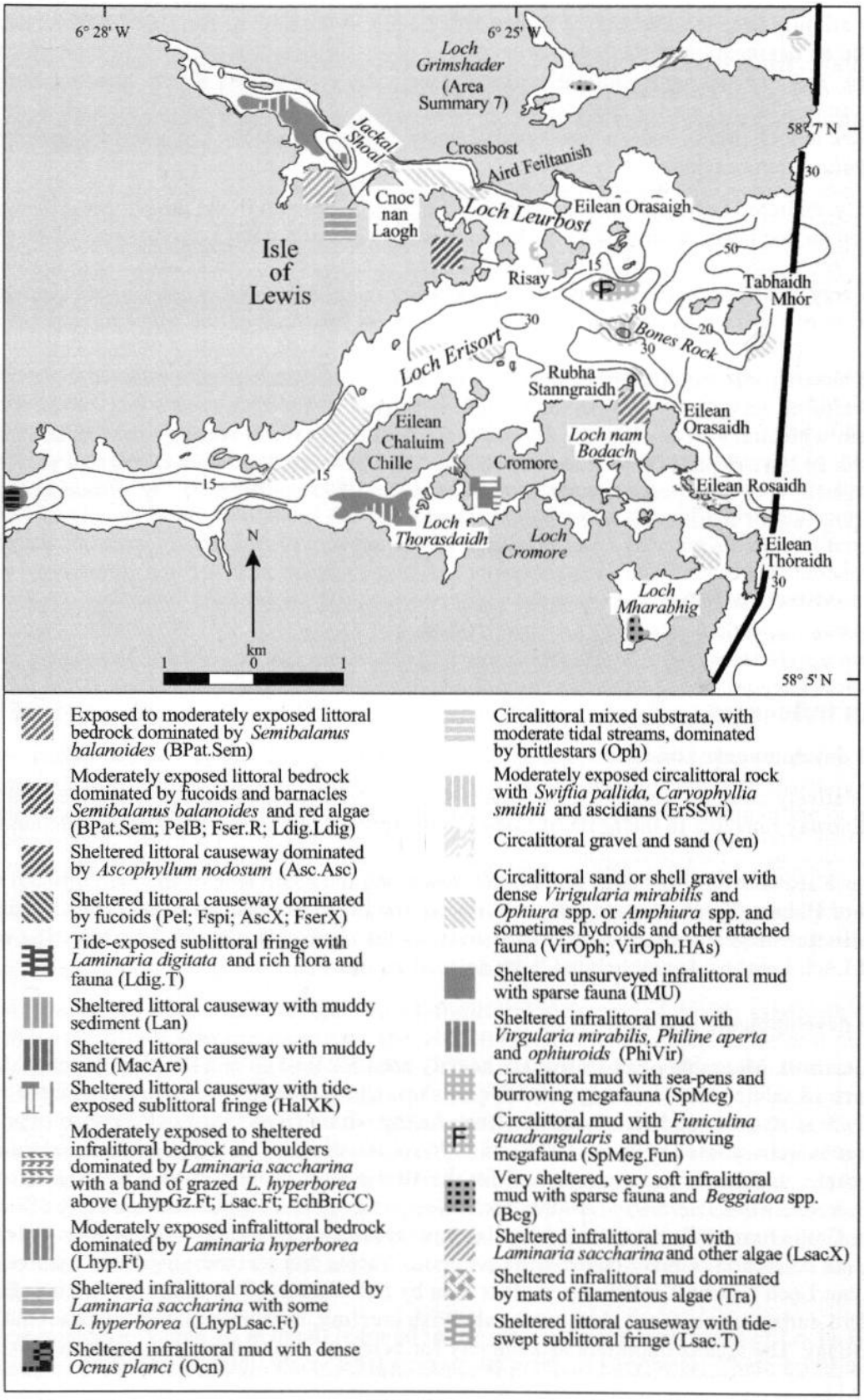

Figure 8.2a Indicative distribution of the main biotopes in the area (eastern part) (based on data from survey sites shown in Figure 8.1a, cited literature and additional field observations).

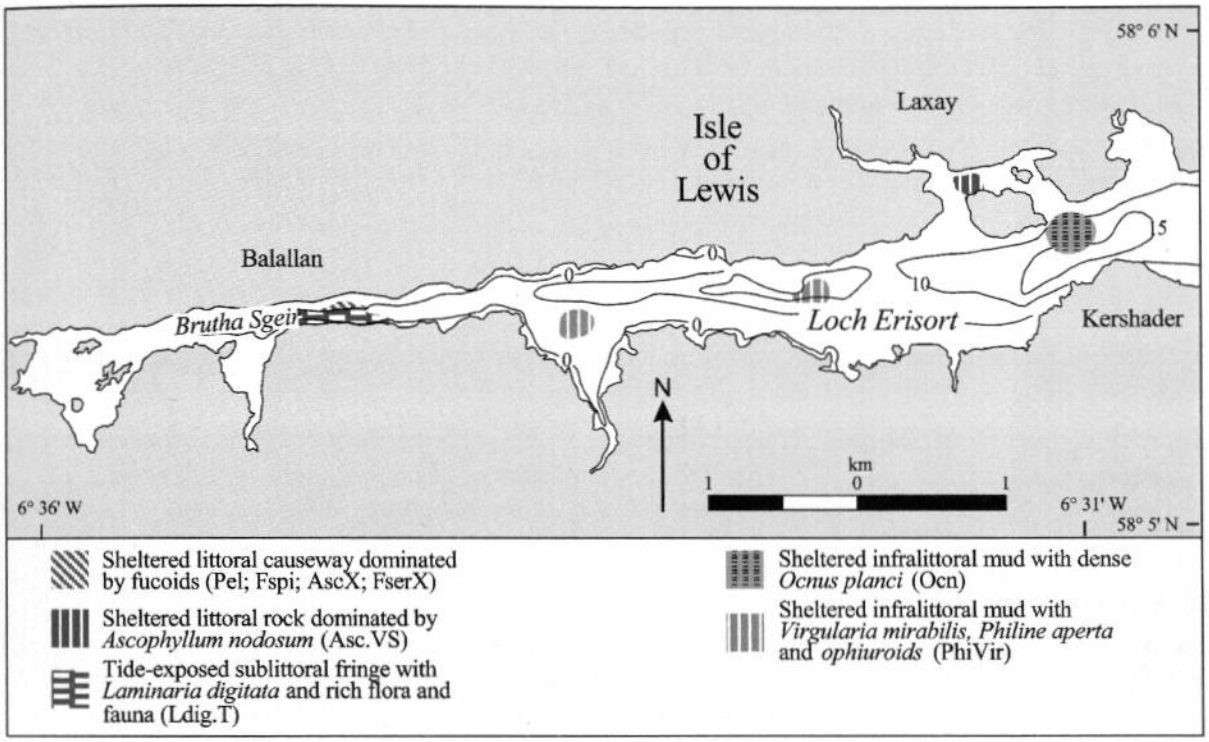

Figure 8.2b Indicative distribution of the main biotopes in the area (western part) (based on data from survey sites shown in Figure 8.1b, cited literature and additional field observations).

References and further reading

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Sites surveyed

Survey 31: 1990 UMBSM survey of sealochs of Harris and Lewis (Holt 1991).
Survey 58: 1984 OPRU Western Isles sealochs survey (Rostron 1984).
Survey 93: 1982 Smith Lewis & Harris littoral mollusc survey (Smith 1982).
Survey 265: 1970–1980 SMBA/MBA intertidal survey of Great Britain (Powell *et al.* 1979).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes recorded*
31	39	NE Stanngraidh, Loch Erisort, Lewis	NB 410 220	58°06.7'N 06°23.8'W	YG; Ver.Ver; Ver.B; BPat.Sem; BPat.Cht; Ldig.Ldig
31	42	Tanneray, Loch Erisort, Lewis	NB 396 222	58°06.7'N 06°25.2'W	YG; Ver.Ver; Fser.R; PelB; Ldig.Ldig; BPat.Sem; Fser.R
31	44	N of Toa, Loch Thorasdaidh, Loch Erisort, Lewis	NB 390 210	58°06.1'N 06°25.7'W	MacAre; Asc.Asc; AscX; Pel; Fspi; FserX; HalXK; Lsac.T
31	50	NW Eilean Mór Laxay, Loch Erisort, Lewis	NB 334 209	58°05.8'N 06°31.4'W	FvesX; Ver.Ver; Asc.VS; FserX; Pel; Fspi
31	53	Shore opposite Brutha Sgeir, Loch Erisort, Lewis	NB 291 202	58°05.2'N 06°35.8'W	YG; Fves; Ver.Ver; Pel; Asc.T; Ldig.T; Fserr.T
31	54	Shore of Brutha Sgeir, Loch Erisort, Lewis	NB 281 203	58°05.3'N 06°36.8'W	FvesX; Ldig.T; Fspi; FserX; BPat
31	55	Risay Causeway, Loch Erisort, Lewis	NB 395 233	58°07.3'N 06°25.4'W	Fser.Fser; Cor; BPat.Sem; Ldig.Ldig.Bo
93	2	Quier, Lewis.	NB 413 246	58°08.0'N 06°23.7'W	MLR; FK
93	3	Crossbost, Eilean Orasaidh, Lewis.	NB 402 242	58°07.8'N 06°24.8'W	LS; SLR
93	4	Balallan: Brutha Sgeir, Lewis.	NB 292 202	58°05.2'N 06°35.7'W	LS; SLR
93	5	Balallan: upper loch, Lewis.	NB 280 202	58°05.2'N 06°36.9'W	LMU
93	6	Crobeg, Lewis.	NB 390 212	58°06.1'N 06°25.8'W	LMX; SLR
93	7	Loch nam Bodach, Lewis.	NB 409 208	58°06.0'N 06°23.8'W	LMX; SLR
93	8	Rubha Dubh, Lewis.	NB 411 206	58°05.9'N 06°23.6'W	LMX; SLR
93	9	Mharabhig, Lewis.	NB 407 198	58°05.4'N 06°24.0'W	LMS; SLR
265	166	Orasaidh isthmus, Cromore, Loch Erisort	NB 412 211	58°06.2'N 06°23.6'W	Ver.Ver; Pel
265	174	Rosay (E), Cromore, Loch Erisort	NB 423 208	58°06.0'N 06°22.4'W	BPat.Sem; Ala.Ldig
265	175	Rosay (S), Cromore, Loch Erisort	NB 420 207	58°06.0'N 06°22.7'W	YG; BPat.Sem
265	176	Rosay (W), Cromore, Loch Erisort	NB 415 208	58°06.0'N 06°23.6'W	AscX; Asc.Asc; Pel
265	177	Rosay narrows, Cromore, Loch Erisort	NB 415 210	58°06.1'N 06°23.2'W	Fserr.T; Ldig.T

Sublittoral sites					
31	33	SW Sgeir a'Bhuic, Loch Mharabhig, Lewis	NB 410 193	58°05.2'N 06°23.6'W	Beg
31	34	W of Eilean Thòraidh, Loch Mharabhig, Lewis	NB 418 200	58°05.6'N 06°22.8'W	VirOph; EchBriCC; Tra
31	36	Caolas na h-Acarsaid, Loch Mharabhig, Lewis	NB 419 206	58°06.0'N 06°22.8'W	Lhyp.Ft; Tra; Lsac.Pk
31	37	E Tabhaidh Mhór, Loch Erisort, Lewis	NB 424 227	58°07.1'N 06°22.4'W	VirOph.HAs; Ven
31	38	NE Stanngraidh, Loch Erisort, Lewis	NB 410 220	58°06.7'N 06°23.8'W	VirOph.HAs; CorMetAlc; EchBriCC; LhypGz.Ft; Lsac.Ft
31	40	Bones Rock, Loch Erisort, Lewis	NB 409 225	58°06.9'N 06°24.0'W	ErSSwi; VirOph.HAs; Lhyp.Ft; Ant
31	41	S of Seumas Cleite, Loch Erisort, Lewis	NB 408 231	58°07.3'N 06°24.1'W	SpMeg.Fun
31	43	NW Riasaidh, Loch Erisort, Lewis	NB 395 223	58°06.8'N 06°25.3'W	VirOph; LhypLsac.Ft; Tra
31	45	Narrows to Inner Loch, Loch Erisort, Lewis	NB 386 223	58°06.8'N 06°26.3'W	VirOph.HAs
31	46	W of Eilean Chaluim Chille, Loch Erisort, Lewis	NB 375 214	58°06.2'N 06°27.2'W	VirOph
31	47	N of Rubh'an Tanga, Loch Erisort, Lewis	NB 380 205	58°05.8'N 06°26.7'W	PhiVir
31	48	SE Eilean Cheois, Loch Erisort, Lewis	NB 369 210	58°06.0'N 06°27.9'W	VirOph; LhypLsac.Ft; LsacX
31	49	SE of Eilean Mór Laxay, Loch Erisort, Lewis	NB 340 205	58°05.6'N 06°30.8'W	Ocn; VirOph
31	51	N of Bogh'a'Chaolais, Loch Erisort, Lewis	NB 324 203	58°05.5'N 06°32.4'W	PhiVir
31	52	E of Corran Rubha nan Lion, Loch Erisort, Lewis	NB 309 202	58°05.3'N 06°33.9'W	PhiVir
31	56	W of Tannaraidh, Loch Erisort, Lewis	NB 399 234	58°07.4'N 06°25.0'W	SpMeg
31	57	Aird Feiltanish, Loch Leurbost, Lewis	NB 392 242	58°07.8'N 06°25.7'W	VirOph; LhypLsac.Ft; Tra
31	58	Cnoc nan Laogh, Loch Leurbost, Lewis	NB 382 244	58°07.9'N 06°26.8'W	VirOph; Oph; Lsac.Ft; LsacX; Tra
31	59	E of Meavaig Island, Loch Leurbost, Lewis	NB 377245	58°07.9'N 06°27.3'W	SpMeg; Oph; VirOph; PhiVir
31	60	S of Leurbost, Loch Leurbost, Lewis	NB 371 250	58°08.2'N 06°28.0'W	PhiVir
58	10/1	Loch Mharabhig, Lewis	NB 410 195	58°05.3'N 06°23.6'W	CMU
58	10/2	Loch Mharabhig, Lewis	NB 411 194	58°05.2'N 06°23.5'W	IMU; Beg
58	10/4	Loch Mharabhig, Lewis	NB 413 193	58°05.2'N 06°23.3'W	CMU
58	10/5	Loch Mharabhig, Lewis	NB 410 192	58°05.1'N 06°23.6'W	LsacX
58	10/6	Loch Mharabhig, Lewis	NB 414 194	58°05.2'N 06°23.2'W	CMU

Compiled by: Ruth Beaver and Frances Dipper