JOINT NATURE CONSERVATION COMMITTEE

Marine Nature Conservation Review

Sector 12

Sealochs in the Clyde Sea

Area summaries

Frances A. Dipper & Ruth Beaver

1999

Series editor: David Connor

Coasts and seas of the United Kingdom - MNCR series

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough PE1 1JY
UK

Recommended citation:

Dipper, F.A., & Beaver, R. 1999. *Marine Nature Conservation Review Sector 12. Sealochs in the Clyde Sea: area summaries.* Peterborough, Joint Nature Conservation Committee. (Coasts and seas of the United Kingdom. MNCR series.)

ISBN: 1 86107 467 0

Biotope analysis: David Connor, JNCC
Technical editing: Colin R. McLeod, JNCC
Cartography: Nic Miller & Brian Miller, JNCC
Cover design: R & W Publications (Newmarket) Limited
Printed by: CLE Ltd, St Ives, Cambs.

Contents

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. 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.

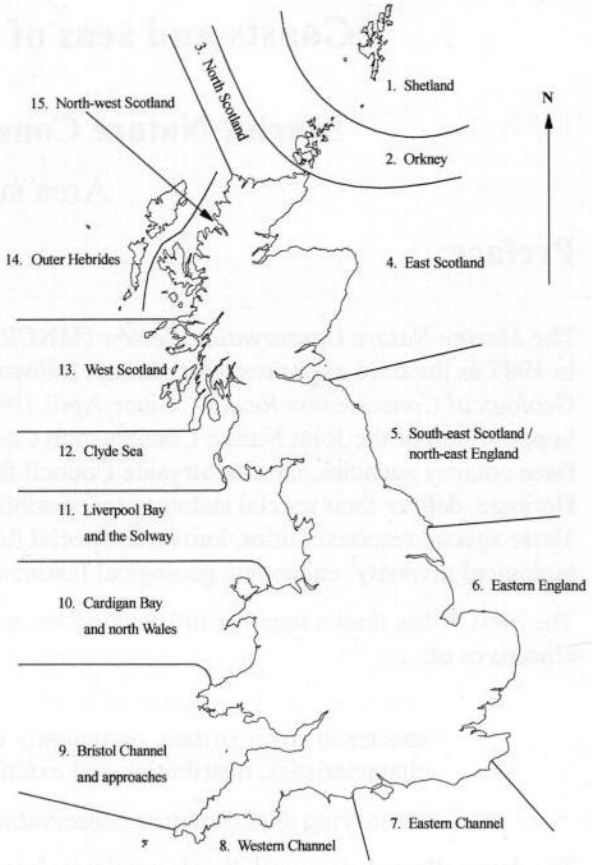
MNCR studies have been undertaken within particular coastal sectors around Britain (see map overleaf) or of major physiographic types, such as lagoons and sealochs. These studies are being presented, in the *Coasts and seas of the United Kingdom - MNCR series*, as *area summaries*, each of which provides 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 the Marine Information Officer, JNCC. JNCC publications can be purchased from NHBS Ltd, 2-3 Wills Road, Totnes, Devon, TQ9 5XN (tel. 01803-865 913; fax. 01803-865 280; e-mail nhbs@nhbs.co.uk). JNCC reports are available directly from JNCC (tel. 01733-562 626; fax. 01733-555 948).

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	Due 1999
1-2	Lagoons in Shetland and Orkney	Thorpe	1998
2	Orkney	Murray, Dalkin, Fortune & Begg	Due 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	Due 1999
11	Liverpool Bay and the Solway Firth	Covey	1998
12	Sealochs in the Clyde Sea	Dipper & Beaver	1999
14	Lagoons in the Outer Hebrides	Thorpe, Dalkin, Fortune & Nichols	1998
14	Sealochs in the Outer Hebrides		Due 1999
15	Sealochs in north-west Scotland		Due 1999

Marine Nature Conservation Review

Sector 12

Sealochs in the Clyde Sea

Area summaries

Synopsis

The sealochs of the Clyde Sea (MNCR Sector 12) have been studied as part of the Marine Nature Conservation Review programme. The studies included field surveys of the shores and the sublittoral zone between 1988 and 1990 to describe the habitats and communities (together referred to as biotopes) present and to assess their natural heritage importance. Comparable data from other organisations or previous studies have been added to provide information on nearly 250 sites within the region and the data analysed to classify the biotopes present. Information on the designated conservation sites and main human influences in the sealochs has also been compiled.

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

1. Loch Ryan
2. Gareloch
3. Loch Long and Loch Goil
4. Holy Loch
5. Loch Striven, Loch Riddon and the Kyles of Bute
6. Loch Fyne
7. Campbeltown Loch

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 the region (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 sealochs of the Clyde Sea (MNCR Sector 12) (Figure 1) comprise a series of long, deep fjordic lochs in the northern part of the Clyde Sea and smaller, shallower lochs at Campbeltown and Loch Ryan to the south. All the lochs are protected by the generally sheltered nature of the Firth of Clyde, which is itself protected from strong wave exposure by the Kintyre peninsula, and are influenced by its lowered salinity, compared with the more wave-exposed and more saline coasts of western Scotland. Therefore all the lochs, and in particular the deeper northern ones, are generally sheltered throughout their length and exhibit only gradual changes in habitats and biotopes from entrance to head. This feature makes the Clyde sealochs different from sealochs in the Western Isles and in north-west Scotland which open directly into the Minch or the Atlantic and which have a typical exposure gradient from very sheltered at the head to very exposed at the mouth. Greater differences are instead associated with changes in depth and sometimes tidal streams. The northern lochs all exhibit a similar range of substrata with sediments predominant, but with interesting deep rock biotopes associated with the steep sides found in all but Holy Loch and Gareloch. The sheltered nature of the Clyde Sea area has also resulted in the lochs being heavily used by both naval and commercial shipping.

The northern lochs lie close to the major conurbations around Glasgow and have long been affected by the industrialisation of the Clyde. Water quality in the Clyde estuary was at its worst in the second half of the nineteenth century, but has improved throughout the twentieth century, with a trend towards recovery of the biota apparent since quantitative studies commenced in the 1960s (MacKay, Tayler & Henderson 1978). The northern lochs are still affected to some extent by eutrophication from sewage pollution and by industrial discharges. Their proximity to Glasgow means they are popular destinations for visitors. There are ferry links to several of the lochs from Gourock. Loch Ryan and Campbeltown Loch, in the south, support ferry links to Northern Ireland.

Data collection and the classification of biotopes

Field surveys of the shores and the sublittoral zone of the lochs 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, Connor & Holt 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 Paisley College of Technology (now Paisley University) (Paisley College of Technology 1979) and the University of Stirling (McLusky & Hunter 1985). 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 habitats and their associated communities (together referred to as biotopes) were 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. 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 & 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.

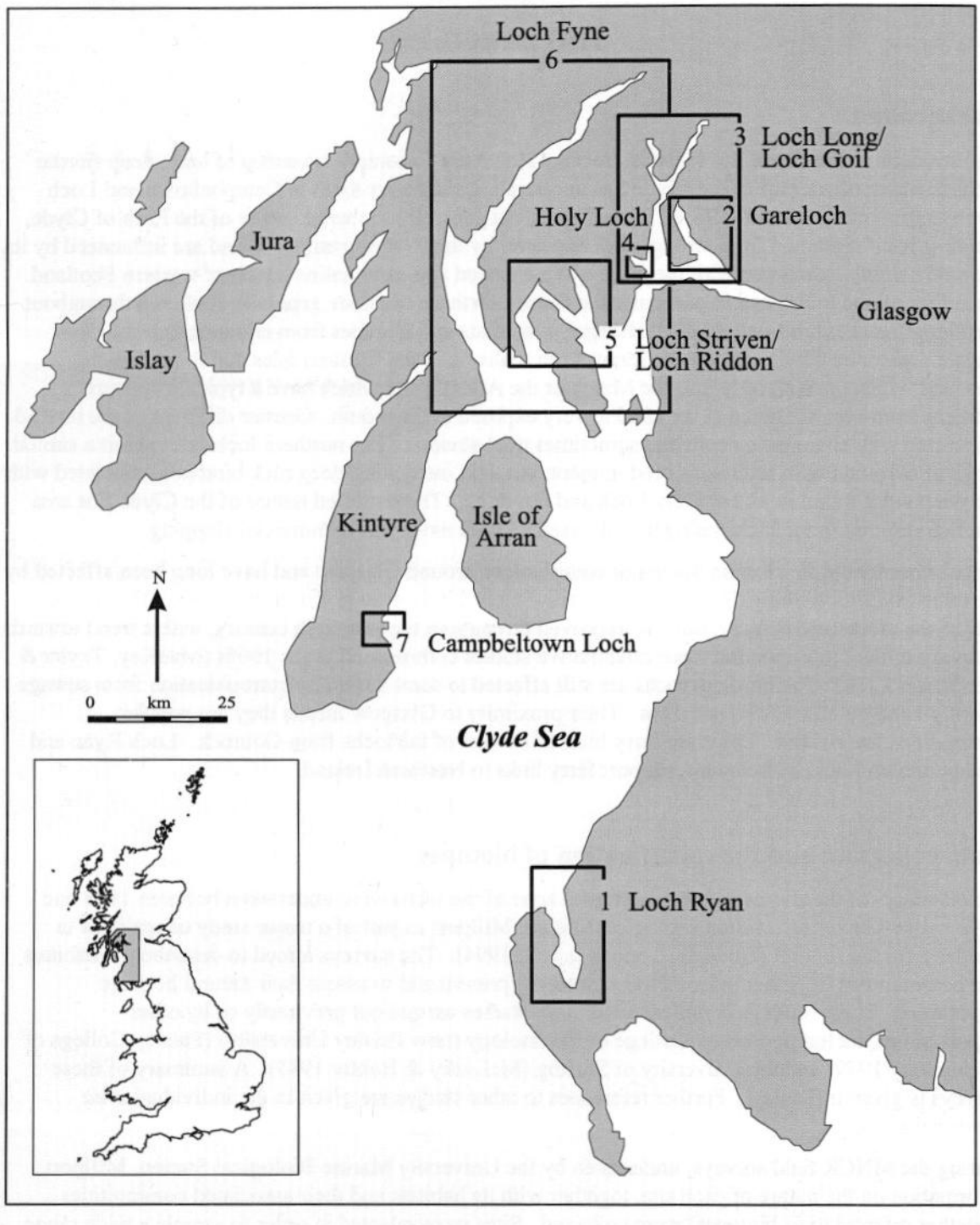


Figure 1 Location of the seven sealochs (area summaries) in MNCR Sector 12.

Table 1 Sources of field survey information.

MNCR database survey no.	*Survey*	*Source*	*No. of sites*	*No. of habitats surveyed*
22	1988-1990 UMBSM Loch Fyne littoral, sublittoral and towed video survey	Davies (1989); Howson & Davies (1991)	73	226
23	1988 UMBSM Loch Ryan littoral and sublittoral survey	Howson (1989)	20	44
28	1989 UMBSM sealochs in the northern Firth of Clyde survey	Holt & Davies (1991)	103	277
49	1978-79 PCT Clyde Sea Area littoral survey	Paisley College of Technology (1979)	43	79
264	1982 University of Stirling Loch Riddon (Ruel estuary) littoral survey	McLusky & Hunter (1985)	7	28
326	1965-1970 DAFS Scottish sandy shores survey	Eleftheriou & McIntyre (1976)	1	13
		Total	**247**	**667**

Abbreviations: DAFS = Department of Agriculture and Fisheries for Scotland; PCT = Paisley College of Technology; 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. In Loch Ryan four box cores (15x7.5 cm) were employed. 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. A towed video sledge was used to survey the deep-water habitats in Loch Fyne (Howson & Davies 1991).

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 247 sites (667 different habitat records) from the MNCR Sector 12 sealochs were used in the analyses, resulting in the identification of 95 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 listed in Table 1 are given in Appendix C.

Area summaries and their format

The coast of MNCR Sector 12 has seven sealochs (see Figure 1) and each has been described in the standard MNCR *area summary* format. The seven sealochs described are:

1. Loch Ryan
2. Gareloch
3. Loch Long and Loch Goil
4. Holy Loch
5. Loch Striven, Loch Riddon and the Kyles of Bute
6. Loch Fyne
7. Campbeltown Loch

Each *area summary* contains the following sections:

Location

The geographic location is given as the central latitude/longitude position and Ordnance Survey grid reference, together with the local government administrative area and the relevant nature conservation agency (Scottish Natural Heritage) and its local area office. A location map shows the main features of the area, bathymetry, key place names, and the limit of the area considered by the *area summary*. Place names are taken from the most recent Ordnance Survey 1:50,000 scale Landranger series maps. The sites surveyed are shown according to four main types of survey: recording on littoral (▲) or sublittoral (●) rock/hard substrata and sampling in littoral (Δ) or sublittoral (○) sediment habitats.

Physical features

A summary of the main physical features includes: the type of physiographic feature as defined in Connor & Hiscock (1996); the length of coastline and bathymetry summarised from Admiralty charts; the areas and lengths of inlets, taken from Edwards & Sharples (1986), the length being from the mouth of the inlet to the limit of tidal influence; wave exposure and tidal stream ranges taken from field observations, as defined in Connor & Hiscock (1996); tidal range figures for mean spring and mean neap tidal range, quoted for the nearest secondary port, and based on Admiralty tide tables; the salinity range is estimated at the time of survey or given in available literature, as categorised in Connor & 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 biological surveys

Marine biological surveys of the shores and sublittoral which have been used in compiling the *area summary* are listed to include the survey type (littoral/sublittoral), survey method, date of survey and reference source. The distribution of survey sites is shown on the location map.

Marine biology

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. The heights and depths noted in the text are corrected to lowest tide level (chart datum). The biotope codes given in parentheses are from the MNCR national classification, as listed in Appendix A; a summary of biotopes present within each Area is presented in Appendix B. Marine species nomenclature follows Howson & Picton (1997); that for lichens follows Purvis *et al.* (1992), and that for higher plants follows Stace (1991).

A map illustrates the distribution of the main biotopes within the area; some mapped areas represent more than one biotope.

NOTE: the biotopes 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.* (1996, 1997), where further information on each designation can be found).

Key to abbreviations used:

GCR	Geological Conservation Review site
MCA	Marine Consultation Area
MoD	Ministry of Defence
NCR	Nature Conservation Review site
NNR	National Nature Reserve
NSA	National Scenic Area
RSC	Regional Scenic Coasts
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, commercial fishing, recreation and shipping.

References and further reading

This lists cited references and other relevant literature.

Sites surveyed

This lists the sites surveyed within the area from the surveys shown in Table 1, with additional information on the location of each site, the date of survey and an inventory of the biotopes present at the time of survey.

Acknowledgements

Thanks to the following Scottish Natural Heritage staff for their local knowledge, contacts, advice and comments on draft reports:

John M. Baxter; Andrew Bielinski; Helen Doherty; Alexander J. Downie; Richard Pollit; David Wood

Thanks also to Geoff Moore for his advice and comments on the draft of this volume.

We are indebted to the Solway River Purification Board (now part of Scottish Environment Protection Agency) who made available unpublished information and data from their surveys.

Field surveyors for NCC/JNCC-commissioned surveys (all staff of NCC or its successor agencies at some time during the surveys, unless stated):

Dave Agnew (Fisheries Research Laboratory, Coleraine), John Baxter, Teresa Bennett, Gill Bishop (Independent surveyor), Steve Bolt, Francis Bunker (Marine Seen), Lois Calder (UMBSM), Ken Cameron (UMBSM), David Connor, Dominic Counsell, Roger Covey, Jon Davies, L. Mark Davies, Ian Dixon (UMBSM), Philip Dixon-Smith, David Donnan, Chris Emblow, Clare Eno, Sarah Fowler, Ian Fuller, Robert Hillier, Keith Hiscock, Sue Hiscock (Scott), Rohan Holt, Steve Howard (Independent surveyor), Christine Howson (UMBSM), Robert Irving (Independent surveyor), Charlotte Johnston, Dan Laffoley, Chris Lumb, Christine Maggs (Queens University, Belfast), Dave Mills, Jon Moore (Independent surveyor), Colin Munro (UMBSM), Thom Nickell (UMBSM), Bernard Picton (Ulster Museum), Jane Picton (Independent surveyor), Anna-Maria Rossolini (UMBSM), Dale Rostron (SubSea Survey), Michael Scott (BBC Radio 4), Barbara Smith, Philip Smith (University of Glasgow), Lucy Stone, Ian Strachan, Joy Sturtevant (UMBSM), Peter Taylor (Independent surveyor), Valerie Wilson.

Thanks are also due to all the boat crew and technical, administrative and catering support staff who made the surveys possible.

The maps are based upon Admiralty chart No. 2131 with the permission of the Controller of the United Kingdom Hydrographic Office and upon the Ordnance Survey 1:50,000 scale Landranger maps, with the permission of the Controller of Her Majesty's Stationery Office © Crown copyright. Joint Nature Conservation Committee licence number GD 27254X/02/99.

References

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P. & Davidson, N.C. *eds*. 1996. *Coasts and seas of the United Kingdom. Region 13 Northern Irish Sea: Colwyn Bay to Stranraer, including the Isle of Man.* Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series.)

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C., & Buck, A.L. *eds*. 1997. *Coasts and seas of the United Kingdom. Region 14 South-west Scotland: Ballantrae to Mull.* Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series.)

Connor, D., & Hiscock, K. 1996. Data collection methods (and Appendices 5-10). *In*: *Marine Nature Conservation Review: rationale and methods*, ed. by K. Hiscock, 51-65, 126-158. Peterborough, Joint Nature Conservation Committee. (Coasts and seas of the United Kingdom. MNCR series.)

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.

Davies, L.M. 1989. Surveys of Scottish sealochs: Loch Fyne. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 984.

Edwards, A., & Sharples, F. 1986. *Scottish sea lochs: a catalogue*. Oban, Scottish Marine Biological Association and Peterborough, Nature Conservancy Council.

Eleftheriou, A & McIntyre, A.D. 1976. *The intertidal fauna of sandy beaches – a survey of the Scottish coast*. Aberdeen, Department of Agriculture and Fisheries for Scotland. (Scottish Fisheries Research Report, No. 6.)

Holt, R., & Davies, L.M. 1991. Surveys of Scottish sealochs. Sealochs in the northern Firth of Clyde. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 1147.

Howson, C.M. 1989. Surveys of Scottish sealochs. Loch Ryan. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 953.

Howson, C.M., Connor, D.W., & Holt, R.H.F. 1994. The Scottish sealochs. An account of surveys undertaken for the Marine Nature Conservation Review. (Contractor: University Marine Biological Station, Millport.) *JNCC Report*, No. 164. (Marine Nature Conservation Review Report, No. MNCR/SR/27.)

Howson, C.M., & Davies, L.M. 1991. Surveys of Scottish sealochs. A towed video survey of Loch Fyne. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 1189.

Howson, C.M., & Picton, B.E. *eds.* 1997. *The species directory of the marine fauna and flora of the British Isles and surrounding seas.* Belfast/Ross-on-Wye, Ulster Museum and Marine Conservation Society. (Ulster Museum Publication, No. 276.)

MacKay, D.W., Tayler, W.K. & Henderson, A.R. 1978. The recovery of the polluted Clyde estuary. *In*: *Current studies in the marine environment. Proceedings of the Royal Society of Edinburgh (Section B)*, *76*(1/3): 135-152.

McLusky, D., & Hunter, R. 1985. Loch Riddon revisited - the intertidal of the sea-loch resurveyed after 53 years. *Glasgow Naturalist*, *21*: 53-62.

Mills, D.J.L. 1994. A manual for the analysis of data held on the Marine Nature Conservation Review database. *JNCC Report,* No. 173. (Marine Nature Conservation Review Report, No. MNCR/OR/18.)

Paisley College of Technology. 1979. *A biological survey of seashores in the Clyde Sea Area - 1978-79.* (Contractor: Paisley College of Technology.) Unpublished, Nature Conservancy Council, Scotland, South-west Region. (Internal report, No. NC 211 J.)

Purvis, O.W., Coppins, B.J., Hawksworth, D.L., James, P.W., & Moore, D.M., *eds.* 1992. *The lichen flora of Great Britain and Ireland.* London, Natural History Museum and British Lichen Society.

Stace, C. *ed.* 1991. *New flora of the British Isles.* 1st ed. Cambridge, Cambridge University Press.

1 Loch Ryan

Location		
Position (centre)	NX 055670	54° 57.2′ N 5° 2.0′ W
Administrative area	Dumfries and Galloway; South Ayrshire	
Conservation agency/area	Scottish Natural Heritage	West Areas (Dumfries and Galloway)

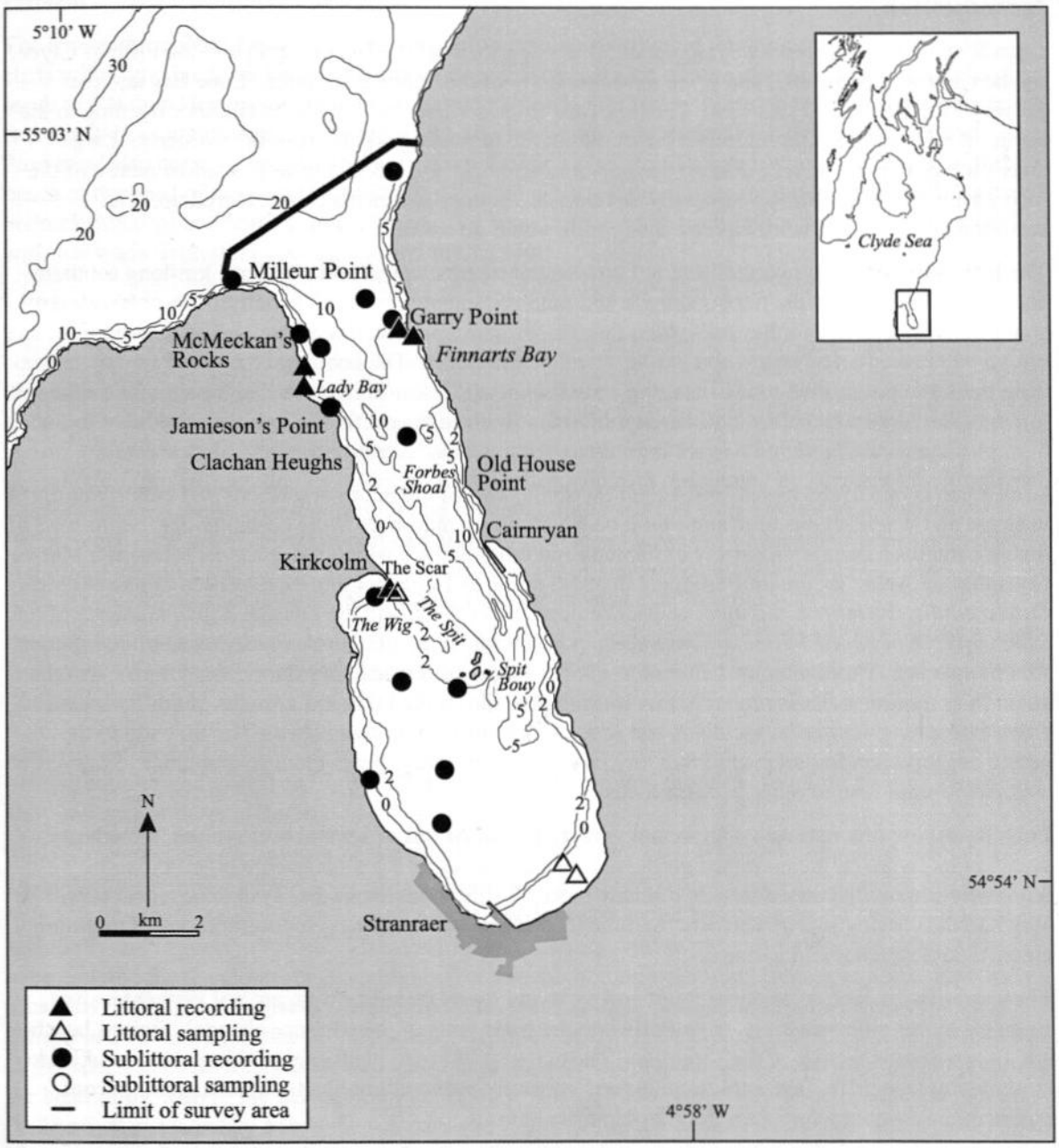


Figure 1.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Open sealoch
Length of coast	Approximately 35 km
Length of inlet	13.4 km
Area of inlet	41.6 km^2
Bathymetry	Maximum depth 17 m
Wave exposure	Moderately exposed to sheltered
Tidal streams	Very weak in southern part; up to 1.3 knots between The Spit and Cairnryan
Tidal range	2.9 m (springs); 1.8 m (neaps)
Salinity	Fully marine

Introduction

Loch Ryan is an open sealoch lying about 50 km due south of the Isle of Arran and the Firth of Clyde, on the Galloway peninsula, and is the most southerly of the Scottish sealochs. Luce Bay and the Solway Firth lie to the south-east. The loch runs from north to south with the entrance opening to the north. It is therefore exposed in this direction but the prevailing winds are south-westerly. Large swells are rare in the loch because it has only a short fetch. However, the wide shallow nature of the loch means that a sharp chop can easily develop and bottom sediments can be stirred up. The surrounding hinterland is mainly low-lying hills which afford little protection.

The loch is divided into two sections, a 9 km-long northern channel and a wider 5 km-long southern basin. The division results from a shingle and sand spit extending out diagonally from north-west to south-east, marked at its outer end by the Spit Buoy. The Spit dries out at low spring tides and effectively narrows the loch to about 1 km width at this point. The entrance channel is around 15 m deep but has a poorly defined sill running across it about 4.5 km from the loch entrance. The sill rises to 7 m. The remainder of the loch inside and to the south of the spit is shallow with depths of less than 5 m. A channel dredged to 5 m runs from Stranraer towards Cairnryan to allow ferry access.

Loch Ryan is one of the largest and one of the shallowest of the Scottish sealochs and is fairly uniform in shape and depth. It has little sublittoral bedrock and no mud-burrowing communities, but in spite of this, it contains a surprising variety of habitats and communities which has led to its status as a Marine Consultation Area. It is unique amongst Scottish sealochs for its combination of beds of native oysters *Ostrea edulis*, the largest and most well-developed in Scotland, and the unusual high abundance of the sublittoral red seaweed *Spyridia filamentosa.* Loch Ryan is the northern recorded limit of distribution for this species. The sheltered shallow inner loch warms up considerably during the summer months, yet is fully marine and it is probably this warmth that allows the luxuriant growths of this seaweed. Other interesting seaweeds, ascidians and species-rich littoral communities on The Spit add to the nature conservation importance of this loch, which in some ways bears more resemblance to the rias of southern Britain than to other Scottish lochs.

Loch Ryan supports nationally-important wintering populations of several bird species, including scaup, eider, wigeon, great-crested grebe, red-throated diver, and red-breasted merganser, and regionally-important concentrations of many more. Terns, eider ducks and oystercatchers nest on The Wig and the curving spit of The Scar, and the loch is notable for its large concentrations of moulting eiders in late summer and autumn.

The shores in the loch consist mainly of sediment and, apart from The Spit, are not very extensive. Bedrock shores with relatively steep cliffs line the outer parts of the entrance channel. Raised beaches are a conspicuous feature of the shoreline. They consist of broad platforms of shingle and sand backed in places by low cliffs. The sublittoral is predominantly sedimentary, the sediments grading from coarse at the mouth to very fine at the head of the loch.

The town of Stranraer lies at the southern end of the loch on the isthmus separating Loch Ryan from Luce Bay to the south-east. The isthmus was formed by the deposition of raised beach material after the last glaciation.

Marine biology

Marine biological surveys				
	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	5	September 1988	Howson (1989)
	Infaunal sampling (box cores)	2	September 1988	Howson (1989)
	Infaunal sampling (25x25 cm area sieved)	1	Summer 1978	Paisley College of Technology (1979)
Sublittoral	Recording (epibiota)	14	September 1988	Howson (1989)

Littoral

The shores throughout Loch Ryan consist predominantly of sediment, but moderately steep rocky cliffs with some boulders border the entrance, particularly on the eastern shore. These cliffs extend south to Clachan Heughs on the west shore and almost to Old House Point on the east shore. There are two sandy bays within these rocky areas, at Lady Bay in the west and at Finnarts Bay on the east. Firm sand also occurs along the shoreline from The Spit north to Clachan Heughs, and much of the beach at the head of the loch is also sandy. The remainder of the shores are muddy sand with scattered bedrock outcrops and some cobble shores. The beach at Stranraer itself is stony and has been modified with sea-walls delimiting boating and swimming areas.

Littoral rock

The rocky shores in the entrance channel to the loch are moderately exposed to wave action and consist of steep bedrock giving way to boulders further down the shore. Apart from the well-developed lichen zone in the supralittoral (YG), these shores are mainly animal-dominated with a rather low species richness. The littoral fringe is dominated by the black tar-like lichen *Verrucaria maura* with a band of channelled wrack *Pelvetia canaliculata* and large numbers of the rough periwinkle *Littorina saxatilis* (Ver.Ver; PelB). The mid-shore is dominated by barnacles *Semibalanus balanoides*, dogwhelks *Nucella lapillus* and limpets *Patella vulgata* with patches of *V. maura* (BPat.Sem). The lower shore supports a variously-developed algal turf of fucoids *Fucus vesiculosus* and *Fucus serratus* and foliose algae especially species of *Osmundea* and *Corallina officinalis* (Fser.R). Small rockpools lined by coralline algae are present at some sites (Cor).

Other rocky outcrops include low-lying reefs at Lady Bay projecting across the sand. These support tough species such as fucoid algae and sand-tolerant red algae such as *Audouinella* sp., and species of *Osmundea* (Rho).

Littoral sediment

Mobile cobbles and gravel are found at a number of sites around the loch including parts of Finnarts Bay, and appear barren (BarSh).

The Spit and the adjacent shores of the Wig form an extensive area of littoral sediments, pebbles and cobbles. These mixed substrata provide a variety of habitats and consequently this area is one of the richest in the loch. Much of the eastern side of The Spit is covered by coarse muddy sand with stones and shells and is poorly drained. The standing water, along with exposure to moderate tidal streams, have allowed the development of a rich algal community along with filter-feeding animals, especially ascidians (FserX.T). The latter includes the introduced species *Styela clava*. The prosobranch mollusc *Calyptraea chinensis*, an uncommon southern species, is also found here. The Spit also supports a bed of the seagrass *Zostera angustifolia* on fine sand (Zmar). Littoral seagrass *Zostera* sp. is also present at the head of the loch to the east of Stranraer (Znol). A dense bed of mussels *Mytilus edulis* is present on The Spit immediately above the seagrass and this provides attachment for fucoids and a rich foliose algae community as well as *S. clava* (MytX). The mid-and upper shore of The Spit is a level area of medium-grained sand with embedded pebbles and cobbles and is dominated by fucoids *F. vesiculosus* and *F. serratus* and foliose algae (FvesX).

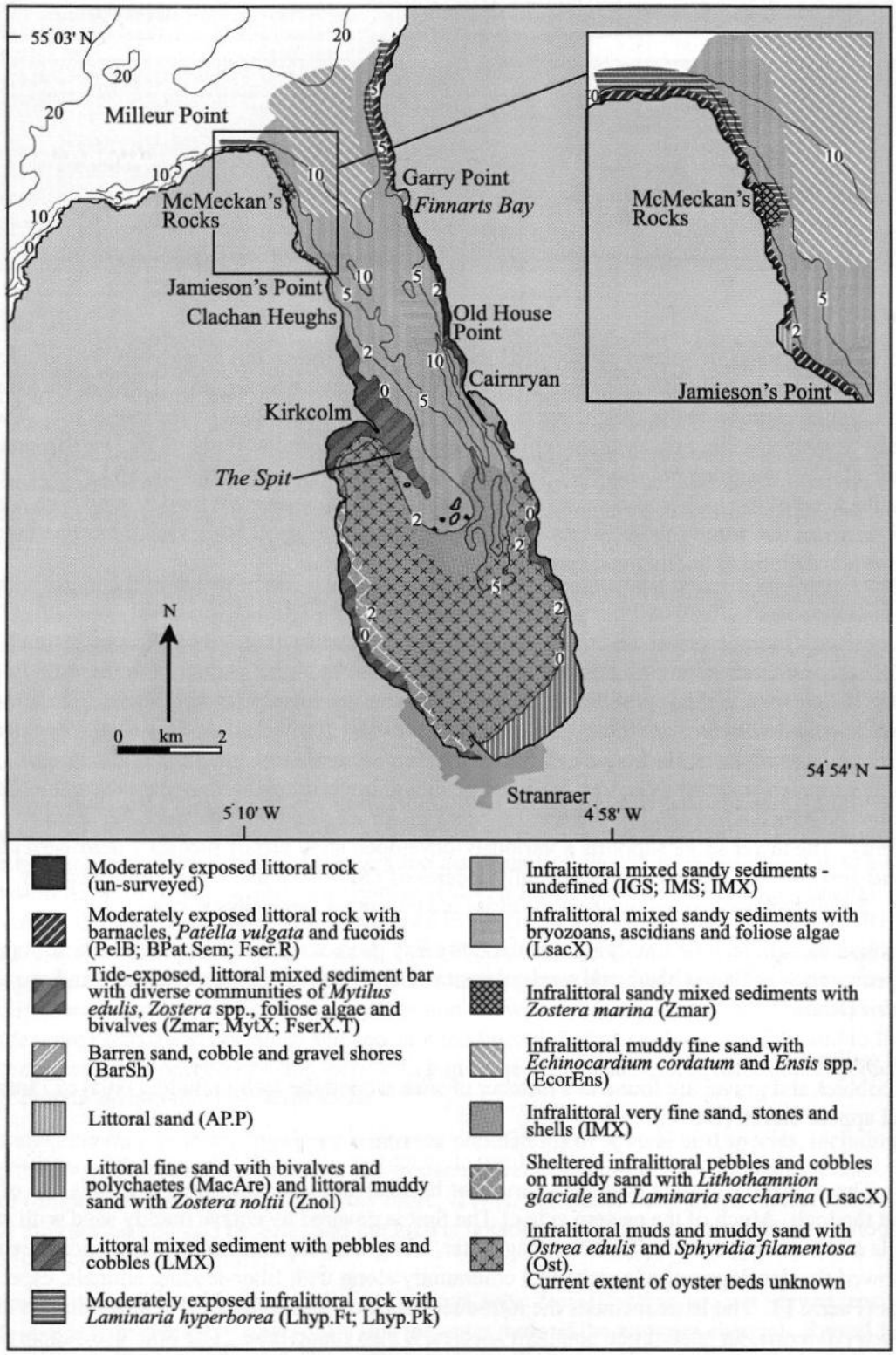


Figure 1.2 Indicative distribution of the main biotopes in the loch (based on data from survey sites shown in Figure 1.1, additional field observations and cited literature).

The extensive beach at the head of the loch consists mainly of firm, fine, rippled sand backed by a shingle ridge and is used as a feeding area by numerous birds. The infauna of the lower shore consists of large numbers of burrowing polychaetes and bivalves dominated by cockles *Cerastoderma edule* and clams *Mya arenaria,* with the tellin *Angulus tenuis* and the lugworm *Arenicola marina* also common (MacAre.Mare). At a slightly higher level, there are patches of *Zostera noltii*. Towards the upper mid-shore and on the upper shore, the mud snail *Hydrobia ulvae* is extremely abundant and there are patches of *M. edulis* as well as the alga *Mastocarpus stellatus*. The cleanest littoral sand occurs in Lady Bay near the mouth of the loch (AP.P).

Sublittoral

The sublittoral in Loch Ryan is predominantly sedimentary, with rock mainly confined to the mouth of the loch and the coast outside, and not extending as far into the loch as it does on the shores. The maximum depth of the rock boundary with the sediment lies at around 14 m at Milleur Point in the loch entrance, but is mostly much less than this. This infralittoral rock is silty and there are no areas of circalittoral rock.

Sublittoral rock

Steep bedrock with boulders is present at Milleur Point, giving way to sand and gravel at a depth of about 14 m. Horizontal bedrock and boulders are present on the other side of the loch at Garry Point. Outcrops of boulders occur in shallow water around 5 m depth at McMeckan's Rocks just north of Lady Bay. Small outcrops such as this may well be widespread in this outer area of the loch. At all the sites examined, both bedrock and boulders support a silty forest and park of kelp *Laminaria hyperborea*, typical of the moderately exposed conditions found here (Lhyp.Ft; Lhyp.Pk). There is an understorey of foliose red algae, especially *Phycodrys rubens*, and a limited fauna of robust species subjected to moderate grazing pressure by the urchin *Echinus esculentus*. Dead man's fingers *Alcyonium digitatum*, the keel worm *Pomatoceros triqueter*, hydroids, especially *Nemertesia antennina,* and the encrusting bryozoan *Parasmittina trispinosa* are all frequent, along with the ascidian *Ascidiella aspersa*.

Hard substrata in the southern basin of the loch are restricted to areas of cobble and pebble embedded in muddy sand. This type of substratum is found in shallow water close to the shore and may extend along most of the west side. It probably originates from raised beach material. Similar substrata are also found in the more exposed outer channel at Jamieson's Point. Species present are characteristically those able to tolerate some instability of substratum and include the kelp *Laminaria saccharina*, foliose algae such as *Gracilaria verrucosa*, the bryozoan *Vesicularia spinosa* and a few species of hydroids (LsacX).

Sublittoral sediment

Sublittoral sediments in the loch grade from coarse sand in the moderately exposed entrance to fine sand and mud at the sheltered head of the loch. Tidal streams in the loch are generally weak and appear to have little effect on the distribution of the sediment types. The seabed in the outer half of the entrance channel consists mainly of rippled sand burrowed by the urchin *Echinocardium cordatum* (EcorEns). Other species present vary from site to site but mostly include razor shells *Ensis* sp., brittlestars *Ophiura* sp., the sand mason worm *Lanice conchilega* and hermit crabs *Pagurus* sp. A bed of the seagrass *Zostera marina* is present at 3.5 to 5 m depth at McMeckan's Rocks near the loch entrance and other beds may occur elsewhere in this entrance area (Zmar).

The seabed throughout the majority of the shallow southern basin of the loch south of the Spit, consists of soft muds to firm muddy sands. Beds of the native oyster *Ostrea edulis* form the predominant community over these soft sediments (Ost) varying in their density at different sites. Along with their dead shells, they provide attachment for large numbers of ascidians, mainly *Ascidiella aspersa*, and tufts of foliose algae including *Spyridia filamentosa*. This latter species is found throughout the loch

but forms particularly dense carpets in the southern basin, especially in The Wig area. The mollusc *Calyptraea chinensis*, mentioned above as being found in the littoral zone around The Wig, also occurs on the oyster beds. An area of fine sand occurs just south of The Spit on the edge of the oyster beds and also extends north from Cairnryan along the west coast in an area known as Forbe's Shoal. A variety of species tolerant of shallow and somewhat mobile sand characterise this habitat (LsacX).

Nature conservation

Conservation sites		
Site name	***Status***	***Main features***
Loch Ryan	MCA	Native oyster beds, seaweeds, rich intertidal communities
Milleur Point-Corsewall Point	SSSI	Geological

Human influences

Coastal developments and uses

The shoreline around much of the loch has remained natural apart from Stranraer on the south side of the loch. This is the main centre of population in the region with around 11,300 people. There is a creamery here which processes the produce from the surrounding dairy-farming countryside. The small town of Cairnryan lies on the east coast and there are many other small villages and developments dotted along the main roads that encircle the loch. The least-developed areas lie either side of the outer part of the entrance channel. All sewage discharges into the loch are treated, and a new sewage treatment works serving Stranraer, and discharging into deeper water than at present, is scheduled for completion in the near future. Together with other capital works, this is expected to greatly improve discharges to the loch, in compliance with the EC Urban Wastewater Treatment Directive.

There are extensive jetties at Stranraer and Cairnryan; the latter installed originally for military use during World War II. Both towns are busy ferry ports for Northern Ireland crossings to Larne and Belfast. In addition to conventional ferries, high-speed ferries operate from both ports, leading to concerns being expressed about the impact of the wash from these vessels. There are other small slipways throughout the loch, and there have been a number of proposals over the years for marina developments, particularly at Cairnryan and Stranraer.

An Advisory Management Forum has been established to document current activities which occur in and around the loch and identify concerns and opportunities, and a management strategy has been developed for the loch (Loch Ryan Advisory Management Forum 1998).

Marine developments and uses

The loch is famous for its beds of native oysters *Ostrea edulis* in the southern basin, which have been fished for centuries. The rights to the oyster fishery have been held by the Wallace family of Cairnryan since the 18th century. In the past the beds have been heavily overfished and underwent a sharp decline around 1954. They have been fished spasmodically since then. Since 1988, when fishing was temporarily stopped while the Wallace family tried to re-establish the beds as a commercial proposition, the fishery has re-started and there are proposals for further expansion. The history of the oyster beds and their structure during the 1950s and 1960s was described by Millar (1961, 1963, 1964, 1968). The loch is a designated Shellfish Water under the EC Directive 79/923 which places restrictions on some fishing activities. A ban on the use of mobile fishing gear throughout most of the loch, to further protect the oyster beds, has been in force since 1986. Current concerns centre on the impact of increased siltation within the loch and the number of oysters being washed ashore, possibly as a result of 'fast ferry' operations (Loch Ryan Advisory Management Forum 1998).

Some fishing with static gear takes place, especially for thornbacks *Raja clavata* and other rays, and there is some potting for lobsters *Homarus gammarus* and crabs. These activities are mostly confined

to the northern channel. Cockles *Cerastoderma edule* and mussels *Mytilus edulis* are taken from The Spit and from the beach east of Stranraer. Cockle tractors with hydraulic pumps have been used. Commercial-scale bait-digging, mostly for lugworms *Arenicola marina*, occurs on the beach near Stranraer and on The Spit.

Salmon *Salmo salar* netting is a long-established practice along the western shore of the loch between Port Beag and Milleur Point, with records going back to 1895. Nets are worked at four stations from April to September. Sea-angling is popular, and the loch has its own sea-angling association.

At the time of the 1988 MNCR survey there was one salmon farm behind the pier at Cairnryan and one trout farm on the burn behind Finnarts Bay (both since closed). Some fish-processing takes place near Cairnryan.

References and further reading

Craig, N.D.C., Lewis, R.E., & Tapp, J.F. 1980. *A field survey of Loch Ryan (Dumfries and Galloway).* (Contractor: Imperial Chemical Industries, Brixham Laboratory, Brixham.) Unpublished, Scottish Milk Marketing Board. (Report, No. BL/B/2009.)

Howson, C.M. 1989. Surveys of Scottish sealochs. Loch Ryan. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 953.

Loch Ryan Advisory Management Forum. 1998. *Loch Ryan Advisory Management Forum strategy.* Dumfries, Dumfries & Galloway Council.

Mason, J., & Key, D. 1977. *Investigations carried out in 1976 on the oyster fishery in Loch Ryan.* Unpublished, Department of Agriculture and Fisheries for Scotland. (Working paper, No. 77/6.)

Millar, R.H. 1961. Scottish oyster investigations, 1946-1958. *Marine Research, 3.*

Millar, R.H. 1963. Investigations of the oyster beds in Loch Ryan. *Marine Research, 5.*

Millar, R.H. 1964. *Breeding and gonadial cycle of oysters in Loch Ryan, Scotland, 28*: 432-439.

Millar, R.H. 1968. Changes in the populations of oysters in Loch Ryan between 1957 and 1967. *Marine Research, 1.*

Nature Conservancy Council. 1990. *Marine Consultation Areas: Scotland.* Unpublished, Nature Conservancy Council (Scotland), Edinburgh.

Paisley College of Technology, Department of Biology. 1979. *A biological survey of seashores in the Clyde Sea Area - 1978-79.* Unpublished, Nature Conservancy Council, Scotland, South-west Region. (Internal report, No. NC 211 J.)

Rendall, D.A. 1990. *Biological survey of the beach and seabed around the Galloway Creamery outfall, Loch Ryan, 1989.* (Contractor: Solway River Purification Board.) Unpublished, Scottish Milk Marketing Board. (Biological report, No. 7.)

Smith, S.M. 1991. *Calyptraea chinensis* (L. 1758) in Loch Ryan. *Porcupine Newsletter, 5*: 48-49.

Sites surveyed

Survey 23: 1988 UMBSM Loch Ryan littoral and sublittoral survey (Howson 1989).
Survey 49: 1978-79 PCT Clyde Sea Area littoral survey (Paisley College of Technology 1979).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
23	3	N of Lady Bay, Loch Ryan.	NX 027 720	55°00.2'N 05°05.1'W	YG; Ver.Ver; PelB; BPat.Sem; Fser.R; Cor
23	4	Lady Bay, Loch Ryan.	NX 027 716	54°59.9'N 05°05.1'W	BPat.Sem; Fser.R; Rho; EphX; SwSed; AP.P
23	5	E of Garry Point, Loch Ryan.	NX 048 728	55°00.6'N 05°03.1'W	YG; Ver.Ver; PelB; BPat.Sem; Cor
23	6	Finnarts Bay, Loch Ryan.	NX 051 726	55°00.5'N 05°02.9'W	BarSh
23	19	The Scar, Loch Ryan.	NX 046 675	54°57.8'N 05°03.1'W	FvesX; FserX; FserX.T; MytX; Zmar
23	20	Head of loch near Low Balyett, Loch Ryan.	NX 082 619	54°54.8'N 04°59.5'W	Fspi; MytX; S; Znol; MacAre.Mare
49	82	Loch Ryan	NX 080 621	54°54.9'N 04°59.7'W	AP.P; BatCor; PCer

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
23	1	Boak Port, Loch Ryan.	NX 014 738	55°01.1'N 05°06.4'W	Lhyp.Pk; EcorEns
23	2	N of Portandea, Loch Ryan.	NX 047 760	55°02.4'N 05°03.4'W	Lhyp.Pk; Mrl
23	7	SE of the Beef Barrel, Loch Ryan.	NX 032 724	55°00.4'N 05°04.6'W	EcorEns
23	8	Near McMeckan's Rocks, Loch Ryan.	NX 028 727	55°00.5'N 05°05.0'W	Lhyp.Ft; Zmar; EcorEns
23	9	Near Forbes Shoal, Loch Ryan.	NX 050 706	54°59.5'N 05°02.9'W	LsacX
23	10	Jamieson's Point, Loch Ryan.	NX 034 712	54°59.7'N 05°04.4'W	LsacX
23	11	N of Garry Point, Loch Ryan.	NX 047 730	55°00.7'N 05°03.2'W	XKScrR
23	12	NW of Garry Point, Loch Ryan.	NX 041 734	55°00.9'N 05°03.8'W	EcorEns
23	13	NW of No.5 Beacon, Loch Ryan.	NX 055 628	54°55.3'N 05°02.1'W	Ost
23	14	W of No.3 Beacon, Loch Ryan.	NX 057 638	54°55.8'N 05°01.9'W	Ost
23	15	SE of Soleburn, Loch Ryan.	NX 042 636	54°55.7'N 05°03.3'W	LsacX
23	16	SW of The Spit, Loch Ryan.	NX 048 656	54°56.8'N 05°02.8'W	Ost
23	17	The Wig, Loch Ryan.	NX 043 673	54°57.7'N 05°03.4'W	Ost
23	18	W of No.1 Beacon, Loch Ryan.	NX 060 654	54°56.7'N 05°01.7'W	Sell

Compiled by: Frances Dipper

2 Gareloch

Location		
Position (centre)	NS 250858	56° 1.8′N 4° 48.5′W
Administrative area	Argyll and Bute	
Conservation agency/area	Scottish Natural Heritage	West Areas (Argyll and Stirling)

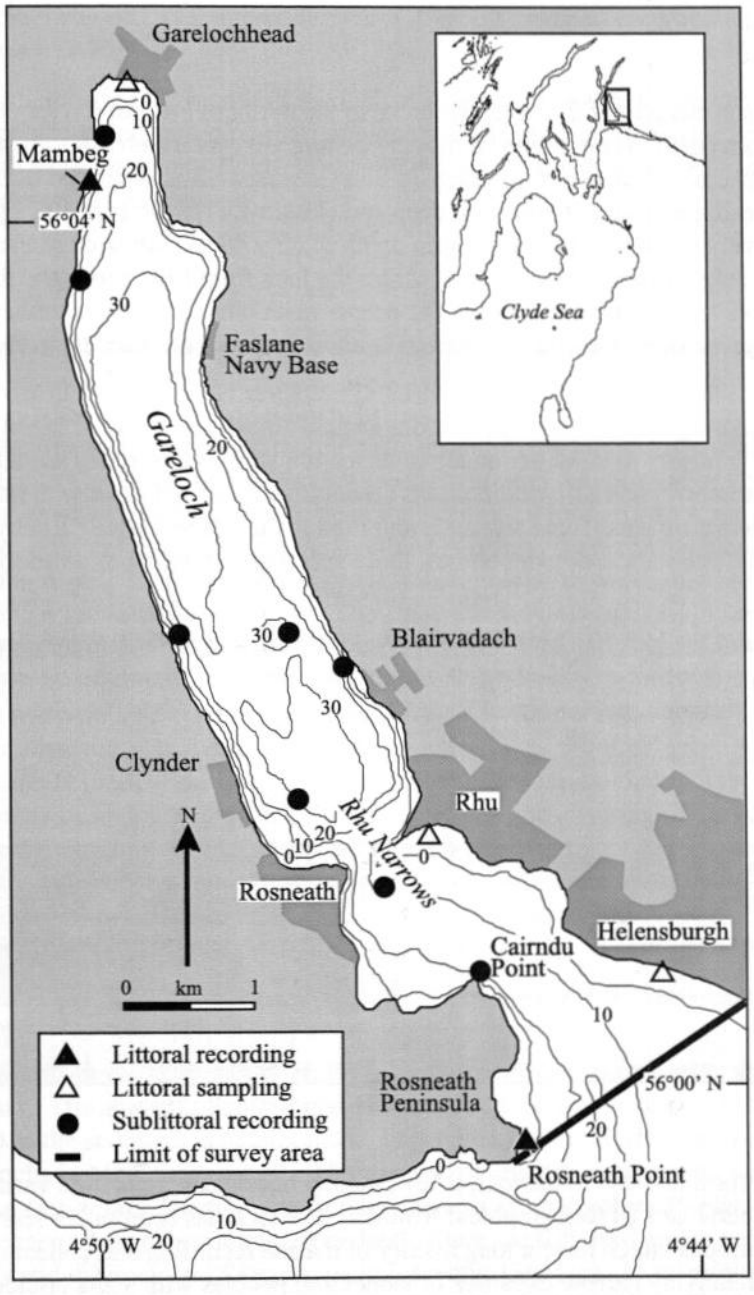


Figure 2.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Fjordic sealoch
Length of coast	31 km
Length of inlet	9.5 km
Area of inlet	12.8 km^2
Bathymetry	Maximum depth 49 m
Wave exposure	Very sheltered
Tidal streams	Very weak
Tidal range	3.1 m (springs); 1.8 m (neaps)
Salinity	Fully marine but locally variable

Introduction

Gareloch is the most easterly of the seven sealochs in the northern Firth of Clyde. The loch runs approximately from north to south with its mouth opening alongside Helensburgh, and is thus the nearest to the industrial conurbations of Glasgow and Greenock. It is separated from Loch Long to the west by the Rosneath peninsula. Unlike the deep and classically fjordic Lochs Long and Fyne, Gareloch is relatively shallow with a maximum depth of only 49 m (Edwards & Sharples 1986). A stone and shingle ridge, extending westwards across the loch from Rhu, forms the Rhu Narrows. Here the seabed shallows to form a sill separating the deeper main basin from the entrance area. The narrows have however been dredged and blasted to allow larger vessels access to the loch.

In common with all the other sealochs in this area, Gareloch is very sheltered from the prevailing south-westerly winds by the mainland and islands around Argyll and Bute. It therefore experiences little gradation of exposure to wave action along its length, with a consequent reduction in the diversity of communities present. The sublittoral consists predominantly of sediment with muddy shell or sand gravel as the predominant superficial sediment and mud in the deepest areas. Rocky habitats are restricted to cobble, pebble and boulder shores, these substrata extending to a variable extent into the sublittoral.

The coastline around the loch has been extensively developed and is flanked by several towns and villages, of which Helensburgh is the largest. Almost the whole of the north-eastern part of the loch around Faslane is occupied by HM Naval Base Clyde.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	2	April & July 1978	Paisley College of Technology (1979)
	Infaunal sampling (25x25 cm area sieved)	3	Summer 1978	Paisley College of Technology (1979)
Sublittoral	Recording (epibiota)	8	September 1989	Holt & Davies (1991)

Littoral

The diversity of littoral habitats in the loch is low, mainly because there is little variation in wave exposure and a general lack of topographical features. The loch has been rather less well studied than the other Clyde sealochs which have a long history of marine recording and collection. The shores consist mainly of relatively narrow expanses of stones and pebbles with some boulders. At Mambeg on the north-west coast, the stony shore is mainly colonised by large numbers of winkles *Littorina littorea* with some mussels *Mytilus edulis* and several species of barnacles. The channelled wrack *Pelvetia canaliculata* is the only common seaweed. This biota is probably typical of much of the west coast shoreline which is fairly linear. The spit extending westwards into the loch from Rhu is similarly stony.

The shore along the head of the loch consists of a more extensive area of firm, well-drained gravel and pebbles with muddy sand. A small river flows across the central region. In common with many other Scottish sealochs, the predominant surface community is one of *M. edulis*, littorinids, fucoids *Fucus* spp., and the mud snail *Hydrobia ulvae* (MytX). Within the sediment, the tellin *Macoma balthica* is predominant together with cockles *Cerastoderma edule* and polychaete worms (PCer). Most of these species are characteristic of slightly estuarine conditions. A similar but possibly more numerous and diverse fauna is present in the muddy sands of the sheltered bay on the south side of the Rhu spit, backed by a shingle ridge and a sea-wall. Beaches of cleaner, fine sand are present at Helensburgh and are typical of the shoreline between Cairndhu Point just south of Rhu, and Craigendoran just outside the loch. They are characterised by scattered lugworm *Arenicola marina* casts and a sparse infauna, mainly of polychaetes (AP.P).

Bedrock shores are restricted to the mouth of the loch at Rosneath Point on the west side. Here there is a smooth rocky promontory dominated by mats of algae mainly *Enteromorpha* sp., *Porphyra* sp. and *Fucus* sp., along with the bristleworm *Fabricia sabella* indicating a high sediment load in the water. *M. edulis* is also common in this area.

Sublittoral

Sublittoral rock

In common with Holy Loch but in contrast to the other lochs in this area, sublittoral areas in Gareloch almost entirely lack rocky substrata. Such rocky areas as there are, consist of cobbles, pebbles and to a lesser extent boulders which give way to sediment at quite shallow depths. These substrata often extend down from the lower shore through the infralittoral and frequently overlie, and are mixed in with, muddy sediments. The extent of these rocky substrata around the loch has not been accurately mapped but the most extensive areas appear to be in the north-western part. At some sites, cobbles give way abruptly to sediment at around 6 m depth whilst at others, scattered cobbles and pebbles persist to around 20 m depth. In the sublittoral fringe, mussels *Mytilus edulis*, are predominant (MytX) often binding the stones and sediment together. The algae *Chondrus crispus* and *Mastocarpus stellatus* are sometimes common here. Below the main *Mytilus* zone, infralittoral cobbles and boulders are typically heavily encrusted with coralline algae such as *Lithothamnion glaciale*, and by the keel worm *Pomatoceros triqueter*. Kelp *Laminaria saccharina* may form a dense canopy down to around 5 m depth, but other algae are sparse due to the grazing activities of the small green urchin *Psammechinus miliaris* (LsacRS.Psa; LsacX). This impoverished type of kelp forest is typical in shallow, sheltered areas of sealochs, especially where there is some lowering of the salinity. Cobbles extending below the kelp are also encrusted by coralline algae and the barnacle *Balanus crenatus*, along with scattered dead man's fingers *Alcyonium digitatum*. There may be dense patches of foliose algae (mainly *Phycodrys rubens*) but grazing, lack of suitable substrata and possibly reduced water quality, prevents the growth of dense algal swards. Scattered horse mussels *Modiolus modiolus* between the stones are a common feature (ModHo).

Sublittoral sediment

The sublittoral sediments in the loch are predominantly mixed sediments of muddy shell gravel, muddy sand and mud. The amount of coarse material and of pebbles and cobbles decreases with depth and below about 20 m the sediment is mainly mud. This type of rather ill-defined sediment is common throughout all the lochs in MNCR Sector 12. The species present are, in the main, widespread species such as the anemone *Cerianthus lloydii*, hermit crabs *Pagurus* sp. and gobies *Pomatoschistus* sp. (ModHo). In the deeper areas, below about 20 m depth, there are soft mud plains with the seapen *Virgularia mirabilis* and the anemone *Sagartiogeton laceratus* (SpMeg). *V. mirabilis* also occurs on mud at shallower depths in areas such as to the south of the Rhu spit (PhiVir). The Norway lobster *Nephrops norvegicus* occurs in burrows at greater depths. These soft sediments are characteristic of most deep Scottish sealochs but in Gareloch appear to be somewhat impoverished. Some areas of soft mud plain, such as opposite the Faslane development, near the head of the loch and towards the middle of the main basin, are very bare often with a cover of bacteria *Beggiatoa* (Beg).

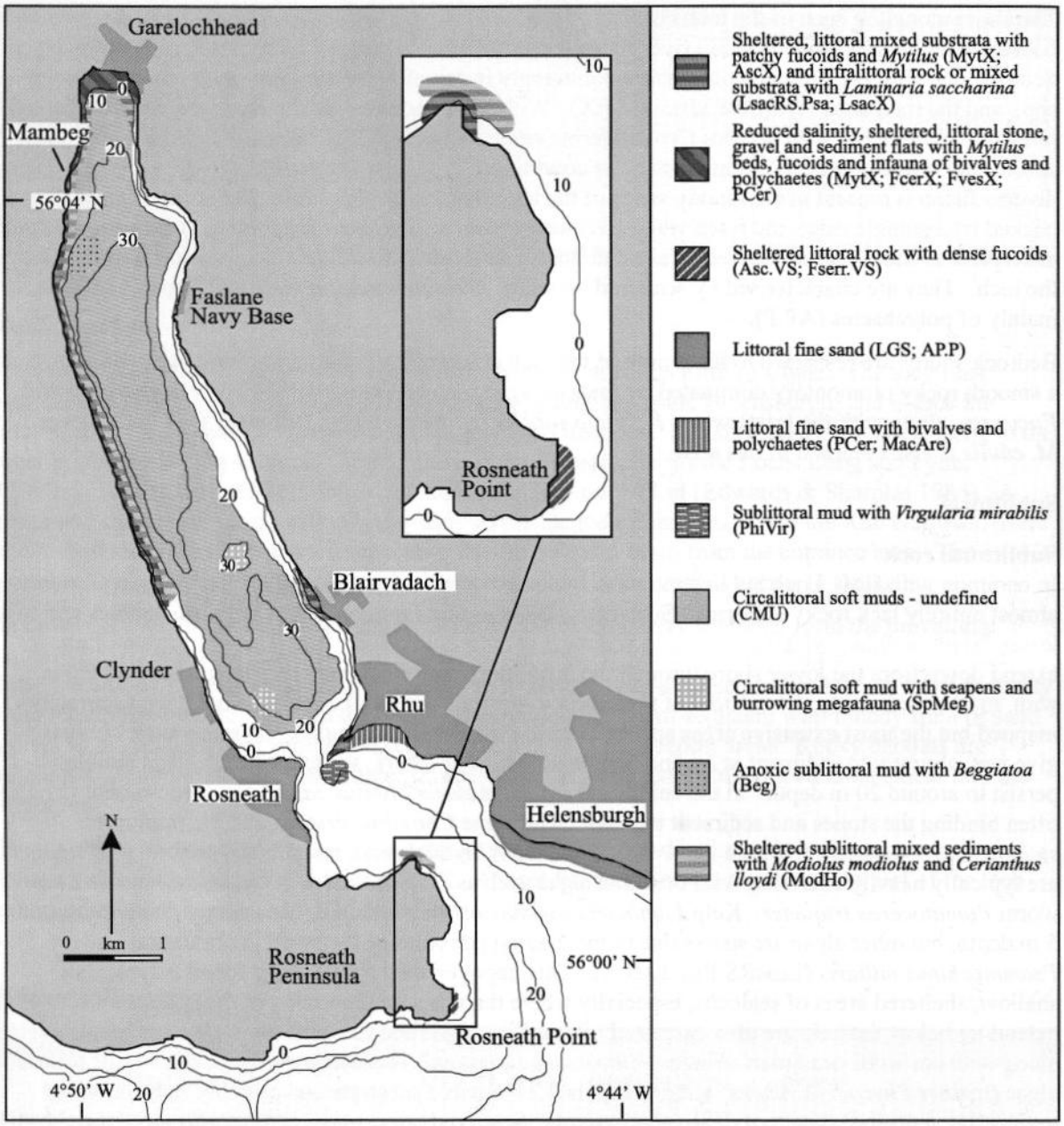


Figure 2.2 Indicative distribution of the main biotopes in the loch (based on data from survey sites shown in Figure 2.1, additional field observations and cited literature).

Nature conservation

Conservation sites		
Site name	*Status*	*Main features*
Rhu Point	SSSI; GCR	Quaternary geology
Garelochhead	MoD site	
Rhu	MoD site	
Rosneath	MoD site	

Human influences

Coastal developments and uses

The coast of Gareloch, particularly the east coast, has been extensively developed. Almost the whole north-eastern area of the loch is occupied by the huge HM Naval Base Clyde. There is a Ministry of Defence (MoD) base and oil fuel depot at Garelochhead and other MoD areas at Rosneath and at Rhu. The loch has been designated as a Dockyard Port, under the jurisdiction of the Queen's Harbourmaster and the harbourmaster of the Clyde Port Authority. As a result, areas in the vicinity of MoD bases, and other areas in the loch such as submarine exercise areas, can periodically be closed to civilian boat traffic.

Helensburgh, with a population of 16,400, extends along the east coast in the mouth of the loch, joining up with the picturesque village of Rhu to the north. Other smaller developments and the naval base are strung out all along the rest of this coast. Garelochhead lies at the northern end of the loch. The west coast is less developed apart from the villages of Clynder and Rosneath near the mouth. These have a long history of boat-building. There are sea-walls and jetties associated with the main conurbations, especially Helensburgh. A summer ferry service runs from Helensburgh to Gourock and Kilreaggan. The Rhu Narrows have been widened and deepened to allow larger vessels to enter the loch. Part of the Rhu Narrows has undergone blasting since the 1989 MNCR survey was carried out.

The area is popular with tourists and there is a 400-berth marina at Rhu where the Royal Northern and Clyde Yacht Club has its base. There is an outdoor centre at Blairvadach.

Marine developments and uses

There are no fish farms in the loch and little in the way of commercial fishing.

References and further reading

Barnett, P. R.O. 1974. *The benthos of the Firth of Clyde.* In: The Clyde Estuary and Firth. An assessment of present knowledge. Natural Environment Research Council Publications, C11, 36-39.

Clyde River Purification Board. 1967. *Interim report on aspects of pollution in the Gare Loch.* Unpublished, Clyde River Purification Board. (Estuary Section Report, No. 2.)

Edwards, A., & Sharples, F. 1986. *Scottish sea lochs: a catalogue.* Oban, Scottish Marine Biological Association and Peterborough, Nature Conservancy Council.

Holt, R., & Davies, L.M. 1991. Surveys of Scottish sealochs. Sealochs in the northern Firth of Clyde. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 1147.

Paisley College of Technology, Department of Biology. 1979. *A biological survey of seashores in the Clyde Sea Area - 1978-79.* Unpublished, Nature Conservancy Council, Scotland, South-west Region. (Internal report, No. NC 211 J.)

Tuck, I.D., Hall, S.J., Robertson, M.R., Armstrong, E., & Basford, D.J. 1998. Effects of physical trawling disturbance in a previously unfished sheltered Scottish sea loch. *Marine Ecology Progress Series, 162*: 227-242.

Sites surveyed

Survey 28: 1989 UMBSM sealochs in the northern Firth of Clyde survey (Holt & Davies 1991).
Survey 49: 1978-79 PCT Clyde Sea Area littoral survey (Paisley College of Technology 1979).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
49	26	Rosneath Point, Gareloch.	NS 275 809	55°59.4'N 04°45.9'W	F
49	27	Mambeg, Gareloch.	NS 233 898	56°04.1'N 04°50.3'W	Pel; Fspi; AscX
49	65	Garelochhead.	NS 237 909	56°04.7'N 04°49.9'W	MytX; PCer
49	67	Rhu, Gareloch.	NS 266 837	56°00.8'N 04°46.9'W	PCer; MacAre
49	68	Helensburgh, Gareloch.	NS 294 822	56°00.1'N 04°44.1'W	AP.P

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	96	Garelochhead.	NS 236 905	56°04.5'N 04°50.0'W	MytX; LsacX; SpMeg
28	97	Opposite Faslane, Gareloch.	NS 232 889	56°03.6'N 04°50.3'W	MytX; LsacRS.Psa; ModHo; Beg
28	98	SE of Little Rahane, Gareloch.	NS 241 858	56°02.0'N 04°49.3'W	MytX; LsacX; ModHo; SpMeg
28	99	Mid lower loch, Gareloch.	NS 252 858	56°02.0'N 04°48.3'W	SpMeg
28	100	W of Blairvadach, Gareloch.	NS 258 854	56°01.8'N 04°47.7'W	LsacRS.Psa; ModHo
28	101	Stroul Bay, Gareloch.	NS 254 841	56°01.1'N 04°48.0'W	SpMeg
28	102	E of Rhu South Buoy, Gareloch.	NS 261 833	56°00.7'N 04°47.3'W	PhiVir
28	103	Castle Point, Gareloch.	NS 270 824	56°00.2'N 04°46.4'W	MytX; LsacX; ModHo

Compiled by: Frances Dipper

3 Loch Long and Loch Goil

Location		
Position (centre)	NS 220930	56° 6.2′ N 4° 51.6′ W
Administrative area	Argyll and Bute	
Conservation agency/area	Scottish Natural Heritage	West Areas (Argyll and Stirling)

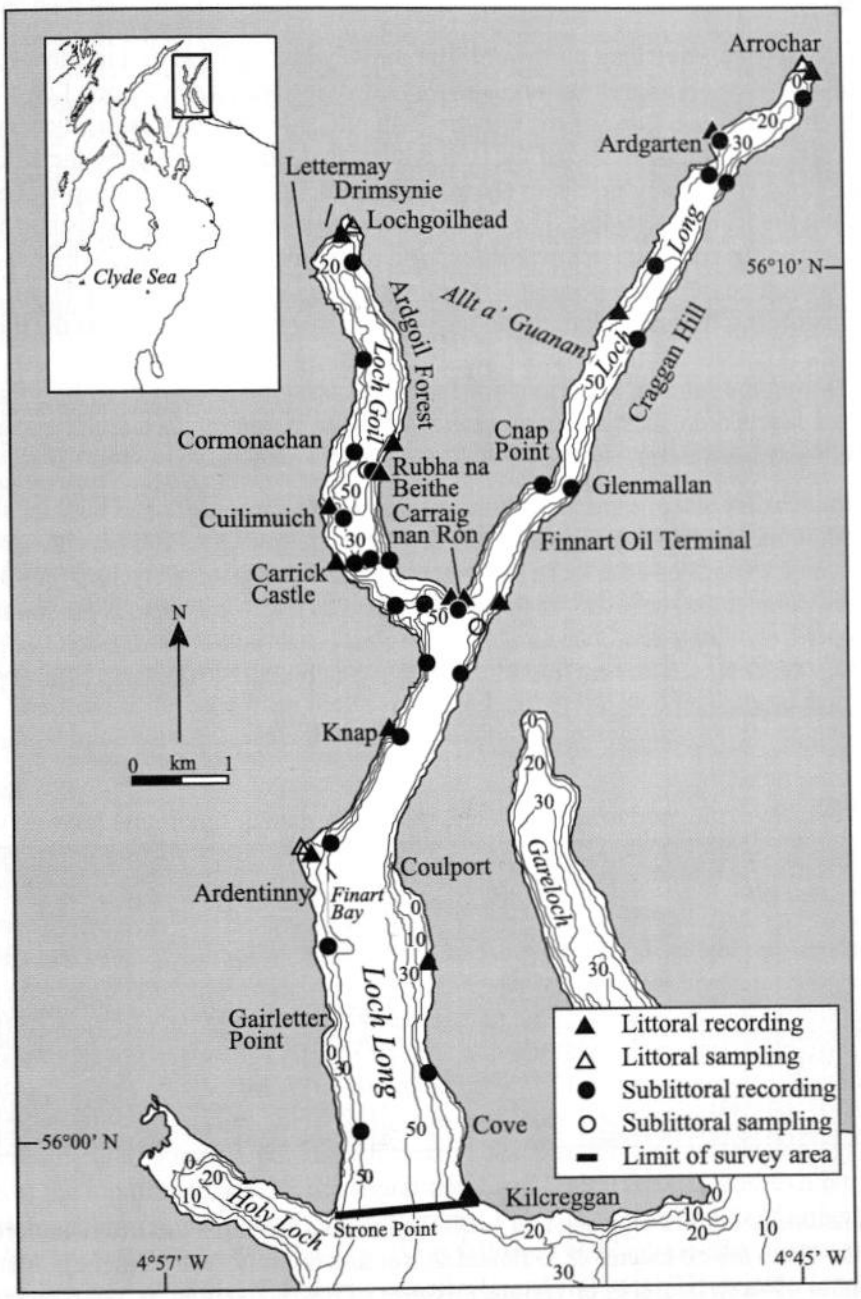


Figure 3.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Fjordic sealoch
Length of coast	Loch Long 60 km; Loch Goil 23 km
Length of inlet	Loch Long 26.9 km; Loch Goil 8 km
Area of inlet	Loch Long 35.7 km^2; Loch Goil 8.5 km^2
Bathymetry	Maximum depth: Loch Long 97 m; Loch Goil 86 m
Wave exposure	Sheltered to very sheltered
Tidal streams	Loch Long weak to very weak, 0.75 knots at entrance; Loch Goil very weak
Tidal range	3.1 m (springs); 1.8 m (neaps)
Salinity	Marine but locally variable

Introduction

Loch Long is aptly-named, stretching northward from the Clyde for 27 km as a narrow, steeply-walled fjord. Loch Goil branches off approximately half-way down the west side of Loch Long, making the whole system Y-shaped. Loch Long opens into the Firth of Clyde with its mouth adjacent to Holy Loch at Strone Point. The southern end of the loch is separated from Gareloch by the Kilcreggan Peninsula. Loch Long is typically fjordic in character, being long, narrow and steep-walled and with two sills separating the loch into basins. The first sill lies across the mouth of the loch at 57 m whilst the second runs across the constriction towards the head of the loch near Finnart, where the seabed rises to 38 m. The outer basin is the deepest at 97 m whilst the inner is still deep at 60 m. Loch Goil is relatively short, extending for only 8 km. It has a single shallow sill running across the mouth of the loch at 16 m depth. This sill effectively separates its single deep basin of 86 m depth from the waters of Loch Long. During the summer a thermocline forms in Loch Goil and the deep-basin waters stagnate as oxygen levels drop. The stagnant water is replaced in winter when dense water flows over and down the sill from Loch Long.

The sides of both lochs are steep, especially the east sides where sheer cliffs and boulder slopes extend from the intertidal to more than 40 m depth. There are therefore few extensive beaches in this loch system. Apart from the heads of both lochs and Finart Bay, the littoral area consists mainly of steep bedrock, boulders, cobbles and pebbles. In the sublittoral steep and vertical cliffs predominate on the east coasts of upper Loch Long and Loch Goil. On the west coasts and in outer Loch Long, mixed slopes of bedrock, boulders, cobbles and muddy sediment predominate. The deep central parts of both lochs consist of soft muds.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	12	September 1989	Holt & Davies (1991)
	Recording (epibiota)	3	September 1978	Paisley College of Technology (1979)
	Infaunal sampling (digging & cores)	2	September 1989	Holt & Davies (1991)
	Infaunal sampling (25x25 cm area sieved)	3	April to October 1978	Paisley College of Technology (1979)
Sublittoral	Recording (epibiota)	27	September (1989)	Holt & Davies (1991)
	Infaunal sampling (anchor dredge)	2	September (1989)	Holt & Davies (1991)

Littoral

The steep-sided nature of both Loch Long and Loch Goil results in shores that are relatively limited in horizontal extent. There are no extensive sediment shores and no truly sandy beaches. Instead the shores consist either of steep bedrock, or various mixtures of bedrock, boulders, cobbles and pebbles. The sheltered nature of the loch also means that the shores are rather uniform and the diversity of habitats and species is not high.

Littoral mixed sediment and rock

The most extensive shores in the loch system are at the heads of the two lochs. At the head of Loch Long (Arrochar) there is a gently-sloping shore of pebbles on gravelly mud extending seawards for approximately 350 m. The Loin Water and small streams cross the shore. The majority of the shore is taken up by a dense mussel *Mytilus edulis* bed which consolidates the sediment and pebbles over which it lies (MytX). The bed is overlain by fucoid algae, mainly *Fucus vesiculosus* with some *Fucus serratus* lower down along with the red alga *Mastocarpus stellatus*. The winkle *Littorina littorea* is abundant throughout the shore. Along the edges of the freshwater streams, *F. vesiculosus* is replaced by *Fucus ceranoides*, which is tolerant of lowered salinities (FcerX).

The shore at the head of Loch Goil is similar in extent and character to that in Loch Long but is in general sandier with less mixed sediment. Most of the shore consists of sand or muddy sand with a layer of gravel beneath whilst the lower shore has more pebbles and mixed sediment. A bed of *M. edulis* (MytX) occurs on the lower shore but is patchy and less extensive than that at the head of Loch Long. The description of this shore given by Paisley College of Technology (1979) gives the impression that the *Mytilus* may have been more abundant in the 1970s. Even then, it was noted that there was considerable disturbance to the shore from bait-digging and boating activities. Much of the mid-and lower shore area is covered by *F. vesiculosus* (FvesX). However, there are sandier areas where there is little algal cover and where the lugworm *Arenicola marina* is frequent. Cockles *Cerastoderma edule*, clams *Mya arenaria* and polychaete worms are also present in these areas (MacAre). At slightly higher levels these sandy areas are covered in some parts by mats of green algae *Rhizoclonium riparium* and *Enteromorpha* sp. as well as scattered fucoids. There are also areas with sparse eelgrass *Zostera noltii* (Znol). Areas influenced by freshwater near the top of the shore have dense growths of *F. ceranoides* (FcerX).

The communities present at the heads of these two lochs are common in other Scottish sealochs and are not especially rich examples.

The only other area of mixed sediment and pebbles in Loch Long is in Finart Bay on the west coast. Here too a substantial stream with associated *F. ceranoides* runs across the shore which consists mainly of shingle overlying sand or muddy sand. Again there is a *M. edulis* bed on the lower shore with abundant *F. vesiculosus* and littorinids (FvesX; MytX). At the time of the 1989 MNCR survey there were also large areas covered by the red alga *Porphyra umbilicalis*. This is probably a seasonal occurrence. The main difference from the shore at the head of the loch is, that on the Finart Bay shore, patches of shingle have been formed into well-drained ridges, particularly on the upper and mid-shore.

Littoral Rock

In relation to the total length of the loch, relatively few shores have been surveyed in detail. However the uniformity of the loch in terms of topography and exposure to wave action, means that it is unlikely that any shores with distinctly different communities to those described below are present around the loch system. In general the east coast of Loch Long is steeper than the west with a greater proportion of steep bedrock along its shores. In Loch Goil, shores of vertical and overhanging bedrock cliffs are present on the east coast. The majority of the shores, whether predominantly of bedrock, boulders or mixed substrata, are backed by bedrock in the supralittoral and littoral fringe zones. On gently or moderately-sloping shores, this bedrock is often broken and rugged with trees extending down almost to the high water-mark. The sheltered nature of the loch means this land vegetation receives little salt spray and so can survive low down. The bedrock sometimes extends to the mid-shore region before giving way to boulders or mixed substrata. Throughout the loch system, bedrock and boulders at the top of the shore, in the supralittoral and littoral fringe areas, exhibit the typical zonation patterns characteristic of sheltered conditions. That is, narrow zones of lichens such as the green *Ramalina* sp. and yellow *Xanthoria* sp. (YG) followed by black tar-like *Verrucaria* sp. (Ver.Ver) and the channelled wrack *Pelvetia canaliculata* (Pel; Fspi). The winkle *Littorina saxatilis* is often abundant in these zones.

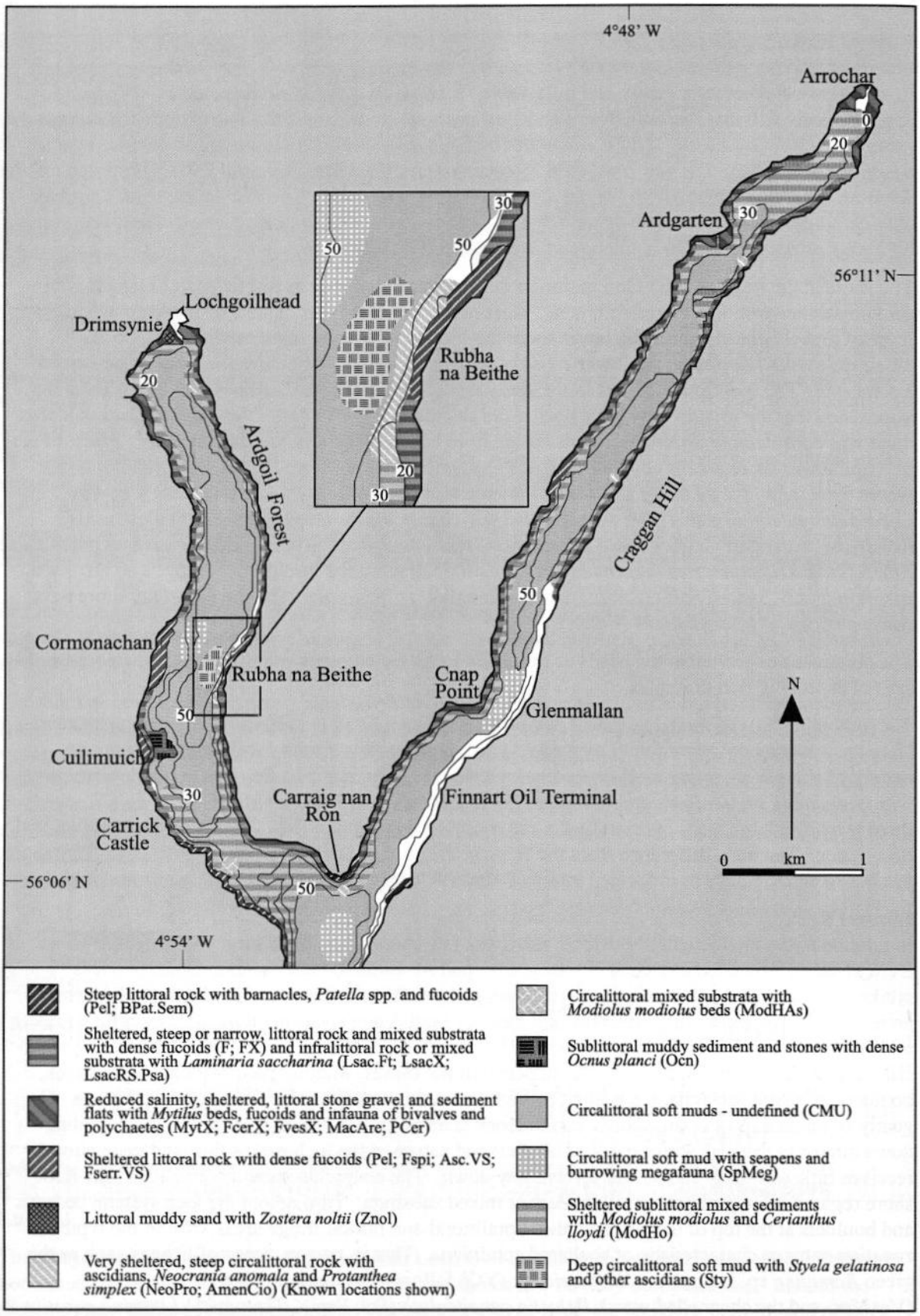


Figure 3.2 Indicative distribution of the main biotopes in Loch Goil and northern Loch Long (based on data from survey sites shown in Figure 3.1, additional field observations and cited literature).

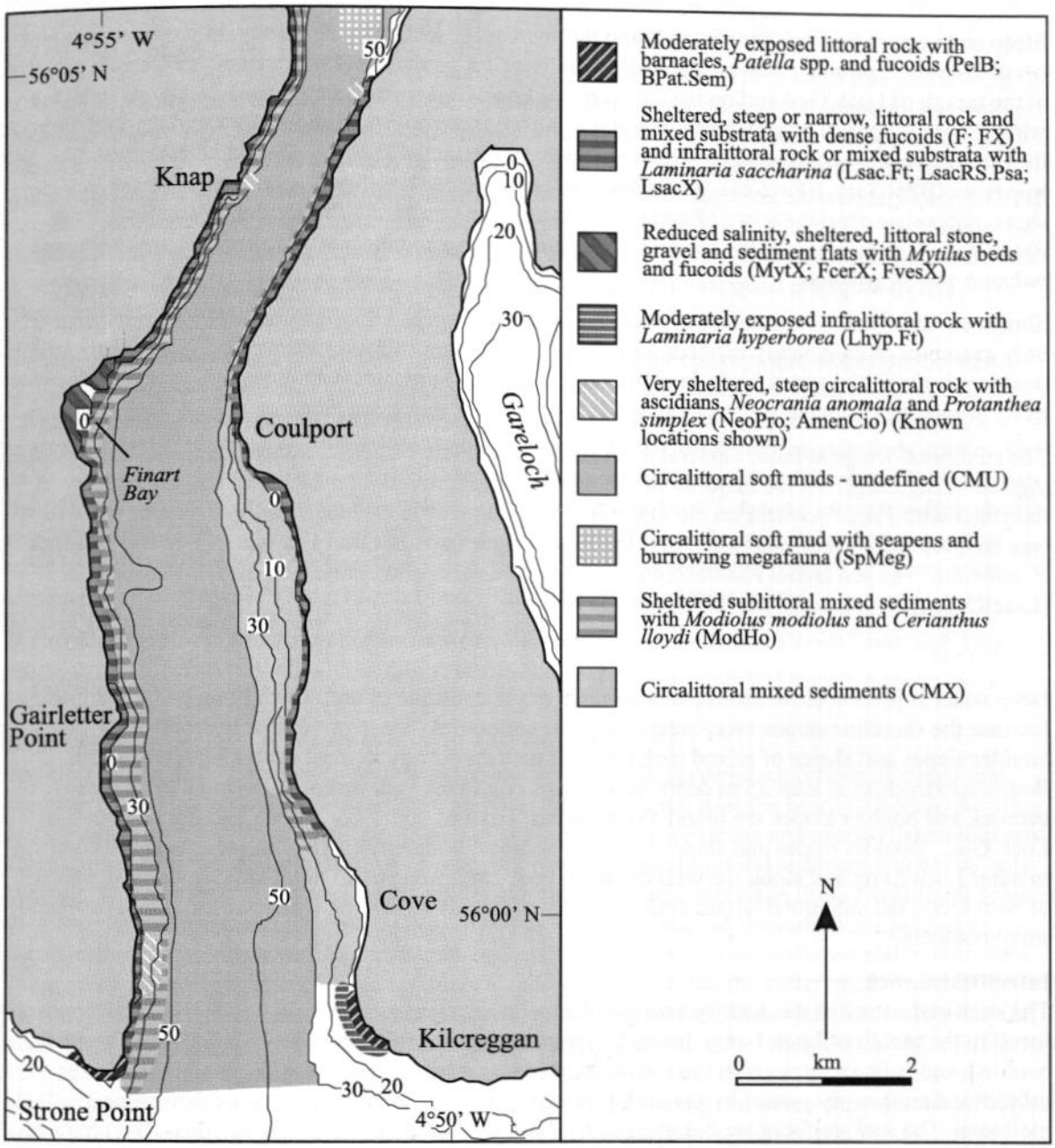


Figure 3.3 Indicative distribution of the main biotopes in southern Loch Long (based on data from survey sites shown in Figure 3.1, additional field observations and cited literature).

Boulder shores along the west coast of upper Loch Long and in Loch Goil are mainly dominated by thick growths of fucoid algae as would be expected in these sheltered conditions. In the mid-shore *Fucus vesiculosus* and *Ascophyllum nodosum* predominate in varying proportions. The latter was found by the 1989 MNCR survey team to be especially abundant on horizontal platforms of bedrock on the shore north-east of Allt a' Guanan in Loch Long and on rugged bedrock on the shore north of Rubha na Beithe in Loch Goil (Asc.VS). Other boulder shores and mixed shores along the outer part of Loch Long have a variable and patchy cover of fucoid algae with the tops of the boulders or cobbles dominated by barnacles *Semibalanus balanoides* and with abundant *L. littorea* and *L. saxatilis*. Some of these sites may experience more abrasion from movement of small boulders and cobbles than is apparent at first sight.

Steep and vertical bedrock shores are found throughout the loch system, mainly on promontories and small skerries close to the shore. Typical examples occur on the small rock skerry off Carraig nan Ròn at the mouth of Loch Goil and on the east coast of Loch Goil at Rubha na Beithe. At these sites, the whole shore is vertical or very steep. Fucoid algae are therefore at a disadvantage and the mid-shore at these sites tends to be dominated by dense growths of barnacles *S. balanoides* and *Chthamalus montagui* (BPat.Sem; BPat.Cht). At Rubha na Beithe, shaded overhanging rock towards the lower shore, supports a greater variety of animals including mussels *M. edulis*, patches of small plumose anemones *Metridium senile*, the ascidian *Ascidiella aspersa* and mats of red algae, mainly *Palmaria palmata* and *M. stellatus*.

Shores on either side of the mouth of Loch Long where it opens into the Firth of Clyde, provide the only examples of moderately exposed rocky shores in this area. The moderately-sloping bedrock with boulders in the lower zones, is again mainly dominated by barnacles with abundant winkles and so has many similarities with the steep and vertical sheltered rock described above.

The sublittoral fringe at these moderately exposed rocky sites was characterised by the kelp *Laminaria digitata* (Ldig.Ldig). At the majority of other rocky sites throughout the loch system the fringe was indistinct with *Fucus serratus* on the lower shore, giving way to *Laminaria saccharina*, or where this was not present, to calcareous algae and foliose red algae such as *Chondrus crispus, M. stellatus* and *P. palmata*. The sea urchin *Psammechinus miliaris* was also often present in the fringe area (LsacRS.Psa).

Sublittoral

Deep water is present close inshore around most of the coastline of both Loch Long and Loch Goil, because the shoreline slopes away steeply into the sublittoral. Steep or vertical bedrock cliffs, steep boulder slopes and slopes of mixed rock and sediment drop away to meet deep muddy sediments. Bedrock extends to at least 35 m depth in parts of Loch Long. The steepest and most extensive bedrock and boulder slopes are found along the east coast of upper Loch Long and the east coast of Loch Goil. Boulder slopes and slopes of mixed bedrock, boulders, cobbles and sediment are common in outer Loch Long and along the west coasts of both Loch Long and Loch Goil. Towards the heads of both lochs, the sublittoral slopes consist mainly of muddy sediments with cobbles, shell gravel and small boulders.

Infralittoral rock

The sheltered nature of this loch system is reflected in the restriction of kelp *Laminaria hyperborea* forest to the mouth of Loch Long. Instead, *Laminaria saccharina* is present on infralittoral bedrock, boulders and cobbles throughout the loch system. The surfaces beneath the kelp and in the lower infralittoral are heavily grazed by the urchin *Psammechinus miliaris*, chitons and other grazing molluscs. The rock surfaces are therefore rather bare with little growth of foliose algae, but crusts of coralline algae and the keel worm *Pomatoceros* sp. (LsacRS.Psa). On the steep east coasts of both Loch Long and Loch Goil, the kelp forest often only extends for a short distance before the slope becomes too steep for it to maintain a foothold. On bedrock cliffs, dead man's fingers *Alcyonium digitatum*, ascidians such as *Clavelina lepadiformis* and *Ascidia mentula*, and the plumose anemone *Metridium senile,* are frequent as an understorey along with filamentous algae such as *Callithamnion* sp. and calcareous encrusting algae. Even where the slope is less steep on the west coasts of both lochs, kelp often occurs only in a narrow band with scattered plants down to around 6 m depth and encrusting coralline algae with scattered ascidians as the main understorey. Intense grazing by large numbers of *P. miliaris* are probably mainly responsible for the lack of foliose algae and generally impoverished nature of the infralittoral rock areas throughout the loch. These urchins are present even in infralittoral areas where the substratum is predominantly muddy sediment overlain by cobbles and pebbles, such as near the heads of both lochs and in outer Loch Long south from Ardentinny where the loch widens. Here the *L. saccharina* extends to between 4 and 8 m depth, attached to cobbles along with some foliose algae such as *Phycodrys rubens* and with the anemone *Cerianthus lloydii* and other sediment species between the cobbles (LsacX).

Circalittoral rock

Deep bedrock walls and cliff faces are common along the east coasts of both lochs and on the west side of Loch Long near the entrance. These rock faces in the lower circalittoral support a distinctive community typically associated with deep bedrock in sheltered fjordic sealochs. The community is characterised by four species of which the most striking is the white anemone *Protanthea simplex*. The long tubes of the fan worm *Sabella pavonina* emerge from amongst the anemones, along with the common ascidian *Ciona intestinalis*. The fourth regular member of the community is the brachiopod *Neocrania anomala* (NeoPro). Other common species include the cup coral *Caryophyllia smithii* and a variety of ascidians. The deep steep cliffs in these two lochs provide good examples of this characteristic community.

Similar communities are also found on deep bedrock and boulder outcrops and slopes on the west coasts of both lochs where the sublittoral slopes are less steep and consist of much more mixed substrata. Here, the community is less distinct and all four characterising species are not always present. Other robust species that are commonly found in these circalittoral areas include species such as *A. digitatum*, *Pomatoceros triqueter*, the barnacle *Balanus balanus*, the saddle oyster *Pododesmus patelliformis* and the tubeworm *Chaetopterus variopedatus*. In Loch Long at Carraig nan Ròn near the mouth of Loch Goil, the large anemone *Bolocera tuediae* and the anthozoan *Sarcodictyon roseum* have been recorded, whilst the anemone *Edwardsiella carnea* is present in bedrock crevices below Craggan Hill on the west coast of Loch Long. These are all uncommon species.

Bedrock in the lower circalittoral of some areas, such as on the west coast of Loch Long near Knap Rock, is rather impoverished with coralline crusts and ascidians *Ascidia mentula* both common (AmenCio).

Sublittoral sediment

Areas of mixed sediment, mostly muddy sands and gravels with varying proportions of stones and cobbles, extend up through the circalittoral and into the infralittoral near the heads of both lochs often as fairly steep slopes. Where sufficient cobbles are present, *L. saccharina* and sparse filamentous and foliose algae occur as described above. However, there is little infralittoral sediment and below only around 2 to 5 m depth, algae are absent and the most characteristic species in these circalittoral areas is the horse mussel *Modiolus modiolus*. Typical sediment species such as the anemone *Cerianthus lloydii* are also present, as well as scavengers such as the whelk *Buccinum undatum* and hermit crabs *Pagurus* sp. (ModHo). These mixed sediment slopes grade down into the softer muds found in the centre of the lochs. Similar mixed sediments are found throughout the loch system at various depths, sometimes extending up into the infralittoral or confined to the bottoms of rock slopes. *M. modiolus* is very common in these situations, and in this loch system it appears to be most dense in relatively shallow water between 2 and 11 m depth, with the *Modiolus* thinning out below this. Boulders, cobble and gravel occur between the *Modiolus* and with *L. saccharina* growing on them at the shallower depths. The *Modiolus* themselves provide a hard substratum and are colonised by foliose algae such as *Phycodrys rubens*, keel worms *P. triqueter*, and crusts of *Lithothamnion glaciale* (LsacRS.Psa; ModHAs; ModHo).

During the 1989 MNCR survey, large numbers of the small sea cucumber *Ocnus planci* (Ocn) were found on a slope of gravelly mud, *Modiolus* shells and pebbles, south-east of Cuilimuich in Loch Goil. Large numbers of the tubeworm *C. variopedatus*, scattered ascidians and *P. triqueter* were also common here. Large aggregations of this sea cucumber have been found at only a very few other locations around the UK, namely Loch Erisort in Lewis, Loch Craignish, Carlingford Lough in Northern Ireland, in the Clyde and possibly also in Pembroke and Orkney.

Much of the deep central area of Loch Long and Loch Goil is beyond diving depth and has not been surveyed in detail. However, Admiralty charts, dredge samples and dives to around 40 m depth have shown that, as might be expected, the predominant habitat is soft mud. These mud plains are characterised by burrowing infauna such as the brittlestars *Amphiura chiajei* and *Amphiura filiformis*, polychaetes, and bivalve molluscs such as *Abra alba* (SpMeg). Widespread but not necessarily common epifaunal species include the seapen *Virgularia mirabilis*, the snake blenny *Lumpenus lumpretaeformis* and the spectacular cerianthid anemone *Pachycerianthus multiplicatus*. This latter

species is a characteristic but rare species of soft muds in sealochs, and is present in relatively high numbers at one site in Loch Goil east of Cormonachan. It is also present in small numbers at other sites in the loch system, for example below the steep bedrock walls along Loch Long's east coast. So far it has not been found in this loch system in anything like the densities found near the head of Loch Fyne (Area 6). Burrows of the Norway lobster *Nephrops norvegicus* and other crustaceans are present in some of these muddy areas in Loch Long but not apparently to any extent in Loch Goil and neither loch appears to have particularly rich mud communities supporting burrowing crustaceans. The stagnation that occurs in the depths of Loch Goil below the thermocline in the summer may have something to do with this.

Dredge samples from 65 m depth around mid-way along the east coast of Loch Goil, brought up large numbers of the ascidian *Styela gelatinosum* along with large numbers of several other ascidians (Sty). *S. gelatinosum* is an Arctic species that has not so far been recorded elsewhere in the British Isles, and this may be an ice-age relict population.

Nature conservation

Conservation sites

Site name	*Status*	*Main features*
Loch Long and Loch Goil	RSC	The west coast of Loch Goil and the east coast of loch Long are Regional Scenic Coasts
Loch Goil	MoD	Shingle
Loch Long	MoD	Rock

Human influences

Coastal developments and uses

This area is popular with tourists, as much of the coastline is remote and very scenic and there are few industrial developments. In Loch Goil there is a chalet and caravan complex at Lochgoilhead, where there is a beach of mixed sand and pebbles. The village of Drimsynie adjacent to Lochgoilhead is a popular holiday centre and the starting point for visits to 'Rob Roy's Cave' situated along the glen at the loch head. Another village, Carrick Castle, lies on the south-east coast. Much of the hinterland behind the shores of Loch Goil is steep and wooded with the Ardgoil Forest on the east side. Sand and gravel are quarried on a small scale from the north side of the Lettermay raised delta in Loch Goil.

In Loch Long there are caravan and chalet complexes at Arrochar and Ardgarten at the northern and of the loch and an outdoor centre, run by the local education authority, at Ardentinny on the south-west coast. This hamlet is situated at the foot of Glen Finart. A few kilometres to the south, Gairletter Point is known as a good location for birdwatching. Diving is popular in Loch Long, which has dramatic underwater scenery and is within a short travelling time from Glasgow. Access to the east coast is made easy by the A814 road which runs along the loch-side from Glasgow through Garelochhead to Arrochar. The West Highland Railway runs from Garelochhead to Arrochar along the hill-side high above the road. The settlements of Cove and Kilcreggan lie at the mouth of the loch on the east side and Strone on the west side. The head of Loch Long has been modified by construction of a sea-wall at Mean High Water Springs.

On the south-east coast of Loch Long is HM Naval Base Coulport, with a naval refuelling jetty and a massive Trident submarine base. About half-way along the east coast of Loch Long lies the Finnart oil terminal. This is one of the deepest-water tanker berths in Europe. Oil is pumped to the Grangemouth refinery on Scotland's east coast.

Marine developments and uses

There are no fish farms in this loch system. There is very little commercial fishing for pelagic or demersal stocks but there is some trawling or creeling for the Norway lobster *Nephrops norvegicus*,

which lives in the soft mud of the loch bottom. Both lochs are designated shellfisheries under the EC Shellfish Waters Directive.

References and further reading

Barnett, P. R.O. 1974. *The benthos of the Firth of Clyde*. In: The Clyde estuary and Firth. An assessment of present knowledge. Natural Environment Research Council Publications, C11, 36-39.

Holt, R., & Davies, L.M. 1991. Surveys of Scottish sealochs. Sealochs in the northern Firth of Clyde. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 1147.

Paisley College of Technology, Department of Biology. 1979. *A biological survey of seashores in the Clyde Sea Area - 1978-79*. Unpublished, Nature Conservancy Council, Scotland, South-west Region. (Internal report, No. NC 211 J.)

Sites surveyed

Survey 28: 1989 UMBSM sealochs in the northern Firth of Clyde survey (Holt & Davies 1991).
Survey 49: 1978-79 PCT Clyde Sea Area littoral survey (Paisley College of Technology 1979).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	51	Shore at head, Loch Goil.	NN 195 012	56°10.2'N 04°54.4'W	FvesX; FcerX; MytX; PCer; MacAre; Znol
28	54	Shore N of Rubha na Beithe, Loch Goil.	NS 207 967	56°07.8'N 04°53.1'W	YG; Ver.Ver; Pel; Asc.VS; Fserr.VS; Ldig.Ldig
28	58	Shore at Rubha na Beithe, Loch Goil.	NS 204 963	56°07.5'N 04°53.3'W	Pra; BPat.Cht; BPat.Sem; Fserr.VS; XR
28	61	Shore at Carrick Castle, Loch Goil.	NS 194 943	56°06.4'N 04°54.2'W	Fspi; FvesX; FserX
28	66	Shore NW of Arrochar, Loch Long (Clyde).	NN 296 046	56°12.2'N 04°44.7'W	Fspi; FcerX; MytX; LMX
28	72	Shore NE of Allt a' Guanan, Loch Long (Clyde).	NS 255 996	56°09.4'N 04°48.6'W	YG; Pel; Fspi; Asc.Asc; FvesX; FserX; LsacX
28	77	Shore at Carraig nan Ròn, Loch Long (Clyde).	NS 221 934	56°06.0'N 04°51.6'W	YG; BPat.Sem; LsacRS.Psa
28	78	Shore NW of Carraig nan Ròn, Loch Long (Clyde).	NS 220 934	56°06.0'N 04°51.7'W	Pel; BPat.Sem; FserX
28	83	Shore at Knap, Loch Long (Clyde).	NS 206 906	56°04.5'N 04°52.9'W	YG; Pra; G; Pel; Asc.VS; Fserr.VS
28	86	Shore at Finart Bay, Loch Long (Clyde).	NS 189 881	56°03.1'N 04°54.5'W	Fspi; FvesX; EphX; FcerX; MytX
28	88	Shore at Peaton Layo, Loch Long (Clyde).	NS 214 860	56°02.0'N 04°52.0'W	YG; Ver.Ver; Pel; Fspi; BLlit
28	91	Shore NW of Barons Point, Loch Long (Clyde).	NS 221 810	55°59.3'N 04°51.0'W	YG; Ver.Ver; PelB; BPat.Sem; FK; Ldig.Ldig; Lhyp.Ft
49	23	Near Cormonachan, Loch Goil.	NS 196 953	56°06.9'N 04°54.1'W	F
49	24	Arrochar, Loch Long (Clyde).	NN 277 035	56°11.5'N 04°46.6'W	Pel; F spi; Asc.Asc
49	25	Portincaple, Loch Long (Clyde).	NS 230 933	56°05.9'N 04°50.7'W	BPat
49	63	Finart Bay, Loch Long (Clyde).	NS 190 884	56°03.2'N 04°54.4'W	AP.P; HedMac.Mare
49	64	Lochgoilhead, Loch Goil.	NN 198 013	56°10.2'N 04°54.1'W	AP.P; PCer
49	66	Arrochar, Loch Long (Clyde).	NN 296 048	56°12.3'N 04°44.8'W	LMS; HedMac

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	52	S of Lochgoilhead, Loch Goil.	NN 198 006	56°09.8'N 04°54.0'W	LsacX; NeoPro; ModHo; Beg
28	53	Rubha Airdh Madaidh, Loch Goil.	NS 199 986	56°08.8'N 04°53.9'W	LsacRS.Psa; NeoPro; ModHo
28	55	E of Cormonachan, Loch Goil.	NS 198 967	56°07.7'N 04°53.9'W	SpMeg
28	56	Basin, Loch Goil.	NS 203 964	56°07.6'N 04°53.4'W	Sty
28	57	Rubha na Beithe, Loch Goil.	NS 203 963	56°07.5'N 04°53.4'W	LsacRS.Psa; AmenCio; NeoPro
28	59	SE of Cuilimuich, Loch Goil.	NS 195 951	56°06.9'N 04°54.1'W	LsacRS.Psa; Ocn
28	60	E of Carrick Castle, Loch Goil.	NS 197 944	56°06.5'N 04°53.9'W	ModHo
28	62	Off Carrick Castle, Loch Goil.	NS 201 945	56°06.5'N 04°53.5'W	SpMeg
28	63	NW of Carraig na Maraig, Loch Goil.	NS 205 943	56°06.5'N 04°53.1'W	LsacRS.Psa; ModHo
28	64	NE of Roinn Diomhain, Loch Goil.	NS 205 935	56°06.0'N 04°53.1'W	LsacRS.Psa; ModHAs; ModHo
28	65	SE of Corran, Loch Goil.	NS 213 935	56°06.0'N 04°52.4'W	ModHo
28	67	Arrochar Pier, Loch Long (Clyde).	NN 295 042	56°12.0'N 04°44.8'W	ModHo
28	68	N of Ardgarten Point, Loch Long (Clyde).	NN 277 032	56°11.4'N 04°46.5'W	LsacX; ModHo
28	69	S of Ardgarten Point, Loch Long (Clyde).	NN 274 025	56°11.0'N 04°46.7'W	LsacX; ModHo
28	70	SW of Ardmay, Loch Long (Clyde).	NN 279 022	56°10.9'N 04°46.3'W	Lsac.Ft; AmenCio; NeoPro; ModHo
28	71	Rocks S of Coilessan, Loch Long (Clyde).	NN 262 006	56°10.0'N 04°47.9'W	LsacX; NeoPro; ModHo
28	73	Below Craggan Hill, Loch Long (Clyde).	NS 260 990	56°09.1'N 04°48.1'W	LsacRS.Psa; NeoPro; Cv; ModHAs; ModHo
28	74	N of Glenmallan jetty, Loch Long (Clyde).	NS 250 972	56°08.1'N 04°48.9'W	LsacRS.Psa; FaV; ModHo
28	75	Mid-loch NE of Cnap Point, Loch Long (Clyde).	NS 244 959	56°07.4'N 04°49.5'W	SpMeg
28	76	SW of Cnap Point, Loch Long (Clyde).	NS 239 959	56°07.4'N 04°50.0'W	LsacRS.Psa; ModHo
28	79	Carraig nan Ròn, Loch Long (Clyde).	NS 221 933	56°05.9'N 04°51.6'W	LsacRS.Psa; AmenCio; NeoPro
28	80	Mid-loch SW of Portincaple, Loch Long (Clyde).	NS 223 929	56°05.7'N 04°51.3'W	SpMeg
28	81	S of Rubha nan Eoin, Loch Long (Clyde).	NS 212 923	56°05.4'N 04°52.3'W	LsacRS.Psa; ModHAs; ModHo
28	82	Opposite Toll a' Bhuic, Loch Long (Clyde).	NS 221 918	56°05.1'N 04°51.5'W	Lsac.Ft; AmenCio; NeoPro; ModHo
28	84	SE of Knap Rock, Loch Long (Clyde).	NS 207 906	56°04.5'N 04°52.8'W	Lsac.Ft; LsacRS.Psa; AmenCio; ModHo
28	85	Finart Bay, Loch Long (Clyde).	NS 192 883	56°03.2'N 04°54.2'W	LsacX; ModHo; VirOph.HAs; Beg
28	87	Ravenrock Point, Loch Long (Clyde).	NS 191 862	56°02.0'N 04°54.2'W	LsacRS.Psa; LsacX; ModHo
28	89	NW of Knockderry Castle, Loch Long (Clyde).	NS 213 835	56°00.6'N 04°52.0'W	LsacX; ModHo
28	90	Blairmore, Loch Long (Clyde).	NS 198 822	55°59.9'N 04°53.3'W	AmenCio; NeoPro; ModHo

Compiled by: Frances Dipper

4 Holy Loch

Location		
Position (centre)	NS 174807	55° 59.1′ N 4° 55.2′ W
Administrative area	Argyll and Bute	
Conservation agency/area	Scottish Natural Heritage	West Areas (Argyll and Stirling)

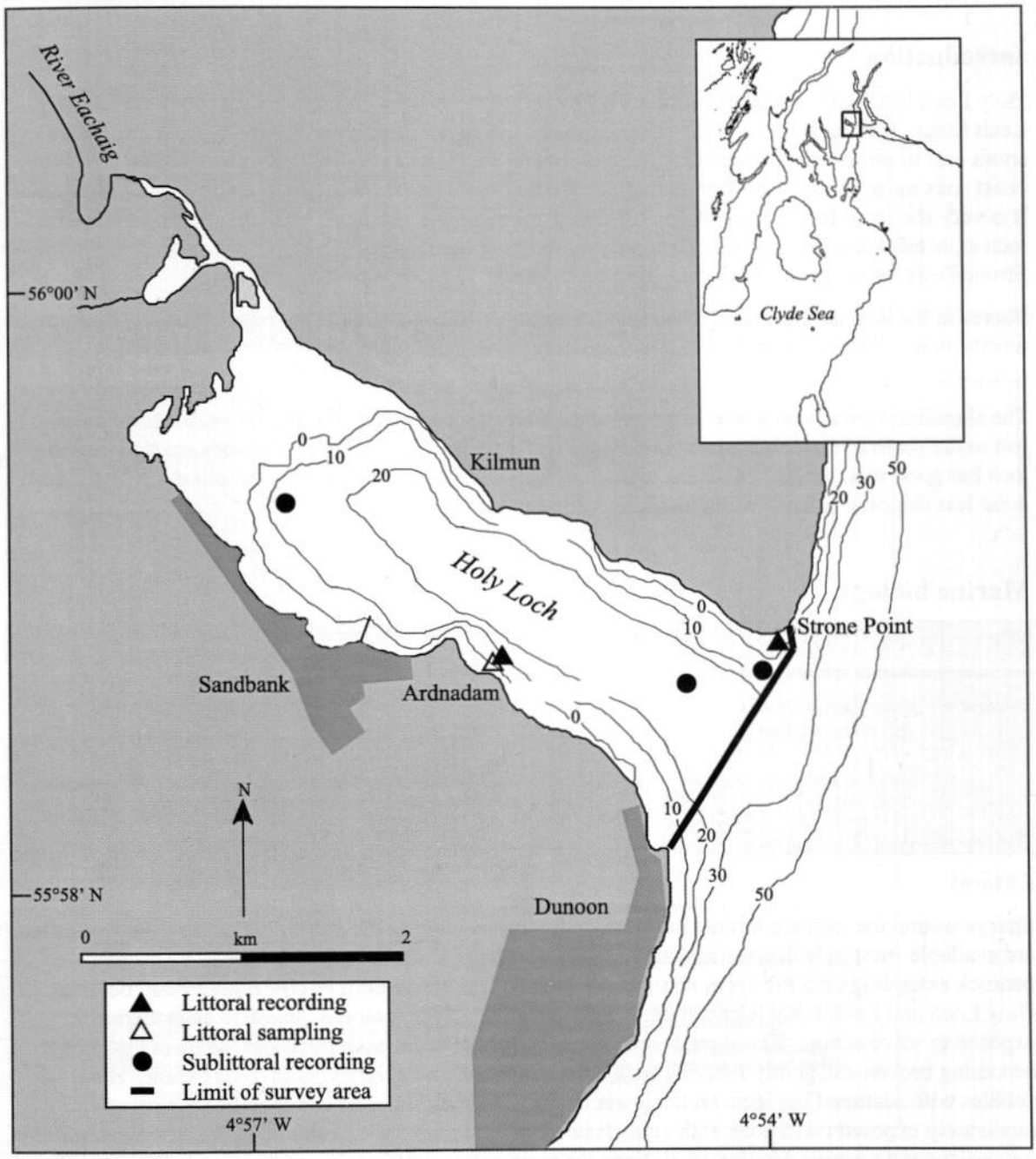


Figure 4.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Open sealoch
Length of coast	16 km
Length of inlet	3.9 km
Area of inlet	4.9 km^2
Bathymetry	Maximum depth 31 m
Wave exposure	Very sheltered
Tidal streams	Very weak
Tidal range	3.1 m (springs); 1.8 m (neaps)
Salinity	Marine but locally variable

Introduction

Holy Loch is a short, rectangular sealoch opening into the Firth of Clyde adjacent to the mouth of Loch Long. It is the shortest of the seven sealochs that in the northern Firth of Clyde, and runs in a south-east to north-west direction. The northern and south-western coasts are steep whilst the south coast rises more gently. The loch is shallow, mostly less than 20 m in depth, and is open with no sills. It is very sheltered from wave action and tidal streams are very weak. The River Eachaig enters the loch at its head and forms a wide river terrace. The northern side of the loch entrance is delimited by Strone Point where gannets can often be seen feeding.

Shores in the loch are limited in extent, with the exception of the area at the head of the loch and are mostly stony. The sublittoral area consists mainly of soft sediments with hard substrata mostly restricted to cobbles and pebbles on sediments.

The shoreline varies from steep and wooded to relatively low-lying. The tourist town of Dunoon lies just to the south of the entrance and the village of Sandbank lies on the loch's south coast. The entire loch has good road access. Since the closure in the early 1990s of the US Navy submarine base, there is far less shipping activity within the loch than previously.

Marine biology

Marine biological surveys				
	Survey methods	***No. of sites***	***Date(s) of survey***	***Source***
Littoral	Recording (epibiota)	1	September 1989	Holt & Davies (1991)
	Recording (epibiota)	1	September 1978	Paisley College of Technology (1979)
	Infaunal sampling (25x25 cm area sieved)	1	September 1978	Paisley College of Technology (1979)
Sublittoral	Recording (epibiota)	3	September 1989	Holt & Davies (1991)

Littoral

Shores around the loch are limited in extent with the exception of the area at the head of the loch. Data are available from only three sites, but it appears that most of the shoreline is backed by broken bedrock extending onto the upper shore and with a typical lichen flora (YG). Strone Point between Holy Loch and Loch Long is one of very few sites in the Clyde sealochs classified as moderately exposed to wave action. The shore here consists mainly of sedimentary bedrock, steep at the top but becoming broken and gently shelving on the middle shore, and giving way to loose pebbles and cobbles with scattered boulders on the lower shore. The rock supports communities typical of moderately exposed conditions with animals predominating on the mid-shore. Barnacles *Semibalanus balanoides* and mussels *Mytilus edulis* form the main cover, with patches of the wrack *Fucus vesiculosus* and abundant periwinkles *Littorina littorea* (FvesB). Algae on the lower shore include *Fucus serratus* and *Mastocarpus stellatus* (Fser.R). The shore at Ardnadam on the south side of the loch is narrow and in this respect is probably typical of this side of the loch. The horizontal extent of the shore is only about 30 m. Again sedimentary rocks, mainly white and red sandstone, are predominant on the upper and mid-shore sloping down to a lower shore of boulders and gravel. The

shore was described as 'poor' in terms of both algal cover and variety of animals by Paisley College of Technology (1979).

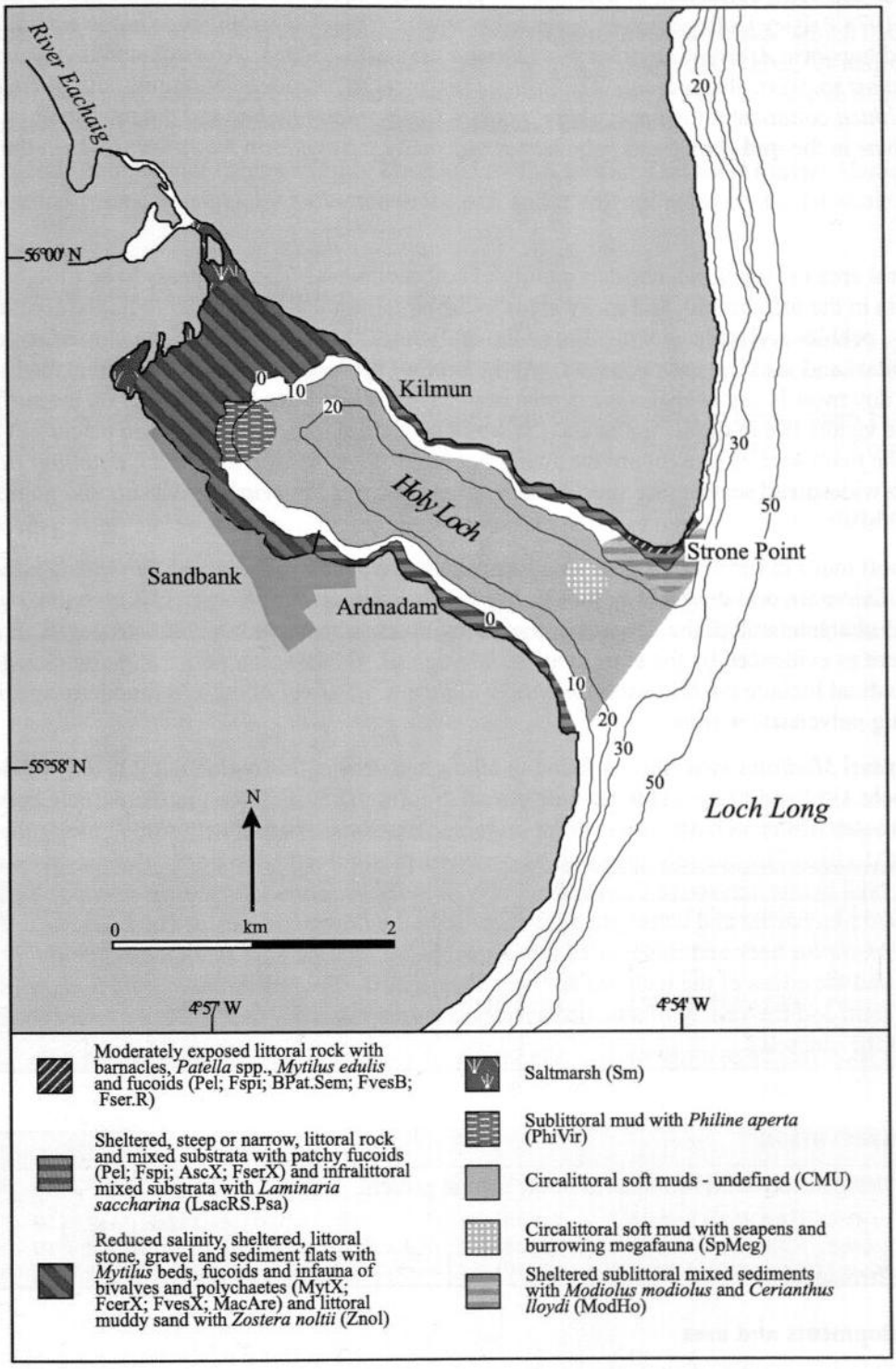


Figure 4.2 Indicative distribution of the main biotopes in the loch (based on data from survey sites shown in Figure 4.1, additional field observations and cited literature).

At the head of the loch there is an area of littoral sediment extending seaward for over half a kilometre. The shore is backed by a saltmarsh area where the Rivers Eachaig and Little Eachaig combine before flowing over the central region of the shore. The sediment is typical of that found at the heads of many Scottish sealochs, consisting of a mixture of gravel and sand, becoming muddier lower on the shore. The 1978 Paisley College survey recorded extensive mussel *M. edulis* beds in the central area and scattered lugworm *Arenicola marina* casts around the sandier edges. Areas of standing water with eelgrass *Zostera* sp. were also present. The infauna is typical of estuarine conditions with the tellin *Macoma balthica* common in the upper shore; cockles *Cerastoderma edule* and the mud snail *Hydrobia ulvae* in the mid-shore; and polychaetes especially the ragworm *Neanthes virens* in the lower shore.

Sublittoral

The sublittoral area in Holy Loch consists mainly of soft sediments. There appears to be little, if any, hard substrata in the infralittoral, and rocky areas in the circalittoral are restricted to mixed sediments with cobbles, pebbles and stone gravel. The sediment floor of the loch probably has only a limited range of habitats and is rather impoverished. At the head of the loch, sheltered soft mud extends from chart datum downwards and at shallower depths has a layer of leaf litter and branches on the surface. There is little visible life in the sediment and the white bacterium *Beggiatoa* occurs in patches in the shallows. The main species present are the anemones *Sagartiogeton laceratus* and *Cerianthus lloydii*, and common widespread scavenging species such as hermit crabs *Pagurus bernhardus* and gobies *Gobius* sp. (PhiVir).

The deeper soft muds in the centre of the loch form extensive plains with seapens *Virgularia mirabilis,* anemones *S. laceratus*, and the Norway lobster *Nephrops norvegicus* (SpMeg). This type of community is characteristic of the deeper parts of many Scottish sealochs but is not very well developed here as evidenced by the scarcity of *N. norvegicus*. Other species normally associated with this type of habitat include the brittlestar *Amphiura filiformis*, a variety of other echinoderm species and burrowing polychaete worms.

The horse mussel *Modiolus modiolus*, is found in all the sealochs in this region but it is only in Holy Loch and Lochs Goil and Long that it has been found to form extensive beds. In Holy Loch, beds occur in the mouth of the loch off Strone Point on mixed muddy sediments with stone gravel, shells and pebbles (ModHo).The mussels appear to be commonest at around 12 m depth, their abundance dropping off both below and above this depth. Cobbles in the shallows in this region support sparse kelp *Laminaria saccharina* and dense growths of the red alga *Phycodrys rubens* (LsacRS.Psa). The extent of the *Modiolus* beds and this type of mixed and rather species-poor muddy and pebbly sediment around the edges of the loch has not been ascertained. The horse mussels themselves provide a hard substratum and the variety of attached species is correspondingly increased compared to similar areas without the mussels.

Nature conservation

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

Human influences

Coastal developments and uses

The steep northern coast of the loch is largely forested and is included in the Forestry Commission's Argyll Forest Park. Sandbank, situated on the south coast, is a sailing and boat-building village. The sprawling town of Dunoon extends up around the south side of the entrance. Dunoon is one of the main centres for tourism in the area, and ferries run from here to Gourock. Fishing, birdwatching and diving excursions run from Dunoon into Holy Loch and other neighbouring lochs.

The River Eachaig enters the loch at its head and the extensive river terrace is quarried for sand and gravel at a relatively high rate, mainly at the higher levels.

Marine developments and uses

Until the early 1990s, Holy Loch supported the US Navy Polaris submarine base which had a huge floating dock. The base has since closed thus reducing shipping usage of the area. A major cleaning and restoration programme has been undertaken by the Ministry of Defence to remove debris from the floor of the loch, using barge-mounted electromagnets and grabs.

There is little commercial fishing in Holy Loch and no fish farms. The horse mussel *Modiolus modiolus* has been commercially harvested in the past and is still collected on a small scale.

References and further reading

Clyde River Purification Board. 1967. *The Holy Loch. A survey of parameters related to pollution control*. Unpublished, Clyde River Purification Board. (Estuary Section Report, No. 4.)

Holt, R., & Davies, L.M. 1991. Surveys of Scottish sealochs. Sealochs in the northern Firth of Clyde. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 1147.

McGeachie, E.A. 1976. *An investigation into the macrobenthos of the Holy Loch, Clyde estuary*. HND dissertation, Paisley College of Technology, Department of Biology.

Paisley College of Technology, Department of Biology. 1979. *A biological survey of seashores in the Clyde Sea Area - 1978-79*. Unpublished, Nature Conservancy Council, Scotland, South-west Region. (Internal report, No. NC 211 J.)

Sites surveyed

Survey 28: 1989 UMBSM sealochs in the northern Firth of Clyde survey (Holt & Davies 1991).
Survey 49: 1978-79 PCT Clyde Sea Area littoral survey (Paisley College of Technology 1979).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	95	Shore at Strone Point, Holy Loch.	NS 192 804	55°58.9'N 04°53.8'W	YG; Pel; Fspi; FvesB; Fser.R; Rkp; Cor
49	22	Near Ardnadam, Holy Loch.	NS 175 803	55°58.8'N 04°55.5'W	Pel; Fspi; AscX; FserX; LsacRS.Psa
49	62	Head of Holy Loch.	NS 157 817	55°59.5'N 04°57.3'W	PCer; MacAre

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	92	Head, Holy Loch.	NS 161 812	55°59.3'N 04°56.8'W	PhiVir
28	93	Mid-loch S of Strone Pier, Holy Loch.	NS 186 801	55°58.8'N 04°54.4'W	SpMeg
28	94	SW of Strone Point, Holy Loch.	NS 191 802	55°58.8'N 04°53.9'W	LsacRS.Psa; ModHo

Compiled by: Frances Dipper

5 Loch Striven, Loch Riddon and the Kyles of Bute

Location		
Position (centre)	NS 047723	55° 54.5′ N 5° 8.0′ W
Administrative area	Argyll and Bute	
Conservation agency/area	Scottish Natural Heritage	West Areas (Argyll and Stirling)

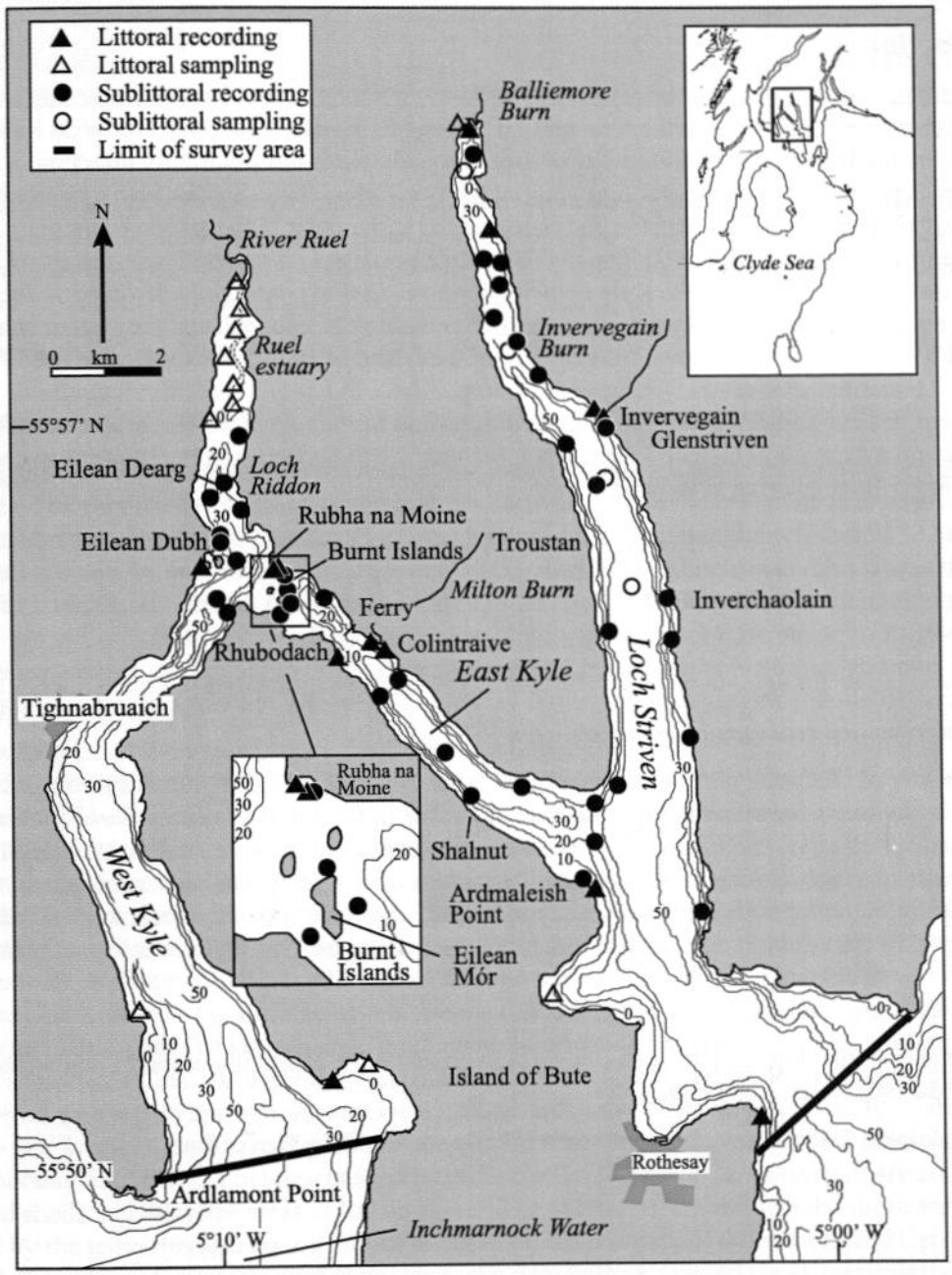


Figure 5.1 Main features of the area, showing sites surveyed.

Physical features	
Physiographic type	Fjordic sealochs with sounds
Length of coast	Striven 34 km; Riddon & Kyles 81 km
Length of inlet	Striven 12.9 km; Riddon 5.3 km
Area of inlet	Striven 12.8 km^2; Riddon 3.4 km^2
Bathymetry	Maximum depth: Striven 69 m; Riddon 44 m; Kyles 61 m
Wave exposure	Sheltered to very sheltered
Tidal streams	Very weak; strong in Burnt Island narrows in East Kyle
Tidal range	2.7 m (springs); 1.5 m (neaps)
Salinity	Marine; variable in upper Riddon

Introduction

Loch Riddon, Loch Striven and the Kyles of Bute form an interconnected system indenting the Cowal Peninsula between Loch Fyne to the west and Loch Long to the east. The East and West Kyles are separated by the Island of Bute and run in an approximately north-north-westerly direction. Loch Riddon runs northward from the meeting point of the two Kyles. Loch Striven also runs northward approximately parallel to Loch Riddon and is connected to the latter by East Kyle. There is a limited exchange of water between Loch Riddon and East Kyle because a string of islands, the Burnt Islands, runs across the northern end of the Kyle with only narrow, shallow passages a few metres deep between the islands. The East Kyle joins with Loch Striven at its entrance and the system enters the Firth of Clyde about half-way down the east side of the Island of Bute near Rothesay. The West Kyle opens into Inchmarnock Water adjacent to the entrance to Loch Fyne. It is difficult to classify this loch system in a cut-and-dried manner. Lochs Riddon and Striven are fjord-like sealochs with sills in the Kyles and a deep sill at the entrance to Loch Striven. Loch Riddon is quite estuarine in character, with the River Ruel entering at its head.

The Island of Bute and surrounding hills mean that Loch Riddon is very sheltered especially at its head, allowing the development of an extensive estuarine area, the Ruel estuary. Estuaries are generally rare on the west coast of Scotland and the Ruel estuary has a diverse and abundant fauna. It is an important stopover point for migratory birds which feed on the rich intertidal sediments. The extensive intertidal sediment areas backed by saltmarsh at the head of the estuary exhibit a classic but rarely-seen gradation from marine to terrestrial habitats. The estuary remains a prime example of an unpolluted estuarine ecosystem, and is notified a SSSI.

The remainder of the loch system is also sheltered from wave action. Tidal streams are in general weak but the water is funnelled through the narrows between the Burnt Islands in East Kyle, and here tidal stream speeds may reach 3 knots, especially in the main channel to the north of Eilean Mór. The shores around the loch system are rocky and rather uniform, consisting of bedrock, boulders, cobble and pebble, often with an admixture of muddy sediment. Apart from the Ruel estuary, sediment shores are restricted to the head of Loch Striven and small areas along the East Kyle. Sublittoral rock is present to at least 35 m depth often intermixed with sediment. The majority of the loch floor consists of mixed sediments and mud.

Much of the hinterland around the loch system is steep and hilly, especially around Loch Striven, and there are few coastal developments.

Common dolphin *Delphinus delphis* are sometimes spotted in the Kyles of Bute.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Date(s) of survey*	*Source*
Littoral	Recording (epibiota)	8	June 1989	Holt & Davies (1991)
	Recording (epibiota)	5	May & June 1978	Paisley College of Technology (1979)
	Infaunal sampling (cores along transects)	7	September 1982	McLusky & Hunter (1985)
	Infaunal sampling (25x25 cm area sieved)	5	April to October 1978	Paisley College of Technology (1979)
Sublittoral	Recording (epibiota)	38	June 1989	Holt & Davies (1991)
	Infaunal sampling (anchor dredge)	4	June 1989	Holt & Davies (1991)

Littoral

The littoral zone in Loch Striven and the Kyles of Bute is relatively small in extent as is the case with other steep-sided lochs such as Loch Long, in the Clyde Sea area. Loch Riddon, however, has the largest percentage of intertidal area of all the northern Clyde sealochs due to the extensive sediment shores associated with the Ruel estuary at the head of the loch.

Littoral sediments

Sediment shores are present at the head of Loch Riddon, the head of Loch Striven and along the East Kyle.

Loch Riddon. The River Ruel enters the head of the loch, draining a largely uninhabited moorland catchment. The very sheltered nature of the loch has allowed the river to construct an extensive estuarine area extending for approximately 2.6 km along the loch, with a width of about 800 m. In contrast, other sealochs in the area such as Loch Long, Loch Goil and Loch Fyne, have intertidal areas at their heads of only 100 to 200 m long. The estuary is backed in the upper reaches by saltmarsh (Sm).

Along the 2.5 km length of the estuary, there is a typical gradation from low salinity at the head to full salinity where it expands into the marine part of the loch; and from fine estuarine sediments to coarser marine sediments. In the upper estuary the freshwater influence is greatest and fine muddy sediments, largely originating from the river flow, predominate. These are extensively burrowed by polychaete worms (mainly *Hediste diversicolor*), and by the amphipod *Corophium volutator*, both typical estuarine species. Large numbers of mud snails *Hydrobia ulvae* feed on the bacterial and algal films present on the sediment surface. *Hydrobia* is common throughout most of the estuary, apart from the lower end. Towards the middle of the estuary, the sediment becomes less muddy but is still fairly fine. The intermediate salinities here are tolerated by a wider range of species and the biomass is high. One of the most obvious species is the lugworm *Arenicola marina* whose casts cover wide areas. Other polychaetes hidden below the surface include *Eteone flava*, *Nephtys hombergii*, *Scoloplos armiger* and *Capitella capitata*. The bivalves *Macoma balthica* and *Cerastoderma edule* are also common to abundant (MacAre, PCer). At the lower end of the estuary the littoral sediments are mainly coarse or medium sand with stones and cobbles and are much less extensive. The fauna is typically marine and similar to that found at the heads of other sealochs in the area. Dense mussel *Mytilus edulis* beds form a distinct community (MytX) binding the sediment, barnacles *Semibalanus balanoides* are common on stones and shells and there are areas of fucoid algae. The sediments lower down the shore are inhabited by the tellin *Angulus tenuis*, whose pretty butterfly-wing shells dot the sands (PCer). The stonier peripheral areas above the mid-shore level, are dominated by fucoid algae, particularly the knotted wrack *Ascophyllum nodosum*, for some distance up the estuary.

Loch Striven. The shore at the head of Loch Striven is similar to that of most other loch heads in the area such as Loch Goil and Loch Long. The intertidal extent is about 350 m and the central region is crossed by the Balliemore Burn. The area is one of mixed muddy sand with gravel and pebbles and sandy areas mainly around the edges and on the lower shore near the water. The shore is dominated

mainly by fucoid algae *Fucus* spp. and *M. edulis*. The extent and species of *Fucus* present depends on the height of the shore and the availability of stones and shells for attachment. In areas directly influenced by the freshwater streams, *Fucus ceranoides* is common along with the green alga *Enteromorpha intestinalis*, both of which are tolerant of brackish conditions (FserX). Dense *Fucus spiralis* (Fspi) covers the surface in the mid-shore, with *Fucus vesiculosus* covering large areas lower on the shore (FvesX).

In contrast to the Ruel estuary, the infauna of these sediments is relatively restricted in variety and does not have a very large biomass.

East Kyle. The shore to the south of Colintraive Point near the ferry terminal is a relatively extensive area of shingle and muddy sand bordering the Milton Burn. It is a wide, gently-sloping area, most of which is covered by fucoid algae and is similar to the shore at the head of Loch Striven. Pebbles and cobbles on the upper shore and on raised shingle ridges on the lower shore are densely-covered by *F. spiralis* (Fspi). Much of the mid-shore is muddy sand bound and stabilised by mussels *M. edulis* and with a dense cover of *F. vesiculosus* and *A. nodosum* (MytX). The dense fucoid cover continues down to the lower shore (AscX) but here there are also open areas of wet muddy sand with little algal cover. Here *C. edule* are common and there are scattered *A. marina* casts (PCer). The edges of the freshwater stream are bounded by dense growths of *F. ceranoides* and *E. intestinalis* (FcerX).

The only truly sandy shores in the loch system are found on the mainland to the east of Rubha na Moine which is in the vicinity of the Burnt Islands. Pocket beaches here have a lower shore of fine sand extending down into the sublittoral. The sand is burrowed by the heart urchin *Echinocardium cordatum* and *A. marina*, and is similar to the clean to slightly muddy sand sublittoral community found in many areas throughout the East Kyle (EcorEns).

Littoral rock

The majority of rocky shores throughout the loch system consist of mixtures of bedrock, boulders, cobbles and pebbles, dominated by fucoid algae. Steep rock is present at some sites including the east coast of Loch Striven and promontories in Loch Riddon and West Kyle. Extensive rocky shores are only found at the entrance to West Kyle; these are moderately exposed and support rich and varied growths of algae and animals.

Loch Striven. The rocky shoreline of Loch Striven is similar to that of Loch Long and Loch Goil. The shores are generally rather short in horizontal extent and mostly steep in the upper parts, backed by bedrock or boulders with lichens in the supralittoral zone (YG), and giving way to various proportions of bedrock, boulders, cobbles and pebbles. Where rivers and streams flow down into the loch, the shores are flatter with small boulders, cobbles and pebbles predominant. The shores are basically fucoid-dominated but the fucoid cover may be patchy and sparse. Only three rocky shores in this loch have been surveyed in detail, all on the east coast. However, the linear nature and sheltered conditions within the loch mean that rocky shore communities throughout the loch are likely to be relatively uniform. The shoreline just north of Invervegain is backed by steep, broken bedrock extending down to the mid-shore and giving way to flatter bedrock, boulders and gravel. The channelled wrack *Pelvetia canaliculata* and the black lichens *Verrucaria maura* and *Verrucaria mucosa* carpet the upper littoral fringe bedrock (Pel; Ver.Ver). Mid-shore steep bedrock is dominated by barnacles *Semibalanus balanoides* and limpets *Patella* sp. (BPat.Sem) with scattered fucoid algae and *Mastocarpus stellatus* at the lower levels. This type of community is often present in sheltered areas where the rock is too steep for dense growths of fucoids. The shore at Invervegain is influenced by the Invervegain Burn and is relatively flat, consisting mainly of cobbles and small boulders. These are dominated by patchy fucoid algae, barnacles especially on the tops of boulders, and the littorinids *Littorina saxatilis* and *Littorina littorea*.

East Kyle. Steep rocky shores are not a feature of the East Kyle. Shores examined along the rather linear east coast south of Colintraive mostly consist of cobbles, boulders, pebbles and gravel dominated by fucoid algae exhibiting the usual zonation. Boulder shores on the west coast at either end of the Kyle were identified by Paisley College of Technology (1979) as having a rich and diverse fauna especially at Ardmaleish Point. At these sites, the boulders overlie fine sand and in the damp

under and between boulder areas, support a variety of sessile animals mainly hydroids, ascidians, bryozoans including *Alcyonidium hirsutum* and mobile animals such as polychaetes, and the squat lobster *Galathea squamosa*. Fucoid algae overlie the boulders (FserX). The richness of this area was attributed to the tidal streams that run through the Kyle.

Loch Riddon and West Kyle. Steep rocky shores are present on the promontory that forms the southern side of the anchorage behind Eilean Dubh, at the junction of Loch Riddon and West Kyle. Paisley College of Technology (1979) recorded many essentially sublittoral species at this site including the sea urchin *Echinus esculentus*, the brittlestar *Ophiocomina nigra* and the ascidian *Ascidia* sp., indicating the sheltered nature of the area. In contrast, moderately exposed rocky shores are present at Ardlamont Point at the entrance to West Kyle (Area 6).

Sublittoral

Throughout the loch system there are no extensive rock slopes or large areas of uniform sediment. Instead, there are mixtures of bedrock, boulders, cobble and sediment slopes. Sublittoral rock in East Kyle is almost entirely restricted to the channels between the Burnt Islands. The sloping sides of the Kyle consist mainly of mixtures of pebbles, gravel and sediment and rock is often only found in the sublittoral fringe. In Loch Riddon, sublittoral rock is only present towards its junction with the Kyles, since the upper part comprises the sedimentary Ruel estuary. Short bedrock slopes may be interspersed with boulder slopes and pockets of sediment. Circalittoral bedrock is present at some sites to at least 30 m depth but generally as outcrops rather than unbroken rock slopes. Mixed rock and sediment slopes similar to those in Loch Riddon occur in Loch Striven. Sublittoral rock slopes of boulders, bedrock or a mixture of the two, are more extensive and are present in the upper loch to at least 17 m depth with bedrock outcrops to at least 36 m depth. The bedrock is often stepped with small cliffs.

Infralittoral rock

Infralittoral rock throughout the loch system is in general rather impoverished with heavy grazing by urchins, brittlestars and chitons resulting in only sparse growths of foliose algae. *Laminaria saccharina* is the only kelp present, except where there are strong tidal streams which encourage the growth of *Laminaria hyperborea*. Encrusting coralline algae are widespread along with robust animal species especially the keel worm *Pomatoceros triqueter*.

East Kyle. One of the most interesting and diverse shallow sublittoral areas is that around the Burnt Islands at the north end of East Kyle. Here the narrow, shallow channels between the islands experience considerable tidal flow of up to 3 knots. This encourages the growth of filter-feeding animals and also allows the development of a *L. hyperborea* kelp forest (Lhyp.TFt). This species will only grow in sheltered conditions if there is sufficient water movement in the form of tidal flow. *L. hyperborea* is present on the bedrock and boulder sides of the channels and on the floor where there is a sufficiently stable hard substratum. The undergrowth in the kelp forest is a mixture of foliose algae and filter-feeding animals especially dead man's fingers *Alcyonium digitatum*, plumose anemones *Metridium senile*, and scattered hydroids especially *Tubularia larynx*. Due to grazing pressure from the urchins *Psammechinus miliaris* and *Echinus esculentus*, much of the horizontal rock is covered extensively by encrusting calcareous algae. Where urchins are less common, foliose algae especially *Phycodrys rubens, Delesseria sanguinea* and *Membranoptera alata*, grow well especially on the kelp stipes. Small vertical surfaces are animal-dominated with the above species plus the anemone *Sagartia elegans* and some sponges such as *Myxilla incrustans*. In the lower infralittoral there are few algae and the above species of animals predominate along with brittlestars *Ophiocomina nigra* and *Ophiothrix fragilis*. Areas of cobbles and pebbles form the floor of the shallow channels and are heavily encrusted with the pink, knobbly growths of the encrusting alga *Lithothamnion glaciale* (Lgla). Brittlestars *O. fragilis* and *O. nigra* are common and sediment between the cobbles is colonised by the burrowing anemone *Cerianthus lloydii*. In the south channel, where there is a fast current, there is a dense brittlestar bed of *O. fragilis* (Oph). Other species, able to survive on larger cobbles and rocks, include the anemones *Urticina eques* and *Sagartia elegans* var. *miniata*, and *A. digitatum*.

Loch Riddon. At all sites where infralittoral rock is present, it is characterised by a rather species-poor kelp forest of *L. saccharina*. Algal species diversity is low due to grazing pressure from sea urchins, especially *P. miliaris*, and brittlestars, especially *O. nigra*, both of which are common. So only robust species such as *P. triqueter*, the ascidian *Ascidia mentula* and encrusting coralline algae are common as an understorey (LsacRS.Psa).

Loch Striven. A well-developed *L. saccharina* kelp forest is present on the more extensive infralittoral boulder and bedrock slopes present in Loch Striven to around 6 m depth. The large brown algae *Chorda filum* and *Desmarestia viridis* are also common, along with the foliose red alga *Phycodrys rubens*. All these species are typical of silty sheltered kelp forests (LsacRS.Psa). Vertical rock faces in the infralittoral support *A. digitatum, A. mentula, P. triqueter* and the barnacle *Balanus balanus* is also common. On small boulder and cobble slopes, *L. saccharina* may be sparse and extend to only 2 or 3 m depth. As is common throughout the rest of this loch system, the rock surfaces are often heavily grazed mainly by *P. miliaris*. The latter is especially common on slopes of small boulders, cobbles and pebbles with the result that the rocks are heavily encrusted with *L. glaciale* and *P. triqueter*. *Modiolus modiolus* is often common between the rocks in these situations. *L. hyperborea* is occasionally present, mixed in with the *L. saccharina* on rock slopes in the lower end of the loch.

Circalittoral rock

Short bedrock walls and cliffs are present in Loch Riddon and Loch Striven, often as outcrops near the bottom of mixed sediment and rock slopes. East Kyle has little if any circalittoral rock.

Loch Striven. Steep and vertical circalittoral rock in the form of short bedrock walls and cliffs is present at sites on both sides of the upper part of the loch. There are no extensive unbroken bedrock walls from the littoral or infralittoral through to the circalittoral. Instead, bedrock cliffs and plateaux tend to occur as part of complex mixed slopes of rock and sediment. Deep bedrock slopes and outcrops below about 25 m depth are very silty and covered in anemones *Protanthea simplex*, tubeworms *Sabella pavonina*, brachiopods *Neocrania anomala* and ascidians *Ciona intestinalis*, a distinctive community typical of these conditions (NeoPro). This community is also present in Lochs Goil, Long and Fyne in the Clyde Sea area and in deep fjordic sealochs in north-west Scotland and Scandinavia. On the east coast of upper Loch Striven, such bedrock outcrops occur from around 25 to beyond 35 m depth and as submerged rock pinnacles such as the one north of Troustan about half-way up the loch. The proportions of these four main species present varies from site to site but the community is most easily recognised when large numbers of *P. simplex* are present, decorating the rock surfaces with their long white tentacles.

Steep circalittoral rock at shallower depths between about 10 to 20 m, may have elements of this community but tends to be dominated by encrusting algae with scattered *A. digitatum*, *M. senile*, ascidians *Ascidiella aspersa*, barnacles *Balanus crenatus* and robust sponges resistant to grazing (AmenCio). At some sites, brittlestars are common, with *Ophiopholis aculeata* in crevices and *Ophiura albida* on the open rock surfaces.

Loch Riddon. Rock at depths is only present in the seaward half of Loch Riddon near the junction with the Kyles, since the upper half forms the sediment-filled Ruel estuary. Deep, steep rock occurs as stepped cliffs and rocky outcrops, interspersed with sediment slope between about 20 to 30 m depth, for example on the west side of Eilean Dearg. The deep circalittoral communities at this site and others in the vicinity, are very similar to those in Loch Striven with *P. simplex* (NeoPro) present in varying abundance.

Sublittoral sediment

Sublittoral sediments throughout this loch system are predominantly mixed and difficult to define. Sediment and rock are widely intermixed in the slopes around the edges of the lochs. The totally sheltered nature of the system means that there is no gradation in sediment types along the length of the lochs that can be attributed to wave action. There is, however, a gradual increase in muddiness with depth and the deepest areas are of soft mud. Tidal streams through the East Kyle result in cleaner sediments in this area.

East Kyle. The moderate tidal streams running through the East Kyle from the Burnt Islands to lower Loch Striven, prevent the accumulation of fine sediments and this is the only area in the loch system where clean sandy sediments are found. On both sides of the East Kyle there are slopes of fine sand and fine muddy sand extending from the lower shore to around 15 to 20 m depth. The sand is characterised by the heart urchin *Echinocardium cordatum* and the burrowing synaptid sea cucumber *Labidoplax digitata* (EcorEns). Bivalve molluscs including razor shells *Ensis* sp. and *Mya truncata* may also be present, and other bivalves are also common, especially in the muddier sand found in slightly deeper water away from the narrows towards the southern end of the Kyle. At some sites the sand is mounded up by terebellid worms. The anemone *Actinia fragacea* was recorded by the 1989 MNCR survey at Shalunt. This species is generally regarded as having a southern distribution in the British Isles but has also been recorded from Loch Fyne. Good examples of this clean sand biotope (EcorEns) are also found in the lower parts of Loch Striven as far north as Invercholain Church. These sandy sediments become increasingly muddy with depth but the maximum depth in East Kyle is only 36 m and so there are no extensive areas of deep burrowed mud. *Nephrops*-burrowed mud is present in the deep central parts of East Kyle but better examples of this biotope are found in Loch Riddon.

Loch Riddon. The deeper areas below about 25 m depth, around the mouth of Loch Riddon where it joins the Kyles, are floored by soft mud burrowed by the Norway lobster *Nephrops norvegicus* and other crustaceans (SpMeg) as well as the burrowing urchin *Brissopsis lyrifera*. Seapens *Virgularia mirabilis* are also conspicuous and common in this habitat. This area provides one of the best examples of well-burrowed mud in the Clyde sealochs. These deep muds extend south into West Kyle. Various other grades of muddy and mixed sediments characterise the rest of the loch, often with shells, stones and cobbles, similar to those described below for Loch Striven. The burrowing holothurian *Psolus phantapus* was recorded in large numbers from both Loch Riddon and Loch Striven in May 1989. When its tentacles are extended out over the sediment, it makes a bright splash of pink colour against the muddy sediment and is not easily overlooked. It is therefore surprising that this and other dendrochirotid holothurians were not recorded in Lochs Goil, Long, Holy Loch and Gareloch in very similar habitat conditions. However, the surveys of these lochs were made in September when the holothurians may already have stopped feeding for the winter and retracted beneath the sediment surface.

Loch Striven. Sediments in Loch Striven are similar to those described above for Loch Riddon. Good examples of mud extensively burrowed by *N. norvegicus* are present below about 35 m depth, to the south of the junction between East Kyle and Loch Striven. Mud in the deep central parts of the upper loch and the head of the loch is soft and cohesive and supports similar communities but apparently less *N. norvegicus* (SpMeg). Dredge samples from around 60 m along the central line of the outer half of the loch are of various grades including soft burrowed mud as well as mud with gravel, clinker and shells, emphasising the mixed nature of the sediments in this loch system. These mixed sediments are predominant in the loch, both as slopes around the edges and further out into the loch. They support a variety of widely-distributed species but are essentially rather impoverished. Common species include the burrowing anemone *Cerianthus lloydii*, *V. mirabilis*, holothurians including *Psolus phantapus* and the brittlestars *Ophiura ophiura* and *O. albida* (ModHo). The horse mussel *Modiolus modiolus* is also present throughout the loch system but not in extensive beds as are found in Lochs Goil, Long and Holy Loch. Where the sediment is mixed in with stones, shells and boulders, hard surfaces may be dominated by ascidians such as *A. aspersa* and *Corella parallelogramma*. In the upper part of the loch, the entire slope from the sublittoral fringe downwards may be composed of a scree of pebbles and sandy mud with *M. modiolus* (ModHo), sometimes with deep bedrock outcrops at the bottom of the slope, or the slope may be more gradual with muddy sand predominant and boulders and cobble mainly in the shallows. Clean sand and muddy fine sand slopes with communities similar to those predominating in East Kyle, occur along both coasts of the outer part of Loch Striven (EcorEns).

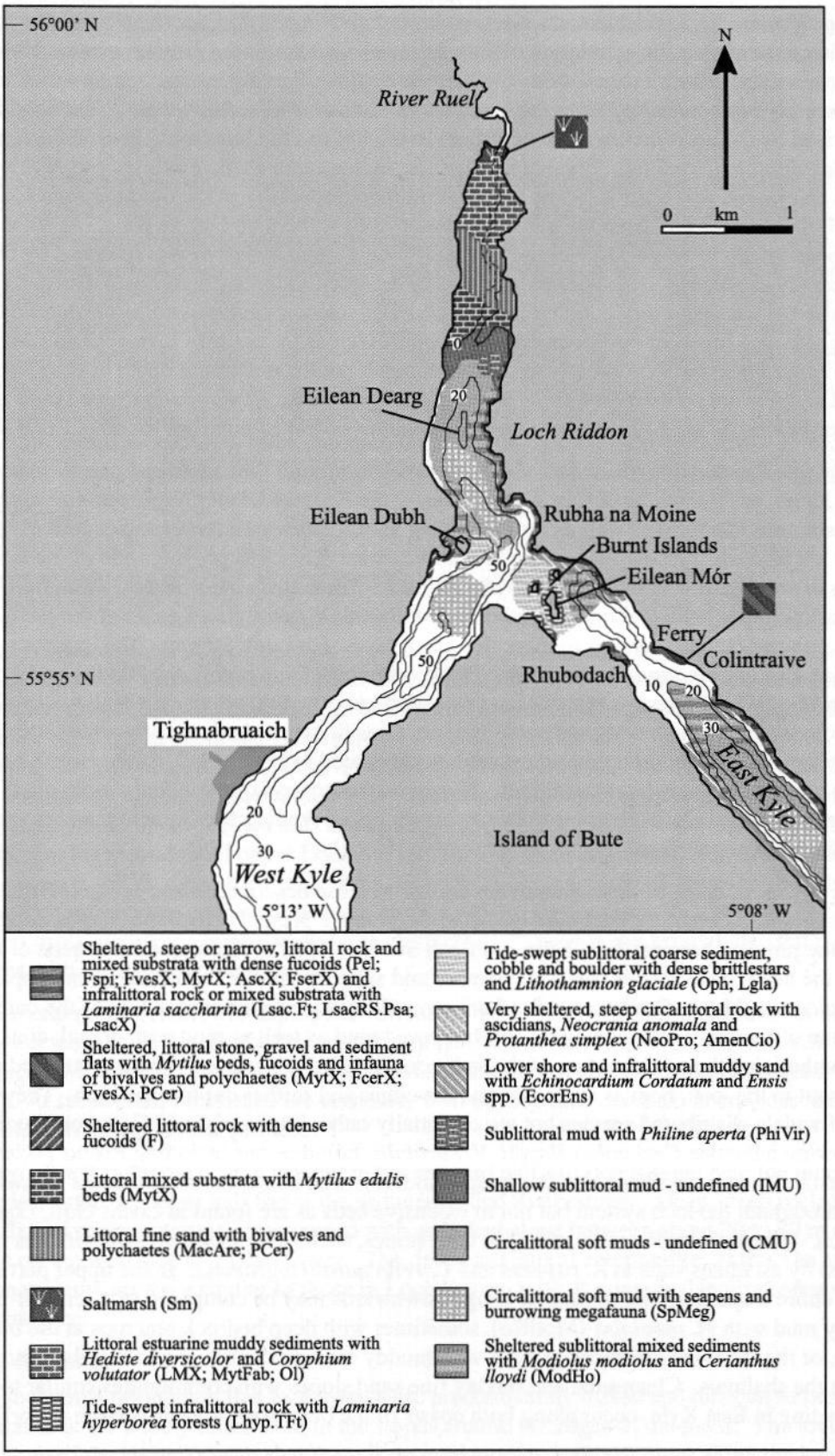


Figure 5.2 Indicative distribution of the main biotopes in Loch Riddon and the Kyles of Bute (based on data from survey sites shown in Figure 5.1, additional field observations and cited literature).

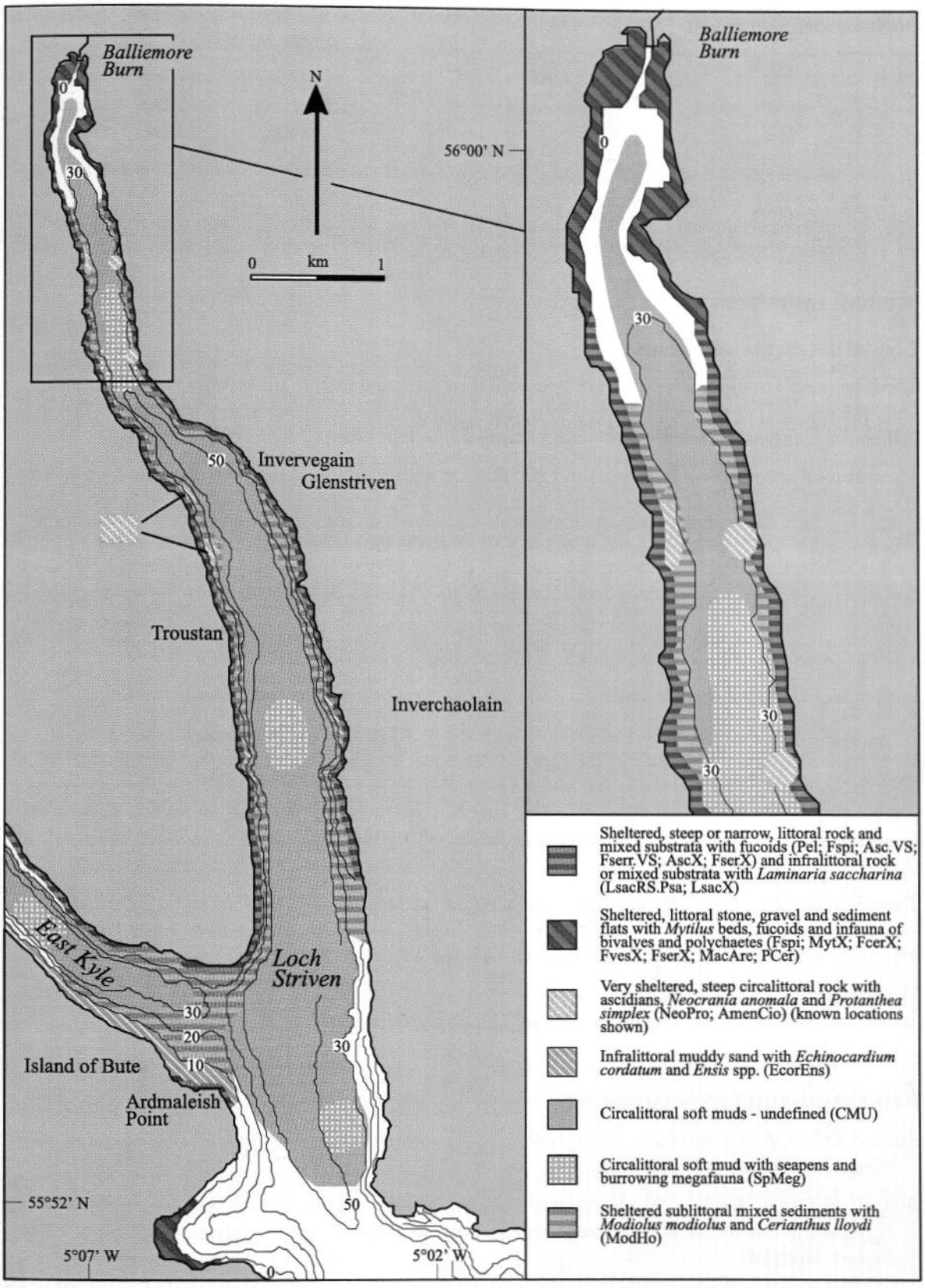


Figure 5.3 Indicative distribution of the main biotopes in Loch Striven (based on data from survey sites shown in Figure 5.1, additional field observations and cited literature).

Nature conservation

Conservation sites

Site name	*Status*	*Main features*
North end of Bute	SSSI	Botanical and ornithological
Ruel estuary	SSSI; NCR	Plants, wading birds, sand/mudflats, saltmarsh
Kyles of Bute	NSA	Loch Riddon and the Kyles of Bute fall within a National Scenic Area
Bute and South Cowal	RSA	Loch Striven, Loch Riddon and the Kyles of Bute fall within a Regional Scenic Area

Human influences

Coastal developments and uses

The hinterland around Loch Striven is steep and hilly and used mainly for forestry and hill farming. Only the east side of the loch is served by a road which extends as far north as Glenstriven. The loch is therefore fairly remote with only small villages on the east coast.

There is road access along both sides of Loch Riddon with excellent viewpoints over the loch and the Kyles but there are few facilities and therefore little impact from tourism.

The East Kyle is crossed at its narrowest point in the north by a busy car ferry service which runs from Colintraive to Rhubodach on the Island of Bute. The small town of Rothesay on the Isle of Bute lies a few miles south of the junction between the East Kyle and Loch Striven, where the Kyle enters the Firth of Clyde.

There is a chalet and caravan complex at Tighnabruaich on the West Kyle.

Marine developments and uses

At the time of the MNCR 1989 survey there was one shellfish and one trout farm on the west side of Loch Riddon; two salmon farms in the Kyles of Bute just south of Eilean Mór; three shellfish farms in Loch Striven and one at the south end of the East Kyle. There is very little fishing of demersal or pelagic fish stocks in this loch system. There may be some trawling and creeling for Norway lobster *Nephrops norvegicus*. All the lochs are designated shellfisheries under the EC Shellfish Waters Directive.

There is very little boat traffic in Loch Striven, mainly connected with the fish farms and the naval fuel jetty. The loch was used as a wartime midget submarine training area. Loch Striven has been used for long-term mooring of redundant supertankers since the 1970s.

There is a small pier near the head of Loch Riddon and a small enclosed anchorage at Eilean Dubh on the west side of its mouth. Tighnabruaich is a popular yachting centre and anchorage.

References and further reading

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

Holt, R., & Davies, L.M. 1991. Surveys of Scottish sealochs. Sealochs in the northern Firth of Clyde. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 1147.

Hunter, R. 1983. *An investigation into the distribution of the macrobenthos of Loch Riddon with a supplementary study on the physico-chemical factors influencing the distribution of the oribiniid polychaete,* Scoloplos armiger. B.Sc. dissertation, University of Stirling, Department of Biology.

Marshall, S.M., & Orr, A.P. 1930. A study of the spring diatom increase in Loch Striven. *Journal of the Marine Biological Association of the United Kingdom, 16*: 853-878.

McLusky, D., & Hunter, R. 1985. Loch Riddon revisited - the intertidal of the sea-loch resurveyed after 53 years. *Glasgow Naturalist, 21*: 53-62.

Paisley College of Technology, Department of Biology. 1979. *A biological survey of seashores in the Clyde Sea Area - 1978-79*. Unpublished, Nature Conservancy Council, Scotland, South-west Region. (Internal report, No. NC 211 J.)

Tett, P., Gowen, R., Grantham, B., Jones, K., & Miller, B.S. 1986. The phytoplankton ecology of the Firth of Clyde sealochs Striven and Fyne. *In: The environment of the estuary and Firth of Clyde*, ed. by J.A. Allen, P.R.O. Barnett, J.M. Boyd, R.C. Kirkwood, D.W. Mackay & J.C. Smyth, *Proceedings of the Royal Society of Edinburgh. Series B: Biological Sciences, 90*: 223-238.

Sites surveyed

Survey 28: 1989 UMBSM sealochs in the northern Firth of Clyde survey (Holt & Davies 1991).
Survey 49: 1978-79 PCT Clyde Sea Area littoral survey (Paisley College of Technology 1979).
Survey 264: 1982 University of Stirling Loch Riddon (Ruel estuary) littoral survey (McLusky & Hunter 1985).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	10	Shore W of bay by Rubha na Moine, East Kyle of Bute.	NS 016 756	55°55.9'N 05°10.5'W	Pel; Fspi; AscX
28	12	Shore E of bay by Rubha na Moine, East Kyle of Bute.	NS 016 756	55°55.9'N 05°10.5'W	AscX; EcorEns
28	17	Shore SE of Colintraive Point, East Kyle of Bute.	NS 034 742	55°55.2'N 05°08.8'W	Fspi; FvesX; FcerX; MytX; PCer
28	18	Shore below Milton Wood, East Kyle of Bute.	NS 036 741	55°55.2'N 05°08.6'W	Pel; FvesX; FserX
28	38	Shore at Invervegain, Loch Striven.	NS 077 783	55°57.6'N 05°04.7'W	YG; Pel; Fspi; AscX
28	39	NW of Invervegain, Loch Striven.	NS 076 785	55°57.7'N 05°04.9'W	YG; Ver.Ver; Pel; Fspi; BPat.Sem; FserX
28	46	Shore W of Cnoc Madaidh, Loch Striven.	NS 057 818	55°59.3'N 05°06.9'W	YG; Ver.Ver; Pra; Pel; Fspi; Asc.VS; Fserr.VS
28	50	Shore at head, Loch Striven.	NS 053 837	56°00.4'N 05°07.3'W	Fspi; FvesX; FcerX; MacAre; LMX
49	14	Eilean Dubh Light, West Kyle of Bute.	NS 003 757	55°55.9'N 05°11.8'W	F
49	15	Rhubodach, Bute (East Kyle).	NS 028 740	55°55.1'N 05°09.3'W	FX
49	16	Ardmaleish Point, Bute (East Kyle).	NS 075 697	55°52.9'N 05°04.6'W	FvesX; FserX
49	17	Bogany Point, Bute (East Kyle).	NS 105 655	55°50.7'N 05°01.6'W	Pel; Fspi; Asc.Asc; Fser.Fser; Ldig.Ldig
49	21	Kildavanan Point, Bute (West Kyle)	NS 026 660	55°50.8'N 05°09.2'W	Pel; Fspi; Asc.Asc; Fser.Fser; Ldig.Ldig
49	58	Carry Point, West Kyle of Bute.	NR 991 673	55°51.4'N 05°12.6'W	AP.P; PCer
49	59	Ruel Estuary, Loch Riddon.	NS 006 784	55°57.4'N 05°11.6'W	AP.P; PCer; MacAre
49	60	Head, Loch Striven.	NS 053 837	56°00.4'N 05°07.3'W	Pcer; MacAre
49	83	Ettrick Bay, Bute.	NS 036 663	55°50.9'N 05°08.2'W	AP.P; AP.Pon
49	84	Kames Bay, Bute.	NS 068 677	55°51.8'N 05°05.2'W	AP.P
264	1	Loch-head, Loch Riddon.	NS 010 810	55°58.8'N 05°11.4'W	LMX; MytFab
264	2	E of Torr Buidhe, Loch Riddon.	NS 010 804	55°58.5'N 05°11.3'W	MytX; Ol; LMS; NVC SM8; LMX; MytFab
264	3	NE of Shellfield, Loch Riddon.	NS 009 800	55°58.3'N 05°11.4'W	MacAre; HedMac, LMX
264	4	SW of Ardachuple Farm, Loch Riddon.	NS 008 795	55°58.0'N 05°11.5'W	MacAre; MytFab
264	5	SW of Springfield, Loch Riddon.	NS 009 790	55°57.7'N 05°11.4'W	MytX; PCer; LMX; MytFab
264	6	W of Salthouse, Loch Riddon.	NS 009 787	55°57.6'N 05°11.4'W	MacAre; MytX
264	7	S of Craig Cottage, Loch Riddon.	NS 004 783	55°57.3'N 05°11.8'W	MytX

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	1	Opposite Craig Lodge, Loch Riddon.	NS 010 780	55°57.2'N 05°11.2'W	LsacRS.Psa; PhiVir
28	2	W of Eilean Dearg, Loch Riddon.	NS 007 771	55°56.7'N 05°11.5'W	LsacRS.Psa; NeoPro; ModHo
28	3	Mid-loch, NE of Glen Caladh Farm, Loch Riddon.	NS 005 769	55°56.6'N 05°11.7'W	SpMeg
28	4	W of Cnoc na Fearn'ach, Loch Riddon.	NS 010 766	55°56.5'N 05°11.1'W	LsacRS.Psa; Oph; ModHo
28	5	Headland N of Caladh Harbour, Loch Riddon.	NS 006 761	55°56.2'N 05°11.5'W	NeoPro; VirOph; SpMeg
28	6	Reef E of Eilean Dubh, Loch Riddon.	NS 009 757	55°56.0'N 05°11.2'W	NeoPro; Oph
28	7	S of Rubh na Croiche, Loch Riddon.	NS 006 762	55°56.2'N 05°11.5'W	LsacRS.Psa; ModHo; SpMeg
28	8	WNW of Buttock Point, West Kyle of Bute.	NS 006 751	55°55.6'N 05°11.5'W	SpMeg
28	9	SW of Buttock Point, West Kyle of Bute.	NS 008 748	55°55.5'N 05°11.3'W	LsacRS.Psa; ModHo
28	11	Rubha na Moine, East Kyle of Bute.	NS 017 756	55°55.9'N 05°10.4'W	?Oph; Lgla; ModHo
28	13	N channel Burnt Islands, East Kyle of Bute.	NS 018 752	55°55.7'N 05°10.3'W	Lhyp.TFt; Lgla
28	14	S channel, Burnt Islands, East Kyle of Bute.	NS 016 748	55°55.5'N 05°10.5'W	Lhyp.TFt; Oph; Lgla
28	15	E of Eilean Mór, Burnt Islands, East Kyle of Bute.	NS 020 750	55°55.6'N 05°10.1'W	Oph; ModHo
28	16	S of Dundarrach, East Kyle of Bute.	NS 025 751	55°55.7'N 05°09.7'W	LsacX; EcorEns
28	19	Altgaltraig Point, East Kyle of Bute.	NS 039 736	55°54.9'N 05°08.3'W	LsacRS.Psa; EcorEns; ModHo
28	20	N of Douglas Rock, East Kyle of Bute.	NS 035 731	55°54.6'N 05°08.6'W	EcorEns
28	21	Mid-channel, NW of Bargehouse Point, East Kyle of Bute.	NS 048 722	55°54.2'N 05°07.3'W	SpMeg
28	22	Shalunt, East Kyle of Bute.	NS 052 713	55°53.7'N 05°06.9'W	EcorEns
28	23	S of South Hall Farm, East Kyle of Bute.	NS 062 715	55°53.8'N 05°05.9'W	ModHo
28	24	NW of Ardmaleish Point, East Kyle of Bute.	NS 072 698	55°53.0'N 05°04.9'W	LsacX; EcorEns
28	25	Between Strone Point and Ardmaleish Point, East Kyle of Bute.	NS 075 706	55°53.4'N 05°04.7'W	ModHo
28	26	SW of Strone Point, East Kyle of Bute.	NS 075 713	55°53.7'N 05°04.7'W	LsacRS.Psa; ModHo
28	27	E side of Stone Point, Loch Striven.	NS 078 715	55°53.9'N 05°04.4'W	LsacRS.Psa; ModHo
28	28	N of Ardyne Point, Loch Striven.	NS 094 693	55°52.7'N 05°02.7'W	SpMeg
28	29	NW of Kilmarnock, Loch Striven.	NS 093 724	55°54.4'N 05°03.0'W	ModHo
28	30	N of Brackley Point, Loch Striven.	NS 090 742	55°55.4'N 05°03.3'W	LsacRS.Psa; ModHo
28	31	Mid-loch, W of Inverchaolain, Loch Striven.	NS 082 752	55°55.9'N 05°04.1'W	SpMeg
28	32	N of Couston, Loch Striven.	NS 078 744	55°55.4'N 05°04.5'W	LsacRS.Psa; EcorEns; ModHo
28	33	Spit below Inverchaolain Church, Loch Striven.	NS 089 750	55°55.8'N 05°03.5'W	LsacRS.Psa; EcorEns; ModHo
28	34	Pinnacle N of Troustan, Loch Striven.	NS 075 771	55°56.9'N 05°04.9'W	NeoPro
28	35	Mid-loch E of King's Landing, Loch Striven.	NS 077 773	55°57.0'N 05°04.8'W	ModHo
28	36	NE of Ardbeg Hill, Loch Striven.	NS 070 780	55°57.3'N 05°05.5'W	AmenCio; ModHo
28	37	SW of Invervegain, Loch Striven.	NS 077 781	55°57.4'N 05°04.7'W	LsacRS.Psa; ModHo
28	40	0.5 km NW of the Craig, Loch Striven.	NS 064 793	55°58.0'N 05°06.0'W	LsacRS.Psa; ModHo
28	41	Mid-loch, NW of the Craig, Loch Striven.	NS 060 796	55°58.2'N 05°06.5'W	SpMeg
28	42	S of Allt na Fearna, Loch Striven.	NS 061 798	55°58.3'N 05°06.3'W	LsacRS.Psa; NeoPro; ModHo
28	43	NNE of Ardbeg Point, Loch Striven.	NS 056 802	55°58.5'N 05°06.8'W	ModHo
28	44	Mid-channel opp. Allt nan Tiadhan, Loch Striven.	NS 058 808	55°58.9'N 05°06.7'W	SpMeg
28	45	Point N of Allt nan Tiadhan, Loch Striven.	NS 059 812	55°59.0'N 05°06.6'W	LsacRS.Psa; NeoPro; FaV; ModHo
28	47	Point opp. Allt nan Tiadhan, Loch Striven.	NS 056 813	55°59.1'N 05°07.0'W	LsacRS.Psa; AmenCio; ModHo

Sublittoral sites continued

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
28	48	Head, Loch Striven.	NS 052 829	56°00.0'N 05°07.4'W	SpMeg
28	49	Near head, Loch Striven.	NS 053 832	56°00.1'N 05°07.3'W	SpMeg

Compiled by: Frances Dipper

6 Loch Fyne

Location		
Position	NR 880 800	55°58' N 05°24' W
Administrative area	Argyll and Bute	
Conservation agency/area	Scottish Natural Heritage	West Areas (Argyll and Stirling)

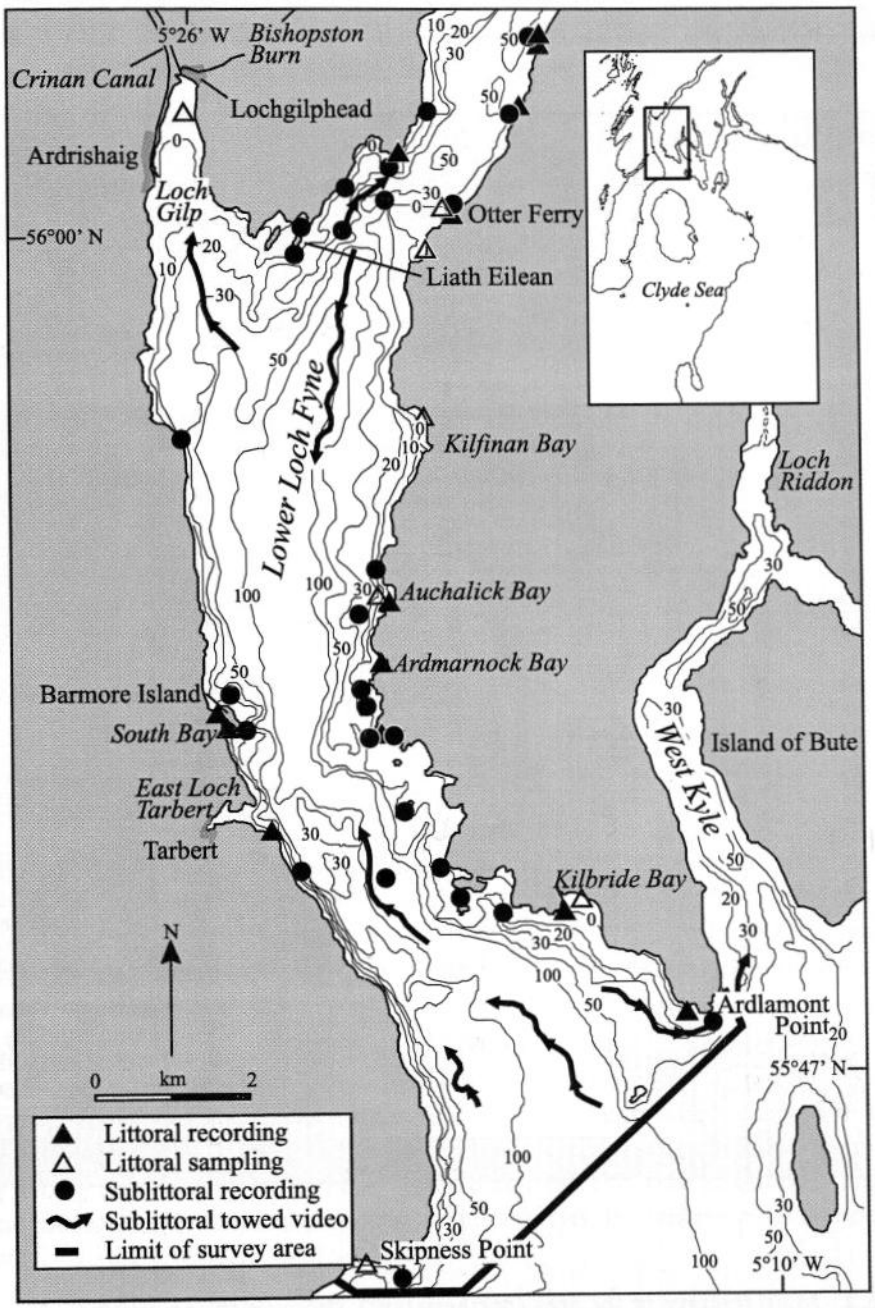


Figure 6.1 Main features of the area (southern part), showing sites surveyed.

Physical features	
Physiographic type	Fjordic sealoch with two sills
Length of coast	173 km
Length of inlet	70 km
Area of inlet	184 km^2
Bathymetry	Maximum depth 185 m
Wave exposure	Very sheltered to extremely sheltered in the upper loch north of Furnace and in Loch Gair; moderately exposed to sheltered in the lower loch and Loch Gilp.
Tidal streams	Very weak to weak except at Otter Ferry and 2 km to the north and south where tidal streams are moderately strong
Tidal range	3.2 m (springs); 2.0 m (neaps)
Salinity	Variable salinity to the north of Newton Bay and at the head of Loch Gilp; otherwise fully marine

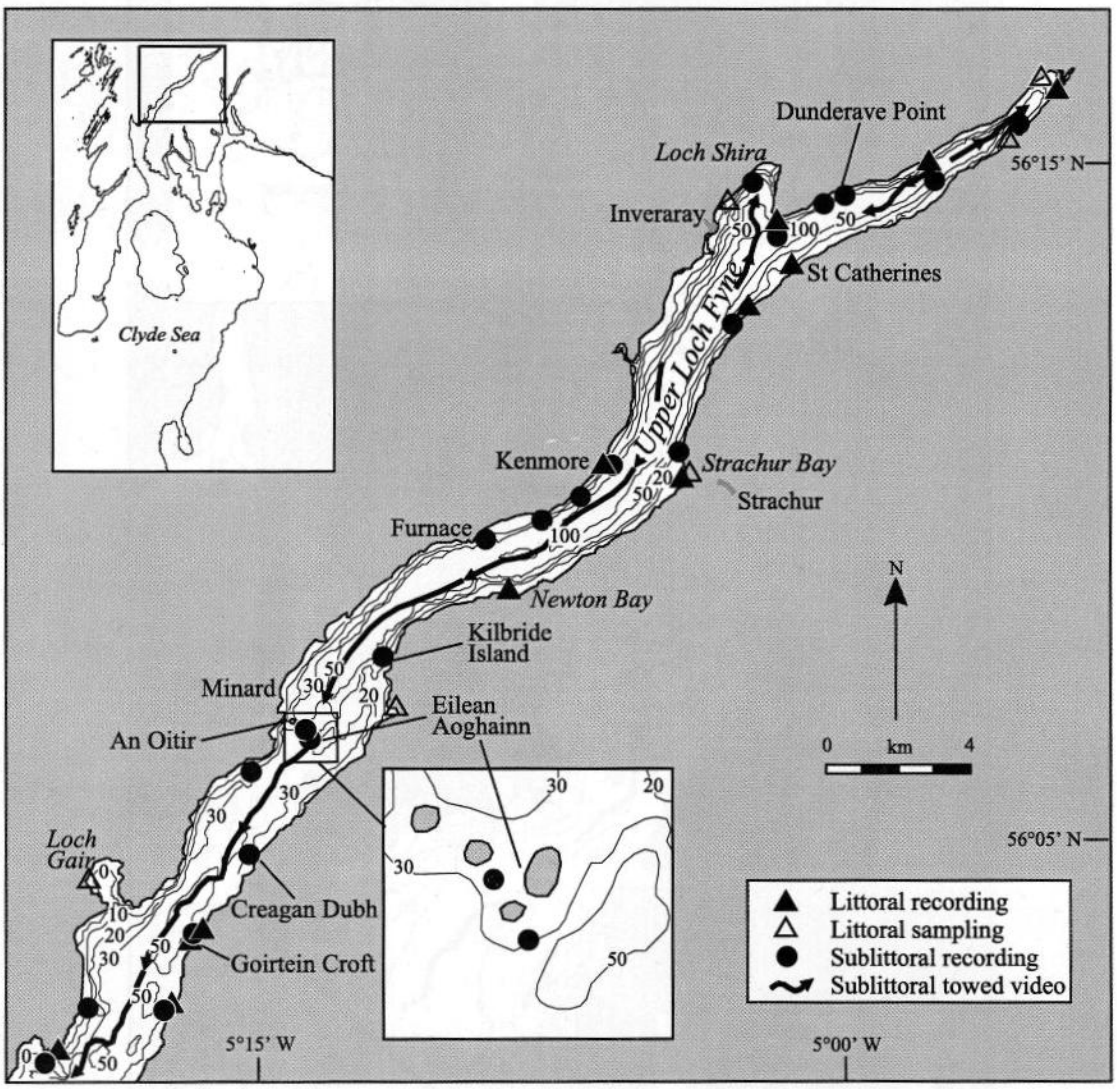


Figure 6.2 Main features of the area (northern part), showing sites surveyed.

Introduction

Loch Fyne, with a length of 70 km and a maximum depth of 185 m, is both the longest and deepest of the Scottish sealochs. The loch is a classic fjord, being long and narrow, with two sills in the upper section at Minard and Otter Ferry. The sills are marked at Minard by a cluster of islands while at Otter Ferry a sandy spit projects more than half-way across the loch forming a resistance to water flow and considerably increasing the tidal streams.

Like all of the lochs leading into the Firth of Clyde, which is itself protected from strong wave exposure by the Kintyre peninsula, Loch Fyne is sheltered or very sheltered along its entire length with the exception of Ardlamont Point at the entrance which is moderately exposed.

Loch Gilp forms a small side branch about 5 km long, opening into Loch Fyne half-way down its length. It has a narrow, shallow head leading to a wider, deeper mouth. Sandflats, which are traversed by the Bishopston Burn, extend for almost 2 km from the head of Loch Gilp.

The land surrounding Loch Fyne and Loch Gilp is steep-sided and forested with conifers which cover almost the entire length. The coast towards the loch entrance on the eastern side of Loch Fyne, which makes up part of the Cowal peninsula, is lower-lying and less steeply sloping with patches of deciduous woodland and sandy bays.

Marine biology

Marine biological surveys

	Survey methods	*No. of sites*	*Dates of survey*	*Source*
Littoral	Recording (epibiota)	17	September 1988	Davies (1989)
	Recording (epibiota)	7	April-September 1978	Paisley College of Technology (1979)
	Infaunal sampling (cores)	3	September 1988	Davies (1989)
	Infaunal sampling (25x25 cm area sieved)	10	1978	Paisley College of Technology (1979)
	Infaunal sampling (grab)	1	March 1969	Eleftheriou & McIntyre (1976)
Sublittoral	Recording (epibiota)	44	August-September 1988	Davies (1989)
	Video recording (epibiota)	12	February 1990	Howson & Davies (1991)

Littoral

With the exception of the entrance, Loch Fyne is generally steep-sided, which results in a relatively small intertidal area. The intertidal consists mostly of steep bedrock with exceptions at the head of Lochs Fyne and Gilp and the small sheltered embayments of Loch Gair, Strachur Bay, Kilfinan Bay, Auchalick Bay and Ardmarnock Bay: these areas consist of mixed substrata and are influenced by freshwater inputs from streams and rivers.

Bedrock and boulders in the littoral zone from Barmore Island north to the head are typical of very sheltered shores, being fucoid-dominated. *Fucus vesiculosus* (Fves) gives way to a dense band of *Ascophyllum nodosum* in the mid-eulittoral (Asc.Asc) which is followed by a band of *Fucus serratus* in the lower eulittoral zone. The south shore of Barmore Island, however, has little hard substrata and consequently is only inhabited by *F. serratus*. The red alga *Mastocarpus stellatus* is frequent underneath the fucoids, while the mussel *Mytilus edulis* inhabits the undersides of boulders on mixed sediment shores.

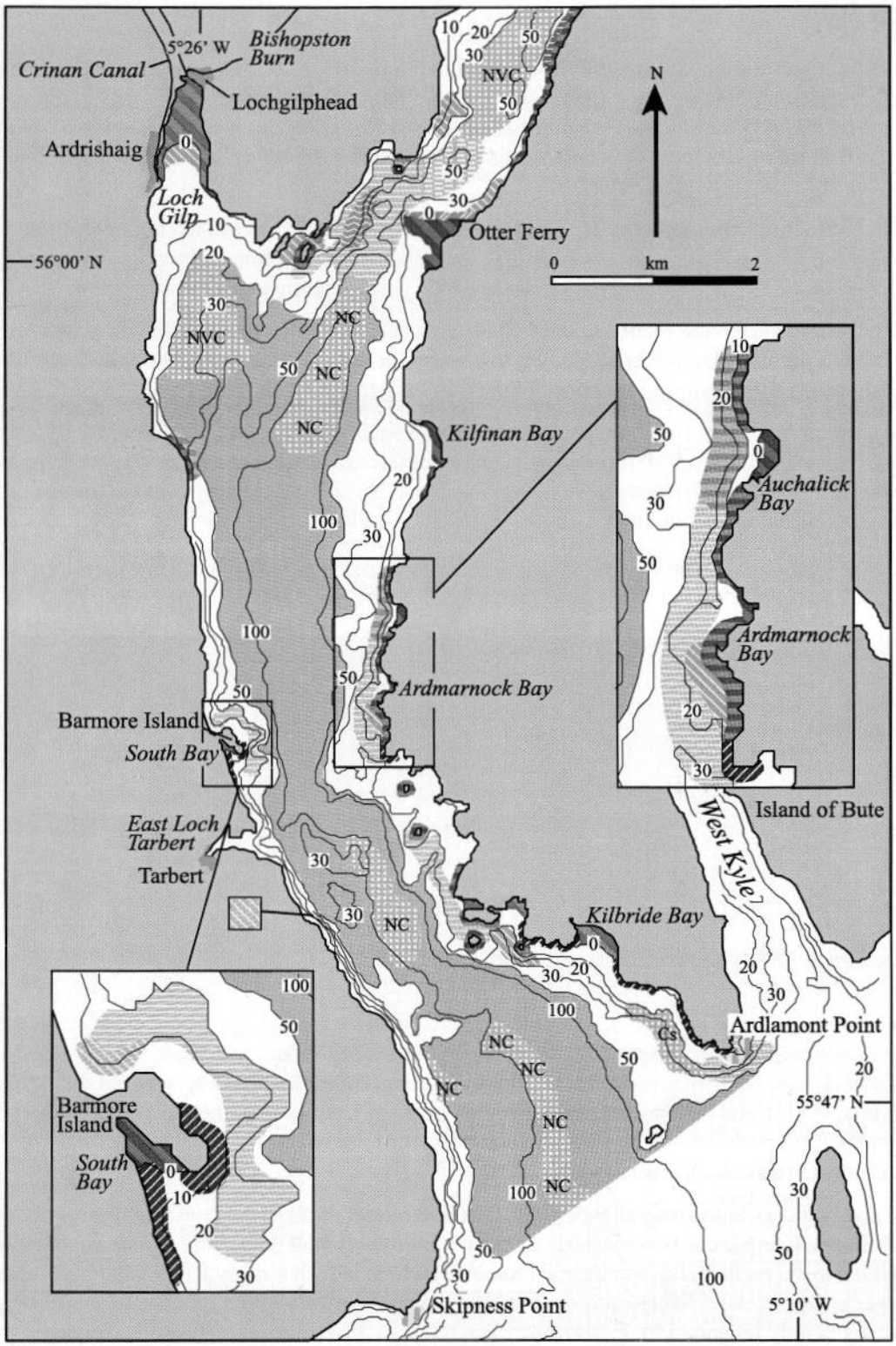


Figure 6.3 Indicative distribution of the main biotopes in the area (southern part) (based on data from survey sites shown in Figure 6.1, additional field observations and cited literature). (Key to biotopes symbols on page 67.)

Shores at Otter Narrows, Ardlamont Point and at the entrance to Kilbride Bay are affected by some wave exposure and, as a result, fucoids are sparse, having been replaced by an animal-dominated community. Barnacles are abundant as a conspicuous band in the upper eulittoral with a smaller band of *Chthamalus montagui* (BPat.Cht) lying above the wider band of *Semibalanus balanoides* (BPat.Sem). Large numbers of the limpet *Patella vulgata* and the dogwhelk *Nucella lapillus* occur amongst the barnacles. The winkle *Littorina saxatilis* is confined to the top of this zone. Algal cover is restricted to clumps of fucoids and the red algae *M. stellatus*, *Osmundea pinnatifida* and *Laurencia hybrida*. The lower eulittoral of this habitat is characterised by *F. serratus* with abundant *M. stellatus* and *O. pinnatifida* beneath. At Kilbride Bay the latter species is conspicuous as a band growing above the *F. serratus* band (Osm). Here, algal cover affords shelter to littorinids such as *Littorina mariae*, *Littorina littorea* and *Littorina obtusata*.

Rockpools occur on most rocky shores throughout the loch. The anemones *Sagartia elegans* and *Actinia equina* are often found in mid-eulittoral rock pools along with *S. balanoides*, *P. vulgata* and a variety of littorinids. The algae *Corallina officinalis*, *O. pinnatifida*, *M. stellatus*, *Halidrys siliquosa* and *Cladophora rupestris* are present in the majority of pools.

Mixed sediment shores with predominantly sand or gravel underlying pebbles, cobbles or boulders occur at St Catherines, Strachur, Auchalick Bay, Ardmarnock Bay, on the north side of Otter Spit, in South Bay by Barmore Island and at the head of the loch. All of these areas are traversed by rivers or have significant freshwater inputs causing variable salinity conditions. The larger substrata, such as boulders and cobbles, tend to be concentrated in the upper and mid-eulittoral zones and are largely absent from the lower shore, being replaced by firm sand: the head of the loch, however, is comprised entirely of coarse sand and gravel. As a result of this substratum-sorting the upper and mid-shores away from localised stream beds are colonised patchily by fucoids including *F. vesiculosus* (FvesX), *A. nodosum* (AscX) wherever suitable hard surfaces allow, and by filamentous green algae. Occasional pebbles or cobbles in the lower shore are colonised by *F. serratus* (FserX). Animal species colonising boulders and pebbles include the winkle *Littorina saxatilis*, *S. balanoides* and *P. vulgata*, while the undersides of cobbles and pebbles harbour a diverse range of species including several normally found in the sublittoral such as the nudibranch *Onchidoris bilamellata*, the anemone *Metridium senile* and the holothurian *Leptosynapta inhaerens*. On the lower shore, where finer sediments predominate, the cockle *Cerastoderma edule* and the lugworm *Arenicola marina* are found at most sites (PCer). In addition the mud snail *Hydrobia ulvae* and the polychaete *Hediste diversicolor* inhabit the gravel and sand at the loch head (MacAre.Mare). *M. edulis* is present in the eulittoral zone, often reaching superabundant levels at Otter Spit, at the loch head and at Barmore Island, where it acts as a binding agent (MytX). The tellin *Angulus tenuis* is common at Strachur, Kilbride Bay and South Bay (AP.P).

The sediment adjacent to natural stream beds is colonised almost entirely by *Fucus ceranoides* (FcerX). Within the streams the green alga *Enteromorpha* sp. is typically found attached to pebbles. *S. balanoides* and *H. diversicolor* are the most widespread animals in these habitats.

The large expanse of sandflats at the head of Loch Gilp consists of poorly-sorted sand across which the Bishopston Burn runs, creating localised areas of low salinity. The mid-shore is dominated by the polychaetes *Pygospio elegans*, *Fabricia sabella*, *H. diversicolor*, the mud snail *Hydrobia ulvae* and the tellin *Macoma balthica* (HedMac.Pyg). The lower shore is dominated by the polychaetes *Nephtys hombergii*, *Scoloplos armiger*, *Spio filicornis* and the bivalves *C. edule* and *A. tenuis* (PCer).

Sublittoral fringe areas are colonised by the kelp *Laminaria digitata* (Ldig.Ldig) in the outer loch and by *Laminaria saccharina* in the inner sheltered areas. At Liath Eilean at the entrance to Loch Gilp the sublittoral fringe is colonised by the brown alga *Halidrys siliquosa*.

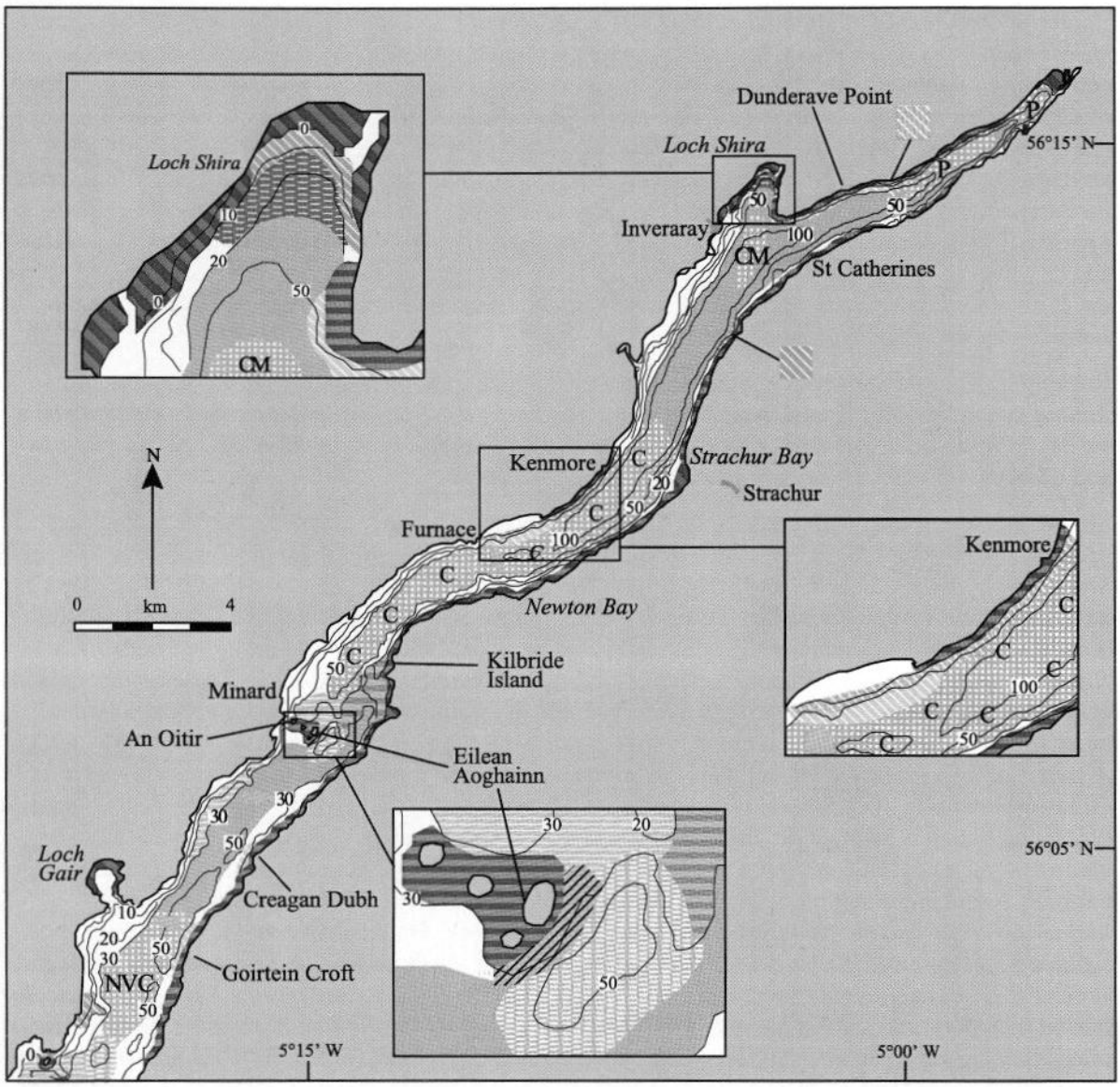
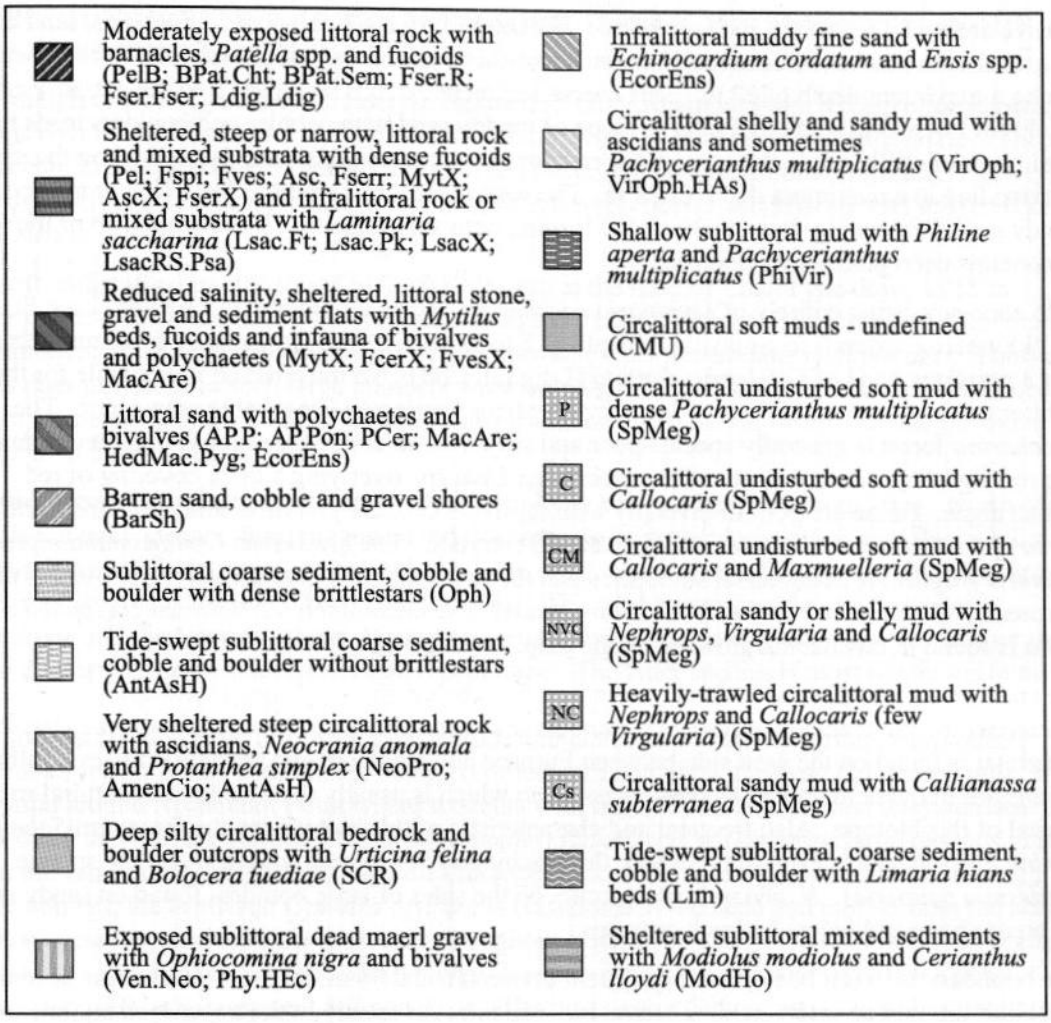


Figure 6.4 Indicative distribution of the main biotopes in the area (northern part) (based on data from survey sites shown in Figure 6.2, additional field observations and cited literature). (Key to biotopes symbols on next page.)

Sublittoral

Loch Fyne has several nationally scarce or uncommon species including the anemones *Pachycerianthus multiplicatus*, *Bolocera tuediae* and *Gonactinia prolifera*, the echiuran worm *Amalosoma eddystonense* and the brachiopod *Terebratulina retusa*. The occurrence of this latter species in Loch Fyne is unusual in that the population is genetically isolated from other Scottish and Irish populations (Cohen *et al.* 1993). The nationally rare amphipods *Monoculodes gibbosus* and *Monoculodes packardi* are known to occur only in Loch Fyne where they inhabit muddy sand (Beare & Moore 1994, 1998). The northern stone crab *Lithodes maia* is present throughout the loch on deep muds and boulder reefs (Howson & Davies 1991).



Bedrock outcrops are absent from Loch Shira and the upper reaches of Loch Fyne north of Strachur. This area is extremely sheltered and the sublittoral zone consists of sandy mud to 5 m depth, followed by a slope of pebbles, cobbles and boulders on gravelly or shelly mud leading to soft, burrowed mud at around 20 m. Between Strachur and Furnace the central basin is deep (137 m) and has a significant tidal flow only at its southern entrance, the Minard sill. The mud in the central part of this upper basin is soft, fine and undisturbed with few animals to provide shell debris. A bedrock wall begins at Kenmore on the west side extending from about 3 to 38 m depth and ends at Furnace where the terrain becomes one of boulders on a sandy mud slope. In contrast, the opposite coast on the east side from Strachur south to Kilbride Island consists of boulders and sandy mud. The Minard Islands, consisting of An Oitir to the west and Eilean Aoghainn to the east, pinpoint the location of the northernmost sill. The 20 m contour at this point projects out from the west side such that An Oitir sits in shallow water with boulders, shell gravel and sand extending to 10 m leading on to a slope of coarse sand and gravel to 17 m. The coarse material making up this area reflects the increase in water flow across the sill. To the east of Eilean Aoghainn, which marks the end of the sill, a bedrock cliff extends to 38 m dropping on to mud to 50 m. The central section of Loch Fyne from Furnace to Otter Ferry is generally shallower (64 m). The narrows at Minard and Otter Ferry result in slightly stronger water flow throughout and a sediment with a sandier content and shell debris. Another bedrock outcrop appears 6 km south of Kilbride Island between Creagan Dubh and Goirtein Croft on the east side of the loch. This outcrop starts close to the surface and peters out at a depth of 30 m. South of Goirtein Croft

extensive areas of circalittoral rock are scarce. At Otter Ferry a sill composed of cobbles, sand and shell gravel with patches of dead maerl extends two-thirds of the way across the loch from the east side reaching a maximum depth of 33 m. This coarse sediment extends southwards to the entrance of Loch Gilp. From Loch Gilp south to Tarbert a slope of muddy sand with pebbles and boulders leads to a central basin of shelly mud. A few bedrock outcrops occur around Barmore Island and on the opposite side extending to a maximum depth of 28 m. The west side from Tarbert to the loch entrance consists of sandy gravel extending down to 30 m and leading onto a mud plain. The central basin of the lower loch contains deep glacial clay deposits.

A kelp zone consisting entirely of *Laminaria saccharina* occurs throughout Loch Fyne (Lsac.Ft., Lsac.Pk) where it extends to a maximum depth of 8 to 12 m. At Dunderave Point this band occurs below a narrower band of *Laminaria digitata* (Ldig.Ldig.Bo). No information is available for the infralittoral zone in the outer parts of Loch Fyne, where *Laminaria hyperborea* may occur. The *L. saccharina* forest is generally species-poor and silty with an understorey consisting predominantly of the red alga *Phycodrys rubens* and the green alga *Ulva* sp. overlying a thick covering of red coralline algae. Fauna are poor in diversity with topshells *Gibbula cineraria* and ascidians *Ascidiella aspersa* and *Ascidia mentula* most widespread and common. The brittlestars *Ophiocomina nigra* and *Ophiothrix fragilis* are abundant at some sites and the two-spot goby *Gobiusculus flavescens* is also widespread and common, especially in shallow water. The uncommon red seaweed *Callophyllis cristata* is found in this habitat growing on the kelp.

Steep and vertical circalittoral bedrock, extending from below the algal zone to at least 38 m, is often characterised by the brachiopod *Neocrania anomala* and the anemone *Protanthea simplex* (NeoPro). This habitat is found on the west side between Furnace and Kenmore and the Minard Isles. Solitary ascidians are frequent including *Polycarpa pomaria* which is usually restricted to circalittoral rock and is typical of this biotope. Also frequent and characteristic of this biotope are the fan worm *Sabella pavonina*, the tubeworm *Protula tubularia*, the brachiopod *Terebratulina retusa* and the sponge *Hymedesmia paupertas*. *N. anomala* also occurs on the sides of large boulders found on sandy mud in these areas above and below bedrock outcrops.

At the boundary between bedrock and sediment between 6 and 30 m, there are often areas of boulders and cobbles on mud or shelly mud. These areas, which occur mostly in the upper loch region, are colonised both by sediment species and rock-dwelling species. No one species is particularly dominant at all sites but the brittlestars *O. nigra*, *O. fragilis* and *Ophiura albida* and solitary ascidians are typically the most conspicuous species. Also present but rare are the anemone *Urticina eques* and the featherstar *Antedon bifida*. The tubeworm *Protula tubularia* and the squat lobster *Munida rugosa* are also common at the majority of sites. *N. anomala* may be present but is more abundant on vertical rock surfaces. Clumps of the horse mussel *Modiolus modiolus* are occasionally found, providing attachment for additional species such as ascidians and hydroids (ModHAs).

More gently-sloping circalittoral bedrock, and sediments overlain by boulders, cobbles and pebbles are often blanketed with brittlestar beds of *O. nigra* and *O. fragilis* (Oph). Where both species occur, *O. nigra* is often more common than *O. fragilis* at shallower depths. *O. nigra* is confined mostly to the lower loch at depths between 6 and 25 m whereas *O. fragilis* occurs down to depths of at least 76 m. Associated species include the scallops *Aequipecten opercularis* and *Pecten maximus*, solitary ascidians, in particular *Ciona intestinalis*, and the anemones *Metridium senile*, *U. eques* and *Bolocera tuediae*. The brittlestar *O. albida* and the seapen *Virgularia mirabilis* occur at sites with a higher proportion of sand and mud often at the edge of this habitat or in areas where the brittlestars are less dense (VirOph). This habitat often continues into deeper water below 50 m where *B. tuediae* dominates rock surfaces while *M. rugosa* occurs frequently between the boulders. The sills at Minard and Otter Ferry, consisting of pebbles and cobbles on sand and gravel, are colonised by beds of *O. fragilis* with smaller numbers of *O. nigra* with the soft coral *Alcyonium digitatum* and *M. senile*. These coarser tide-swept sediments are additionally characterised by the hydroids *Halecium halecinum* and *Rhizocaulus verticillatus* which prefer greater water flow. On the west side at Otter Narrows the file-shell *Limaria hians* also occurs in clumps or nest amongst the muddy sand and gravel (Lim), with

associated species similar to those of the brittlestar beds. A bed *L. hians* also occurs on the west side at Otter Ferry between 8 and 20 m.

At the mouth of Loch Fyne there are coarse sediments. Off Ardlamont Point a plain of dead maerl gravel is covered by brittlestars *O. nigra* and *O. albida*, with the bivalve *Clausinella fasciata* and the heart urchin *Echinogammarus pusillus* living in sediment. Off Skipness Point, dead maerl gravel overlying shell gravel and pebbles supports dense *Cerianthus lloydii* and *Mya* sp. and scattered kelp *L. saccharina* (FaG).

Very soft undisturbed mud is found in Loch Shira and at the head of Loch Fyne down to 15 m (PhiVir). These areas are poor in species and inhabited by the ascidians *A. aspersa* and *A. mentula* and large numbers of the nationally scarce fireworks anemone *Pachycerianthus multiplicatus*. This latter species does not occur in such large numbers anywhere else in the loch and has not been recorded south of Furnace. In Loch Shira *O. albida* is also abundant while the fan worm *Sabella pavonina* is occasional at the head of the loch.

Soft mud occurs throughout the central bed of Loch Fyne below a depth of about 20 m. North of the Minards the mud appears, from the towed video survey, to be particularly soft with a flocculent surface and is undisturbed by burrows. In lower Loch Fyne, mud occurs everywhere below 50 m but appears shellier and is more extensively burrowed (SpMeg). The mud-burrowing shrimp *Calocaris macandreae* and the Norway lobster *Nephrops norvegicus* are frequent to abundant throughout the loch in deeper sediments and characterise this biotope. The latter species is most numerous in the central and outer sections of the loch and reaches its highest densities on the western entrance shelf. Other species characteristic of this biotope include another mud-burrowing shrimp, *Callianassa subterranea* which is less widespread, being recorded occasionally at the head but conspicuous in the sandy mud around Ardlamont Point where it occurs with the echiuran *Amalosoma eddystonense* at depths of 20 to 34 m; the echiuran worm *Maxmuelleria lankesteri* which forms large mounds in the mud in the centre of the upper basin and the entrance to Loch Shira and possibly indicates a high organic content; the brittlestar *Ophiura ophiura* is occasional at the head and mid section; the scallop *Pseudamussium septemradiatum* is present throughout Loch Fyne except for the lower loch region. Two species of burrowing fish, the snake blenny *Lumpenus lumpretaeformis* and Fries's goby *Lesueurigobius friesii* are present in Loch Fyne. The black goby *Gobius niger*, a species not known to excavate its own burrows, but an opportunistic occupier of burrows, is also present.

The seapens *Pennatula phosphorea* and *Funiculina quadrangularis*, which are highly characteristic of sheltered muddy sediments in sealochs, appear to absent from Loch Fyne. The more common seapen *V. mirabilis* is however present throughout the loch but not in large numbers in this habitat. It is generally more abundant in shallower water in sediments with a higher sand content (VirOph). It is frequent in depths of 23 to 62 m in Loch Gilp and the head of Loch Fyne but scarce or absent from the deeper muds. It is also scarce on the sediments surveyed by diving and seems to be restricted to intermediate depths and predominantly on sandy muds. The abundance of *V. mirabilis* may be affected by trawling for *N. norvegicus*, which takes place regularly; however, some untrawled areas are also devoid of seapens.

Nature conservation

Conservation sites

Site name	*Status*	*Main features*
Mealdarroch, Loch Fyne	NNR; SSSI	Steep woodland backing onto shore – botanical
Ardchyline Wood, Loch Fyne	SSSI	Woodland backing onto shore
Strone Point, North Loch Fyne	SSSI	Woodland backing onto shore
Artillagan & Abhain Strathain Burns	SSSI	Woodland backing onto shore
Tarbert to Skipness Coast	SSSI	Botanical, down to MLWS
South Bay, Barmore Island, Loch Fyne	SSSI; GCR	Geological
Mealdarroch Point, Loch Fyne	SSSI; GCR	Geological
Upper Loch Fyne	MCA	Marine biology, including dense populations of *Pachycerianthus multiplicatus*
East and West Loch Fyne (part)	RSC	Regional Scenic Coast

Human influences

Coastal development and uses

There are many small settlements around Loch Fyne, the main ones being Tarbert, Inveraray, Ardrishaig and Lochgilphead. Ardrishaig lies at one end of the Crinan Canal and is busy with boating activity. The canal allows passage of vessels from the Firth of Clyde to the Sound of Jura without having to circumnavigate the Mull of Kintyre. Tarbert, which lies in the lower loch, is a fishing harbour with a fishing fleet working predominantly in the Firth of Clyde. There is also a tradition of yacht-building here and yacht races often take place from and to Tarbert. Inveraray, near the head of Loch Fyne, is a popular tourist destination. There are no major industrial inputs to Loch Fyne. Quarrying takes place at Furnace for aggregates which are used in concrete production.

Mariculture, fishing and recreation

Harbour facilities exist at Tarbert, Ardrishaig and Inveraray. Tarbert is the largest facility with 25 to 30 fishing vessels and many pleasure craft moored at night. Timber barges are loaded at Ardrishaig, an activity which is expected to increase in future as the conifer plantations in the area mature.

There are a number of fish farms in Loch Fyne and further sites with approved leases. Very little fishing of pelagic and demersal fin fish takes place in Loch Fyne. Several fishing boats creel for crabs and lobsters *Homarus gammarus*. *Nephrops norvegicus* is caught by creeling but more commonly by trawling. Scallops *Aequipecten opercularis* and *Pecten maximus* are also caught by dredging.

References and further reading

Beare, D.J., & Moore, P.G. 1994. Observations on the biology of a rare British amphipod: *Monoculodes gibbosus* (Crustacea: Amphipoda: Oedicerotidae). *Journal of the Marine Biological Association of the United Kingdom*, *74*: 193-201.

Beare, D.J., & Moore, P.G. 1998. The life histories of the offshore oedicerotids *Westwoodilla caecula* and *Monoculoides packardi* (Crustacea: Amphipoda) from Loch Fyne, Scotland. *Journal of the Marine Biological Association of the United Kingdom*, *78*: 835-852.

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

Clyde River Purification Board. 1976. *Monitoring in the Loch Fyne designated sea area. A survey in relation to the Stage III construction of a concrete gas production platform*. Unpublished, Clyde River Purification Board. (Technical report, No. 42.)

Cohen, B.L., Balfe, P., Cohen, M., & Curry, G.B. 1993. Molecular and morphometric variation in the European population of the articulate brachiopod *Terebratulina retusa*. *Marine Biology*, *115*: 105-111.

Connor, D.W. 1990. *Amalosoma eddystonense* Stephen, 1956, an echiuran new to Scotland with notes on its proboscis and habitat. *Porcupine Newsletter*, *4*: 226-228.

Davies, L.M. 1989. Surveys of Scottish sealochs: Loch Fyne. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 984.

Eleftheriou, A & McIntyre, A.D. 1976. *The intertidal fauna of sandy beaches – a survey of the Scottish coast*. Aberdeen, Department of Agriculture and Fisheries for Scotland. (Scottish Fisheries Research Report, No. 6.)

Gowen, R., Lewis, J., & Bullock, A.M. 1982. *A flagellate bloom and associated mortalities of farmed trout and salmon in upper Loch Fyne*. Unpublished, Scottish Marine Biological Association. (Internal report, No. 71.)

Howson, C.M., & Davies, L.M. 1991. Surveys of Scottish sealochs. A towed video survey of Loch Fyne. (Contractor: University Marine Biological Station, Millport.) *Nature Conservancy Council, CSD Report*, No. 1189.

Jones, K.J., Cabecadas, L., Gowen, R., Robertson, N., & Tett, P. 1981. *The distribution of phytoplankton and nutrients in relation to the hydrography of Loch Fyne and its approaches: a report of a cruise by M.V. 'Arvor', 7-12 September 1981*. Unpublished, Scottish Marine Biological Association. (Internal report, No. 51.)

McLusky, D.S. 1986. The intertidal ecology of three west coast Scottish estuaries (Loch Crinan, Loch Gilp, West Loch Tarbert). *Bulletin of the Estuarine and Brackish Water Sciences Association*, *43*: 15-25.

Nature Conservancy Council. 1990. *Marine Consultation Areas: Scotland*. Unpublished, Nature Conservancy Council (Scotland), Edinburgh.

Paisley College of Technology, Department of Biology. 1979. *A biological survey of seashores in the Clyde Sea Area – 1978-79*. Unpublished, Nature Conservancy Council, Scotland, South-west Region. (Internal report, No. NC 211 J.)

Tett, P., Gowen, R., Grantham, B., Jones, K., & Miller, B.S. 1986. The phytoplankton ecology of the Firth of Clyde sealochs Striven and Fyne. *In*: *The environment of the estuary and Firth of Clyde*, ed. by J.A. Allen, P.R.O. Barnett, J.M. Boyd, R.C. Kirkwood, D.W. Mackay & J.C. Smyth, *Proceedings of the Royal Society of Edinburgh. Series B: Biological Sciences*, *90*: 223-238.

Sites surveyed

Survey 22: 1998-1990 UMBSM Loch Fyne littoral, sublittoral and towed video survey (Davies 1989; Howson & Davies 1991).
Survey 49: 1978-79 PCT Clyde Sea Area littoral survey (Paisley College of Technology 1979).
Survey 326: 1965-1970 DAFS Scottish sandy shores survey (Eleftheriou & McIntyre 1976).

Littoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
22	29	Shore at Ardmarnock Bay, Loch Fyne.	NR 909 729	55°54.2'N 05°20.7'W	YG; Ver.Ver; Pel; Fspi; BPat.Sem; Asc.VS; Fserr.VS; Cor; FK; FcerX; MacAre.Mare

Littoral sites - continued

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
22	30	S shore, Dun, Rubha Preasach, Loch Fyne.	NR 909 710	55°53.2'N 05°20.6'W	YG; Ver.Ver; PelB; BPat.Sem; Fser.Fser
22	31	Intertidal causeway, Dun, Rubha Preasach, Loch Fyne.	NR 909 711	55°53.2'N 05°20.6'W	YG; Ver.Ver; Pel; Fspi; Asc.Asc
22	38	Shore at Auchalick Bay, Loch Fyne.	NR 911 744	55°55.0'N 05°20.6'W	FvesX; FcerX
22	39	Otter Spit, Loch Fyne.	NR 926 845	56°00.5'N 05°19.6'W	BPat.Sem; Fserr.VS; FserX; MytX; EphX; BarSh; PCer
22	40	Shore at Goirtein Point, Loch Fyne.	NR 953 890	56°03.0'N 05°17.2'W	YG; Ver.Ver; Pel; BPat.Sem; Fser.Fser.Bo; Cor
22	41	Shore S of Goirtein Point, Loch Fyne.	NR 953 888	56°02.8'N 05°17.2'W	YG; Ver.Ver; Pel; Asc.VS; Fser.Fser.Bo
22	42	Shore SW of St Catherines, Loch Fyne.	NN 117 072	56°13.2'N 05°02.2'W	YG; Ver.Ver; Pel; Fspi; FvesX; AscX; FserX; MacAre
22	43	Shore at head of loch, Loch Fyne.	NN 188 126	56°16.2'N 04°55.6'W	FvesX; FcerX; MytX; ?AP.P
22	44	Shore of headland NE of Dunderave Point, Loch Fyne.	NN 155 103	56°15.0'N 04°58.7'W	Pel; Asc.VS; Fserr.VS
22	45	Strachur Bay, Loch Fyne.	NN 087 016	56°10.1'N 05°04.8'W	Fspi; FvesX; FserX; MacAre
22	46	Shore E of Eilean Math-Ghamhna, Loch Fyne.	NS 038 985	56°08.3'N 05°09.4'W	YG; Ver.Ver; Pel; Fspi; Asc.Asc; Fser.Fser
22	49	Shore at W point, Kilbride Bay, Loch Fyne.	NR 956 665	55°50.9'N 05°15.9'W	YG; PelB; Fspi; BPat.Sem; Fser.R; XR; Cor
22	50	Kilbride Bay, Loch Fyne.	NR 960 668	55°51.0'N 05°15.5'W	AP.P; EcorEns
22	51	SW of South Bay, Barmore Island, Loch Fyne.	NR 869 712	55°53.2'N 05°24.4'W	Ver.Ver; Pel; BPat.Sem; Fser.Fser; Ldig.Ldig; Cor
22	52	South Bay, Barmore Island, Loch Fyne.	NR 867 716	55°53.4'N 05°24.6'W	Fspi; Fserr.VS; AscX; FcerX; MytX; AP.P
22	53	Shore W of Port a Ghoblain, Ardlamont Pt, Loch Fyne.	NR 987 639	55°49.5'N 05°12.8'W	YG; Ver.Ver; PelB; BPat.Cht; BPat.Sem; XR; FK; Ldig.Ldig
49	7	Tarbert, Loch Fyne.	NR 880 686	55°51.8'N 05°23.3'W	SLR
49	8	Near Port Ann, Loch Fyne.	NR 915 860	56°01.2'N 05°20.7'W	Pel; Fspi; AscX; Lsac.Ldig
49	9	Kenmore Point, Loch Fyne.	NN 065 020	56°10.2'N 05°07.0'W	F
49	10	Strone Point, Loch Fyne.	NN 112 088	56°14.0'N 05°02.7'W	Asc.Asc; Fser.Fser; Ldig.Ldig
49	11	St Catherines, Loch Fyne.	NN 105 063	56°12.6'N 05°03.3'W	Pel; Fspi; Asc.Asc
49	12	Craig n'Dubh, Loch Fyne.	NR 945 872	56°02.0'N 05°17.9'W	BPat.Cht; BPat.Sem; Ala.Ldig
49	13	Ardlamont Point, Loch Fyne.	NR 992 639	55°49.5'N 05°12.3'W	MLR; FK
49	48	Lochgilphead, Loch Fyne.	NR 860 870	56°01.6'N 05°26.0'W	AP.P; PCer; MacAre
49	49	Loch Gair, Loch Fyne.	NR 925 909	56°03.9'N 05°20.0'W	AP.P; PCer
49	50	Inveraray, Loch Fyne.	NN 097 087	56°13.9'N 05°04.2'W	PCer; MacAre
49	51	Cairndow Bay, Loch Fyne.	NN 179 111	56°15.4'N 04°56.4'W	MacAre.Mare; HedMac.Mare
49	52	Strachur Bay, Loch Fyne.	NN 087 016	56°10.1'N 05°04.8'W	AP.P
49	53	Lachlan Bay, Loch Fyne.	NS 006 952	56°06.4'N 05°12.4'W	AP.P
49	54	Otter Ferry, Loch Fyne.	NR 921 835	55°59.9'N 05°20.0'W	AP.P
49	55	Kilfinan Bay, Loch Fyne.	NR 920 791	55°57.5'N 05°19.9'W	AP; AP.P
49	56	Auchalick Bay, Loch Fyne.	NR 912 745	55°55.0'N 05°20.5'W	AP.P
49	57	Kilbride Bay, Loch Fyne.	NR 960 667	55°51.0'N 05°15.5'W	AP.P; AP.Pon
326	15	Loch Gilp.	NR 860 870	56°01.6'N 05°26.0'W	AP.P; AP.Pon; PCer; MacAre; HedMac.Pyg

Sublittoral sites

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
22	1	Furnace quarry, Loch Fyne.	NN 032 000	56°09.1'N 05°10.1'W	NeoPro; VirOph.HAs
22	2	Pennymore Point, Loch Fyne.	NN 048 005	56°09.4'N 05°08.6'W	Lsac.Ft; NeoPro; VirOph.HAs
22	3	Stallion Rock (An Oigeach), Loch Fyne.	NN 057 011	56°09.7'N 05°07.7'W	Lsac.Ft; NeoPro
22	4	Kenmore Point (N cliff), Loch Fyne.	NN 066 020	56°10.2'N 05°06.9'W	Lsac.Ft; AmenCio; NeoPro
22	5	Creggans Pier, Loch Fyne.	NN 086 024	56°10.5'N 05°05.0'W	LsacX; SpMeg
22	6	Creag a Phuill, Loch Fyne.	NN 102 058	56°12.4'N 05°03.6'W	Aasp; EcorEns
22	7	NW Loch Shira, Loch Fyne.	NN 106 098	56°14.5'N 05°03.4'W	EcorEns; PhiVir; VirOph.HAs
22	8	Strone Point, Loch Fyne.	NN 112 083	56°13.7'N 05°02.7'W	Lsac.Ft; AmenCio
22	9	W of Dunderave Point, Loch Fyne.	NN 131 096	56°14.5'N 05°00.9'W	LsacRS.Psa; CMX
22	10	Cuil House, Loch Fyne.	NN 180 114	56°15.6'N 04°56.3'W	PhiVir; Beg
22	11	W Kilbride Island, Loch Fyne.	NS 005 967	56°07.2'N 05°12.5'W	Lsac.Pk; ModHAs
22	12	W of Eilean Aoghainn, Loch Fyne.	NR 983 947	56°06.1'N 05°14.6'W	LsacX; Oph
22	13	S end of Fraoch Eilean, Loch Fyne.	NR 984 944	56°05.9'N 05°14.5'W	Lsac.Ft; NeoPro; Oph; CGS
22	14	S of Union Bay, near Minard Castle, Loch Fyne.	NR 967 937	56°05.5'N 05°16.1'W	Oph
22	15	Creagan Dubh, Loch Fyne.	NR 967 911	56°04.1'N 05°15.9'W	Lsac.Ft; VirOph.HAs
22	16	S of Goirtein Point, Loch Fyne.	NR 953 890	56°03.0'N 05°17.2'W	Lsac.Ft; AmenCio; AntAsH; Oph
22	17	N of Largiemore, Loch Fyne.	NR 944 870	56°01.9'N 05°18.0'W	Lsac.Pk; LsacX; VirOph.HAs
22	18	S of Glas Eilean, Loch Fyne.	NR 912 856	56°01.0'N 05°21.0'W	Oph
22	19	W point of Otter Spit, Loch Fyne.	NR 911 848	56°00.6'N 05°21.0'W	Oph
22	20	Mid-loch, SW of Otter Spit, Loch Fyne.	NR 900 840	56°00.1'N 05°22.1'W	Lim
22	21	SE Barmore Island, Loch Fyne.	NR 874 712	55°53.2'N 05°24.0'W	Oph
22	22	NW Sgeir Mhaola Cinn, Loch Fyne.	NR 870 721	55°53.6'N 05°24.4'W	Oph; AntAsH
22	23	Headland in Bagh Buic, Loch Fyne.	NR 912 711	55°53.2'N 05°20.3'W	Lsac.Ft; VirOph
22	24	SW Rubha Dubh, Loch Fyne.	NR 904 722	55°53.8'N 05°21.1'W	Lsac.Ft; Oph
22	25	E Eilean a'Chomhraig, Loch Fyne.	NR 888 676	55°51.3'N 05°22.4'W	AntAsH
22	26	SW Sgat Beag, Loch Fyne.	NR 940 665	55°50.8'N 05°17.4'W	Lsac.Pk; AfilEcor
22	27	Channel S of Eilean Aoidhe, Loch Fyne.	NR 929 669	55°51.0'N 05°18.5'W	Lsac.Ft; Oph
22	28	SW Eilean Buidhe, Loch Fyne.	NR 915 691	55°52.1'N 05°19.9'W	Lsac.Pk; Oph
22	32	SW Glas Eilean, Loch Fyne.	NR 912 856	56°01.0'N 05°21.0'W	Ldig.Ldig; Lsac.Ft; Oph; AntAsH
22	33	Creag Gobhainn, Loch Fyne.	NR 901 851	56°00.7'N 05°22.0'W	Lcor; Lim
22	34	S of Liath Eilean, Loch Fyne.	NR 888 834	55°59.8'N 05°23.2'W	SIR; Lsac.Pk; Oph; Lgla
22	35	Point S of Clach Garbh, Loch Fyne.	NR 922 870	56°01.8'N 05°20.1'W	EcorEns
22	36	Dorus Mor, Loch Fyne.	NR 889 841	56°00.2'N 05°23.1'W	Lsac.Ft; LsacX; EcorEns
22	37	Otter Bay, Loch Fyne.	NR 929 846	56°00.5'N 05°19.3'W	KSwMx; EcorEns
22	47	E of Eilean Buidhe, Loch Fyne.	NR 905 719	55°53.6'N 05°21.0'W	Lsac.Ft; LsacX
22	48	Rubha Preasach, Loch Fyne.	NR 906 710	55°53.2'N 05°20.8'W	AmenCio; Oph
22	54	Gob a'Bharra, Loch Fyne.	NR 908 753	55°55.5'N 05°20.9'W	Lsac.Ft; LsacX
22	55	S of Rubh' a'Minidhe Beag, Loch Fyne.	NR 858 787	55°57.2'N 05°25.8'W	Lsac.Ft; FaMx; ModHo
22	56	Reef W of Eil Gurie, Loch Fyne.	NR 903 741	55°54.9'N 05°21.3'W	Oph
22	57	Skipness Point, Loch Fyne.	NR 913 572	55°45.7'N 05°19.6'W	AntAsH; FaG
22	58	Ardlamont Point, Loch Fyne.	NR 994 637	55°49.4'N 05°12.1'W	FaG
22	59	Rubha Stillaig, Loch Fyne.	NR 924 677	55°51.4'N 05°19.0'W	Oph
22	60	SE of Achnatra, Loch Fyne.	NN 126 092	56°14.3'N 05°01.4'W	Lsac.Ft; VirOph.HAs
22	61	Dunderave Point, Loch Fyne.	NN 144 095	56°14.5'N 04°59.7'W	Ldig.Ldig.Bo; Lsac.Ft; AmenCio; NeoPro
22	62	Mid-loch, Otter Spit to Kilfinan Bay, Loch Fyne.	NR 898 813	55°58.7'N 05°22.1'W	Oph; SCR; SpMeg
22	63	Upper loch, Drishaig to Dunderave Point, Loch Fyne.	NN 156 099	56°14.7'N 04°58.5'W	SpMeg

Sublittoral sites - continued

Survey	*Site*	*Place*	*Grid reference*	*Latitude/longitude*	*Biotopes present*
22	64	Upper loch, Creag a' Phuill to Loch Shira, Loch Fyne.	NN 106 077	56°13.4'N 05°03.3'W	SpMeg
22	65	Upper loch, Drishaig to Cairndow, Loch Fyne.	NN 173 110	56°15.3'N 04°56.9'W	SpMeg
22	66	Upper loch, Colliechaol to Minard Isles, Loch Fyne.	NS 045 995	56°08.8'N 05°08.8'W	Oph; SCR; SpMeg
22	67	Upper loch, Minard Isles to Otter Narrows, Loch Fyne.	NR 951 900	56°03.5'N 05°17.4'W	Oph; AntAsH; SCR; SpMeg
22	68	Otter Narrows, Loch Fyne.	NR 905 848	56°00.6'N 05°21.6'W	Oph
22	69	Loch Gilp, Loch Fyne.	NR 865 821	55°59.0'N 05°25.3'W	SpMeg
22	70	Lower loch, Sgat Mor to Tarbert Bank, Loch Fyne.	NR 910 674	55°51.2'N 05°20.3'W	SpMeg
22	71	Mouth of loch, Loch Fyne.	NR 948 636	55°49.3'N 05°16.5'W	SpMeg
22	72	Shelf E of Rubha Grianain, Lower Loch Fyne.	NR 923 626	55°48.7'N 05°18.9'W	SpMeg
22	73	Lamont Shelf, Lower Loch Fyne.	NR 984 634	55°49.3'N 05°13.1'W	Oph; SpMeg

Compiled by: Ruth Beaver & Frances Dipper

7 Campbeltown Loch

Location		
Position (centre)	NR 738 198	55° 25.1′ N 5° 34.7′ W
Administrative area	Argyll and Bute	
Conservation agency/area	Scottish Natural Heritage	West Areas (Argyll and Stirling)

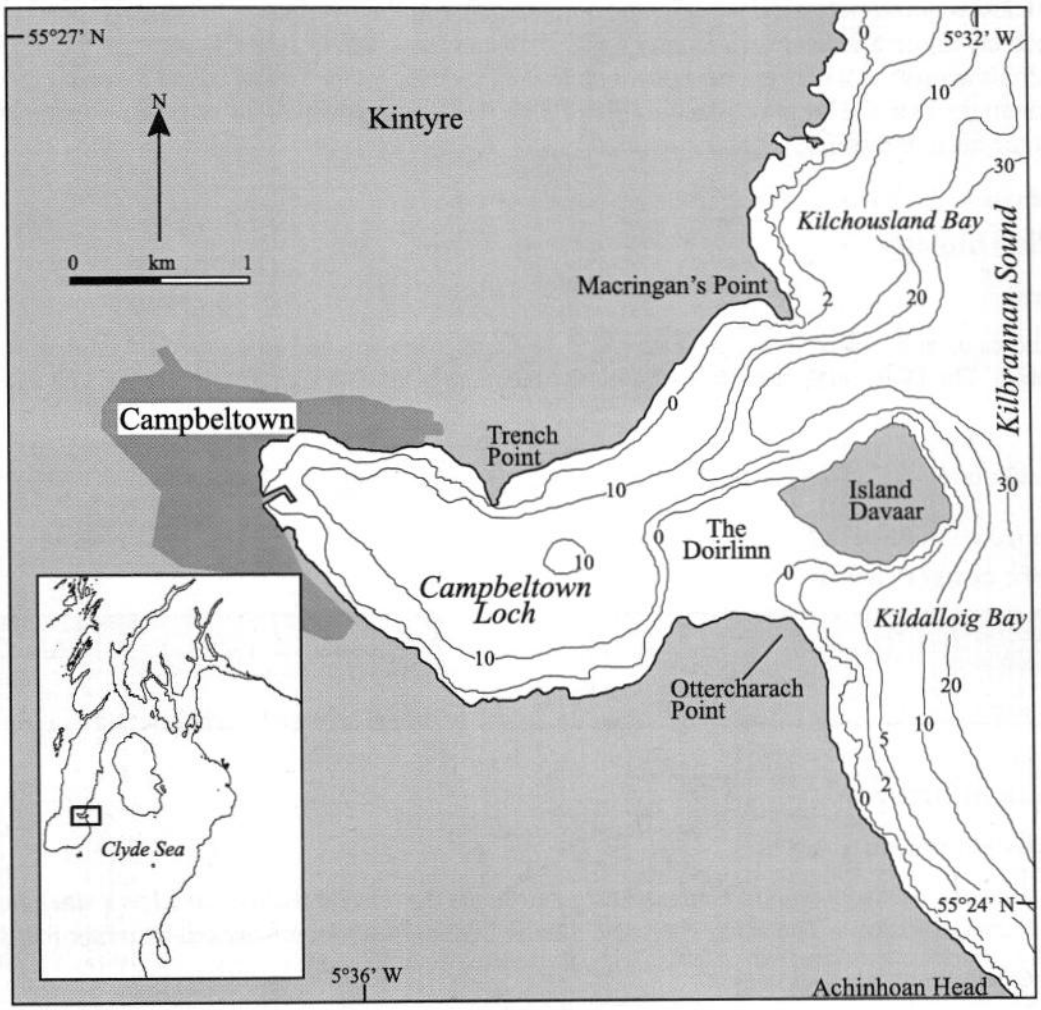


Figure 7.1 Main features of the area, including main bathymetric contours.

Physical features	
Physiographic type	Fjordic sealoch
Length of coast	8 km
Length of inlet	3.9 km
Area of inlet	4.4 km^2
Bathymetry	Maximum depth 35 m
Wave exposure	Sheltered
Tidal streams	No data
Tidal range	2.4 m (springs); 1.4 m (neaps)
Salinity	Marine

Introduction

Campbeltown Loch is a short and relatively wide sealoch indenting the east coast of the Kintyre peninsula. The mouth of the loch opens onto Kilbrannan Sound, the area of water between Kintyre and the Isle of Arran. It is therefore remote from the industrial pollution experienced by sealochs such as Gareloch, which open onto the northern Firth of Clyde. The loch runs approximately from east to west and is sheltered from the prevailing south-westerly winds by the southern end of the Kintyre peninsula. Island Davaar lies in the mouth of the loch affording it further shelter. The island is linked to the mainland for three hours either side of low tide by an intertidal area known as the Doirlinn; a stone causeway runs along the western and northern sides of the Doirlinn. The shores around much of the loch are raised beaches; cliffs occur on the south and east coast of Island Davaar. A sill at 14 m depth runs across the loch from the north side to the Doirlinn, south-west of Island Davaar. The maximum depth in the basin behind the sill is 22 m. The sailing and holiday resort of Campbeltown lies at the head of the loch.

Marine biology

Littoral

The shores of this loch have not been surveyed, as far as is known, and so no specific information is available. The Doirlinn appears from Admiralty charts to be a wide area of littoral sand and stones.

Sublittoral

The sublittoral of this loch has not been surveyed, as far as is known.

Nature conservation

Conservation sites		
Site name	***Status***	***Main features***
East Kintyre	RSC	The loch falls within a Regional Scenic Coast

Human influences

Coastal developments and uses

The sailing and holiday resort of Campbeltown surrounds the head of the loch and has a small harbour and launching facilities. The south shore and much of the north shore are backed by minor roads.

Marine developments and uses

In the 19th century Campbeltown was the centre of a booming herring fishery which has now declined to a low level. A ferry service runs in the summer months between Campbeltown and Ballycastle in Northern Ireland. Sailing is popular in the loch.

References and further reading

There are no specific references relating to this loch.

Sites surveyed

There are no survey sites within the loch.

Compiled by: Frances Dipper

Appendix A — Biotopes classification

A hierarchical classification of the biotopes present in the sealochs in the Clyde Sea (using the data listed in Table 1), shown together with their higher types, is given below. The biotopes listed are derived from the MNCR national biotope classification (Connor *et al.* 1997a, b).

Higher code	*Biotope code*	*Biotope*
LR		**LITTORAL ROCK (and other hard substrata)**
LR.L		**Lichens or algal crusts**
LR.L	YG	Yellow and grey lichens on supralittoral rock
LR.L	Pra	*Prasiola stipitata* on nitrate-enriched supralittoral or littoral fringe rock
LR.L	Ver	*Verrucaria maura* on littoral fringe rock
LR.L	Ver.Ver	*Verrucaria maura* on moderately exposed to very sheltered upper littoral fringe rock
ELR		**Exposed littoral rock (mussel/barnacle shores)**
ELR.MB		***Mytilus* (mussels) and barnacles**
ELR.MB	BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MB	BPat.Cht	*Chthamalus* spp. on exposed upper eulittoral rock
ELR.MB	BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock
MLR		**Moderately exposed littoral rock (barnacle/fucoid shores)**
MLR.BF		**Barnacles and fucoids (moderately exposed shores)**
MLR.BF	PelB	*Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock
MLR.BF	FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid-eulittoral rock
MLR.BF	Fser	*Fucus serratus* on moderately exposed lower eulittoral rock
MLR.BF	Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
MLR.BF	Fser.Fser	Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock
MLR.BF	Fser.Fser.Bo	*Fucus serratus* and under-boulder fauna on lower eulittoral boulders
MLR.R		**Red seaweeds (moderately exposed shores)**
MLR.R	XR	Mixed red seaweeds on moderately exposed lower eulittoral rock

Higher code	Biotope code	Biotope
MLR.Eph		**Ephemeral green or red seaweeds (freshwater or sand-influenced)**
MLR.Eph	Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock
SLR		**Sheltered littoral rock (fucoid shores)**
SLR.F		**Dense fucoids (stable rock)**
SLR.F	Pel	*Pelvetia canaliculata* on sheltered littoral fringe rock
SLR.F	Fspi	*Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock
SLR.F	Asc	*Ascophyllum nodosum* on very sheltered mid-eulittoral rock
SLR.F	Asc.Asc	*Ascophyllum nodosum* on full salinity mid-eulittoral rock
SLR.F	Asc.VS	*Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid-eulittoral rock
SLR.F	Fserr	*Fucus serratus* on sheltered lower eulittoral rock
SLR.F	Fserr.VS	*Fucus serratus* and large *Mytilus edulis* on variable salinity lower eulittoral rock
SLR.FX		**Fucoids, barnacles or ephemeral seaweeds (mixed substrata)**
SLR.FX	BLlit	Barnacles and *Littorina littorea* on unstable eulittoral mixed substrata
SLR.FX	FvesX	*Fucus vesiculosus* on mid-eulittoral mixed substrata
SLR.FX	AscX	*Ascophyllum nodosum* on mid-eulittoral mixed substrata
SLR.FX	FserX	*Fucus serratus* on lower eulittoral mixed substrata
SLR.FX	FserX.T	*Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata
SLR.FX	EphX	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.FX	FcerX	*Fucus ceranoides* on reduced salinity eulittoral mixed substrata
SLR.MX		***Mytilus* (mussel) beds (mixed substrata)**
SLR.MX	MytX	*Mytilus edulis* beds on eulittoral mixed substrata
		Littoral rock (other)
LR.Rkp		**Rockpools**
LR.Rkp	G	Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in upper shore rockpools
LR.Rkp	Cor	*Corallina officinalis* and coralline crusts in shallow eulittoral rockpools
LR.Rkp	FK	Fucoids and kelps in deep eulittoral rockpools
LR.Rkp	SwSed	Seaweeds in sediment (sand or gravel)-floored eulittoral rockpools

Higher code	Biotope code	Biotope
LS		**LITTORAL SEDIMENTS**
LGS		**Littoral gravels and sands**
LGS.Sh		**Shingle (pebble) and gravel shores**
LGS.Sh	BarSh	Barren shingle or gravel shores
LGS.S		**Sand shores**
LGS.S	AEur	Burrowing amphipods and *Eurydice pulchra* in well-drained clean sand shores
LGS.S	AP	Burrowing amphipods and polychaetes in clean sand shores
LGS.S	AP.P	Burrowing amphipods and polychaetes (often with *Arenicola marina*) in clean sand shores
LGS.S	AP.Pon	Burrowing amphipods *Pontocrates* spp. and *Bathyporeia* spp. in lower shore clean sand
LGS.Est		**Estuarine coarse sediment shores**
LGS.Est	Ol	Oligochaetes in reduced or low salinity gravel or coarse sand shores
LMS		**Littoral muddy sands**
LMS.MS		**Muddy sand shores**
LMS.MS	BatCor	*Bathyporeia* spp. and *Corophium* spp. in upper shore slightly muddy fine sands
LMS.MS	PCer	Polychaetes and *Cerastoderma edule* in fine sand and muddy sand shores
LMS.MS	MacAre	*Macoma balthica* and *Arenicola marina* in muddy sand shores
LMS.MS	MacAre.Mare	*Arenicola marina*, *Macoma balthica* and *Mya arenaria* in muddy sand shores
LMS.Zos		**Littoral *Zostera* (seagrass) beds**
LMS.Zos	Znol	*Zostera noltii* beds in upper to mid-shore muddy sand
LMU		**Littoral muds**
LMU.Sm		**Saltmarsh**
LMU.Sm	NVC SM8	*Salicornia* spp.
LMU.SMu		**Sandy mud shores**
LMU.SMu	HedMac	*Hediste diversicolor* and *Macoma balthica* in sandy mud shores
LMU.SMu	HedMac.Pyg	*Hediste diversicolor*, *Macoma balthica* and *Pygospio elegans* in sandy mud shores
LMU.SMu	HedMac.Mare	*Hediste diversicolor*, *Macoma balthica* and *Mya arenaria* in sandy mud shores

Higher code	Biotope code	Biotope
LMX		**Littoral mixed sediments**
LMX	MytFab	*Mytilus edulis* and *Fabricia sabella* in poorly-sorted muddy sand or muddy gravel shores
IR		**INFRALITTORAL ROCK (and other hard substrata)**
EIR		**Exposed infralittoral rock**
EIR.KFaR		**Kelp with cushion fauna, foliose red seaweeds or coralline crusts (exposed rock)**
EIR.KFaR	Ala	*Alaria esculenta* on sublittoral fringe bedrock
EIR.KFaR	Ala.Ldig	*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock
MIR		**Moderately exposed infralittoral rock**
MIR.KR		**Kelp with red seaweeds (moderately exposed rock)**
MIR.KR	Ldig	*Laminaria digitata* on moderately exposed or tide-swept sublittoral fringe rock
MIR.KR	Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock
MIR.KR	Ldig.Ldig.Bo	*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders
MIR.KR	Lhyp	*Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock
MIR.KR	Lhyp.Ft	*Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock
MIR.KR	Lhyp.Pk	*Laminaria hyperborea* park and foliose red seaweeds on moderately exposed lower infralittoral rock
MIR.KR	Lhyp.TFt	*Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock
MIR.SedK		**Sand or gravel-affected or disturbed kelp and seaweed communities**
MIR.SedK	XKScrR	Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock
SIR		**Sheltered infralittoral rock**
SIR.K		**Silted kelp (stable rock)**
SIR.K	Lsac	*Laminaria saccharina* on very sheltered infralittoral rock
SIR.K	Lsac.Ldig	*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock
SIR.K	Lsac.Ft	*Laminaria saccharina* forest on very sheltered upper infralittoral rock
SIR.K	Lsac.Pk	*Laminaria saccharina* park on very sheltered lower infralittoral rock
SIR.K	LsacRS	*Laminaria saccharina* on reduced or low salinity infralittoral rock

Higher code	Biotope code	Biotope
SIR.K	LsacRS.Psa	*Laminaria saccharina* and *Psammechinus miliaris* on reduced salinity grazed infralittoral rock
CR		**CIRCALITTORAL ROCK (and other hard substrata)**
MCR		**Moderately exposed circalittoral rock**
MCR.Bri		**Brittlestar beds**
MCR.Bri	Oph	*Ophiothrix fragilis* and/or *Ophiocomina nigra* beds on slightly tide-swept circalittoral rock or mixed substrata
SCR		**Sheltered circalittoral rock**
SCR.BrAs		**Brachiopod and solitary ascidian communities (sheltered rock)**
SCR.BrAs	AntAsH	*Antedon* spp., solitary ascidians and fine hydroids on sheltered circalittoral rock
SCR.BrAs	AmenCio	Solitary ascidians, including *Ascidia mentula* and *Ciona intestinalis*, on very sheltered circalittoral rock
SCR.BrAs	NeoPro	*Neocrania anomala* and *Protanthea simplex* on very sheltered circalittoral rock
SCR.Mod		**Sheltered *Modiolus* (horse-mussel) beds**
SCR.Mod	ModHAs	*Modiolus modiolus* beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata
		Circalittoral rock (other)
CR.FaV		**Faunal turfs (deep vertical rock)**
CR.Cv		**Caves and overhangs (deep)**
SS		**SUBLITTORAL SEDIMENTS**
IGS		**Infralittoral gravels and sands**
IGS.Mrl		**Maerl beds (open coast/clean sediments)**
IGS.Mrl	Lgla	*Lithothamnion glaciale* maerl beds in tide-swept variable salinity infralittoral gravel
IGS.FaG		**Shallow gravel faunal communities**
IGS.FaG	Sell	*Spisula elliptica* and venerid bivalves in infralittoral clean sand or shell gravel
IMS		**Infralittoral muddy sands**
IMS.Sgr		**Seagrass beds (sublittoral/lower shore)**
IMS.Sgr	Zmar	*Zostera marina/angustifolia* beds in lower shore or infralittoral clean or muddy sand

Higher code	*Biotope code*	*Biotope*
IMS.FaMS		**Shallow muddy sand faunal communities**
IMS.FaMS	EcorEns	*Echinocardium cordatum* and *Ensis* sp. in lower shore or shallow sublittoral muddy fine sand
CMS		**Circalittoral muddy sands**
CMS	AfilEcor	*Amphiura filiformis* and *Echinocardium cordatum* in circalittoral clean or slightly muddy sand
CMS	VirOph	*Virgularia mirabilis* and *Ophiura* spp. on circalittoral sandy or shelly mud
CMS	VirOph.HAs	*Virgularia mirabilis* and *Ophiura* spp. with hydroids and ascidians on circalittoral sandy or shelly mud with shells or stones
IMU		**Infralittoral muds**
IMU.MarMu		**Shallow marine mud communities**
IMU.MarMu	PhiVir	*Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud
IMU.MarMu	Ocn	*Ocnus planci* aggregations on sheltered sublittoral muddy sediment
CMU		**Circalittoral muds**
CMU	SpMeg	Seapens and burrowing megafauna in circalittoral soft mud
CMU	Beg	*Beggiatoa* spp. on anoxic sublittoral mud
IMX		**Infralittoral mixed sediments**
KSwMx		***Laminaria saccharina* (sugar kelp) and filamentous seaweeds (mixed sediment)**
KSwMx	LsacX	*Laminaria saccharina, Chorda filum* and filamentous red seaweeds on sheltered infralittoral sediment
IMX.Oy		**Oyster beds**
IMX.Oy	Ost	*Ostrea edulis* beds on shallow sublittoral muddy sediment
IMX.FaMx		**Shallow mixed sediment faunal communities**
IMX.FaMx	Lim	*Limaria hians* beds in tide-swept sublittoral muddy mixed sediment
CMX		**Circalittoral mixed sediments**
CMX	ModHo	Sparse *Modiolus modiolus*, dense *Cerianthus lloydii* and burrowing holothurians on sheltered circalittoral stones and mixed sediment
COS		**CIRCALITTORAL OFFSHORE SEDIMENTS**
COS	Sty	*Styela gelatinosa* and other solitary ascidians on sheltered deep circalittoral muddy sediment

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.

Appendix B Biotopes present in each area

The biotopes recorded in each area, using the data listed in Table 1, are summarised below; other biotopes noted in the text but not shown here come from additional published sources listed in the individual area summaries. Biotope codes are given according to MNCR classification version 97.06 (Connor *et al.* 1997a, b).

Numbers refer to the area summaries as follows:

1. Loch Ryan
2. Gareloch
3. Loch Long and Loch Goil
4. Holy Loch
5. Loch Striven, Loch Riddon and the Kyles of Bute
6. Loch Fyne
7. Campbeltown Loch (no data available)

Area	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Littoral rock							
YG	•		•	•	•	•	
Pra			•		•		
Ver.Ver	•		•		•	•	
BPat			•				
BPat.Cht			•			•	
BPat.Sem	•		•		•	•	
MLR						•	
PelB	•		•			•	
FvesB				•			
Fser.R	•			•		•	
Fser.Fser					•	•	
Fser.Fser.Bo						•	
XR			•			•	
Rho	•						
SLR						•	
F		•	•		•	•	
Pel		•	•	•	•	•	
Fspi	•	•	•	•	•	•	
Asc.Asc			•		•	•	
Asc.VS			•		•	•	
Fserr.VS			•		•	•	
FX					•		
BLlit			•				
FvesX	•		•		•	•	
AscX		•		•	•	•	
FserX	•		•	•	•	•	
FserX.T	•						
EphX	•		•			•	

Area	*1*	*2*	*3*	*4*	*5*	*6*	*7*
FcerX			•		•	•	
MytX	•	•	•		•	•	
Rkp				•			
G			•				
Cor	•			•		•	
FK			•			•	
SwSed	•						
Littoral sediment							
BarSh	•					•	
AEur						•	
S	•						
AP						•	
AP.P	•	•	•		•	•	
AP.Pon					•	•	
Ol					•		
LMS			•		•		
BatCor	•						
PCer	•	•	•	•	•	•	
MacAre		•	•	•	•	•	
MacAre.Mare						•	
Znol	•		•				
NVC SM8					•		
HedMac			•		•		
HedMac.Pyg						•	
HedMac.Mare	•		•			•	
LMX			•		•		
MytFab					•		
Sublittoral rock							
Ala.Ldig						•	
Ldig.Ldig			•		•	•	
Ldig.Ldig.Bo						•	
Lhyp.Ft	•		•				
Lhyp.Pk	•						
Lhyp.TFt					•		
XKScrR	•						
SIR						•	
Lsac.Ldig						•	
Lsac.Ft			•			•	
Lsac.Pk						•	
LsacRS.Psa		•	•	•	•	•	
Oph					•	•	
SCR						•	
AntAsH						•	
AmenCio			•		•	•	
NeoPro			•		•	•	
ModHAs			•			•	
FaV			•		•		
Cv			•				

Area	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Sublittoral sediment							
Mrl	?						
Lgla					•		
FaG						•	
Sell	•						
Zmar	•						
EcorEns	•				•	•	
AfilEcor						•	
VirOph					•	•	
VirOph.HAs			•			•	
PhiVir	•	•		•	•	•	
Ocn			•				
SpMeg		•	•	•	•	•	
Beg		•	•			•	
LsacX	•	•	•		•	•	
Ost	•						
FaMx						•	
Lim						•	
CMX						•	
ModHo		•	•	•	•	•	
Sty			•				

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.

Appendix C Species recorded

All taxa recorded during the surveys given in Table 1 are listed below; records of species noted in the text but not shown here come from additional published sources noted in the individual area summaries. Species nomenclature follows Howson & Picton (1997); that for higher plants follows Stace (1991) and that for lichens follows Purvis *et al.* (1992).

Numbers refer to the *area summaries* as follows:

1. Loch Ryan
2. Gareloch
3. Loch Long and Loch Goil
4. Holy Loch
5. Loch Striven, Loch Riddon & Kyles of Bute
6. Loch Fyne
7. Campbeltown Loch (no data available)

Porifera

Clathrina coriacea	6
Leucosolenia sp.	5, 6
Leucosolenia botryoides	3, 5, 6
Leucosolenia complicata	4, 5, 6
Scypha ciliata	5, 6
Grantia compressa	5, 6
Demospongiae indet.	1, 5, 6
Oscarella lobularis	3
Pachymatisma johnstonia	6
Suberites sp.	6
Suberites carnosus	1, 5, 6
Suberites ficus	1, 2, 3, 4, 5, 6
Polymastia boletiformis	6
Polymastia mamillaris	5, 6
Cliona celata	1, 6
Axinella infundibuliformis	6
Raspailia hispida	6
Eurypon clavatum	6
Halichondria bowerbanki	1, 6
Halichondria panicea	1, 2, 3, 4, 5, 6
Hymeniacidon perleve	1, 4, 5, 6
Rhaphidostyla kitchingi	6
Mycale sp.	5, 6
Mycale macilenta	2, 6
Mycale rotalis	5, 6
Esperiopsis fucorum	1, 5, 6
Myxilla sp.	1
Myxilla incrustans	1, 3, 5, 6
Iophonopsis nigricans	6
Iophon hyndmani	5, 6
Hymedesmia sp.	3, 4, 6
Hymedesmia pansa	3
Hymedesmia paupertas	5, 6
Haliclona sp.	6
Haliclona urceolus	3, 5, 6
Dysidea fragilis	3, 6
Aplysilla sp.	3
Halisarca dujardini	3, 6
Porifera indet. (crusts)	4

Cnidaria

Cyanea capillata	6
Aurelia aurita (schyphistomae)	3, 5, 6
Corymorpha nutans	3, 5, 6
Tubularia sp.	6
Tubularia indivisa	3, 5, 6
Tubularia larynx	3, 5, 6
Coryne muscoides	5
Coryne pusilla	3
Sarsia eximia	5
Eudendrium sp.	3, 4, 5, 6
Eudendrium ramosum	6
Bougainvillia ramosa	3, 4, 5, 6
Hydractinia echinata	1, 2, 3, 4, 5, 6
Clava sp.	6
Clava multicornis	5, 6
Lafoea dumosa	6
Halecium beanii	1, 5, 6
Halecium halecinum	1, 2, 3, 4, 5, 6
Halecium labrosum	6
Halecium muricatum	6
Aglaophenia pluma	5
Halopteris catharina	3, 4, 6
Kirchenpaueria pinnata	1, 3, 4, 5, 6
Kirchenpaueria similis	6
Nemertesia antennina	1, 6
Nemertesia ramosa	1, 5, 6
Plumularia setacea	1, 2, 3, 5, 6
Polyplumaria frutescens	6
Abietinaria abietina	1, 2
Diphasia pinaster	6
Dynamena pumila	1, 3, 4, 5, 6
Hydrallmania falcata	1, 3, 6
Sertularella gayi	6
Sertularella polyzonias	1, 5, 6
Sertularia argentea	1, 6

Campanularia sp.	6
Campanularia hincksii	6
Campanularia volubilis	3
Clytia hemisphaerica	5, 6
Gonothyraea loveni	6
Laomedea flexuosa	2, 3, 5, 6
Obelia sp.	1, 2, 3, 5, 6
Obelia dichotoma	3, 5, 6
Obelia geniculata	1, 2, 3, 5, 6
Obelia longissima	3, 5
Rhizocaulus verticillatus	3, 5, 6
Anthozoa indet.	6
Sarcodictyon roseum	3, 5, 6
Alcyonium digitatum	1, 2, 3, 4, 5, 6
Virgularia mirabilis	2, 3, 4, 5, 6
Cerianthus lloydii	1, 2, 3, 4, 5, 6
Pachycerianthus multiplicatus	3, 6
Epizoanthus couchii	3, 5
Gonactinia prolifera	3, 5, 6
Protanthea simplex	3, 5, 6
Actinia equina	1, 2, 3, 4, 5, 6
Actinia fragacea	5, 6
Anemonia viridis	5, 6
Bolocera tuediae	3, 6
Urticina felina	1, 2, 3, 5, 6
Urticina eques	3, 5, 6
Stomphia coccinea	5, 6
Metridium senile	1, 2, 3, 4, 5, 6
Sagartia elegans	1, 2, 3, 5, 6
Sagartia troglodytes	6
Cereus pedunculatus	1, 5
Sagartiogeton laceratus	2, 3, 4, 5, 6
Sagartiogeton undatus	1, 2, 3, 4, 6
Adamsia carciniopados	3, 5, 6
Peachia cylindrica	6
Edwardsiella carnea	3
Edwardsia claparedii	6
Corynactis viridis	6
Caryophyllia smithii	1, 3, 5, 6

Nemertea

Nemertea indet.	2, 5, 6
Cephalothrix linearis	6
Tubulanus annulatus	3, 5, 6
Tubulanus polymorphus	6
Lineus sp.	3, 6
Lineus longissimus	3, 4, 5, 6
Lineus ruber	6
Lineus viridis	6
Micrura aurantiaca	2, 3, 5, 6
Amphiporus lactifloreus	5, 6
Nipponnemertes pulcher	5
Emplectonema gracile	6
Malacobdella grossa	3

Nematoda

Nematoda indet.	1, 5, 6

Priapulida

Priapulida indet.	5

Sipuncula

Sipuncula indet.	5
Golfingia sp.	5
Phascolion strombus strombus	1
Amalosoma eddystonense	6
Maxmuelleria lankesteri	5, 6

Annelida

Aphrodita aculeata	3, 5, 6
Polynoidae indet.	4, 5, 6
Alentia gelatinosa	5, 6
Harmothoe sp.	1, 6
Harmothoe imbricata	1, 3, 4, 5
Harmothoe lunulata	4, 5, 6
Lepidonotus squamatus	3, 6
Pholoe inornata	6
Sigalion mathildae	5, 6
Eteone sp.	6
Eteone flava	1, 2, 4, 5, 6
Eteone longa	1, 3, 6
Anaitides maculata	1, 2, 3, 4, 5, 6
Anaitides mucosa	1, 3, 5, 6
Eulalia viridis	2, 5, 6
Eumida bahusiensis	1
Phyllodoce sp.	2, 6
Phyllodoce lamelligera	6
Phyllodoce laminosa	6
Glyceridae indet.	1
Glycera gigantea	6
Glycera tridactyla	3
Goniada maculata	3, 5
Sphaerodorum gracilis	6
Kefersteinia cirrata	2, 3, 5, 6
Nereimyra punctata	6
Ophiodromus flexuosus	3
Syllidia armata	1
Syllidae indet.	6
Streptosyllis websteri	1
Exogoninae indet.	6
Exogone hebes	1
Myrianida pinnigera	6
Hediste diversicolor	1, 3, 5, 6
Neanthes virens	1, 2, 3, 4, 5, 6
Nereis sp.	1
Nereis pelagica	3, 5, 6
Platynereis dumerilii	6
Nephtys sp.	1, 3, 5
Nephtys cirrosa	5, 6
Nephtys hombergii	1, 2, 3, 4, 5, 6
Nephtys longosetosa	6
Dorvillea sp.	6
Protodorvillea kefersteini	6
Leitoscoloplos sp.	1
Scoloplos armiger	1, 2, 3, 4, 5, 6
Aricidea sp.	1, 6
Levinsenia gracilis	1
Paraonis fulgens	6
Poecilochaetus serpens	5
Aonides oxycephala	6
Malacoceros fuliginosus	3, 4, 6
Malacoceros tetracerus	3
Polydora sp.	3, 6
Polydora ciliata	2, 3, 5, 6
Polydora cornuta	1, 3
Polydora quadrilobata	1
Pseudopolydora pulchra	1
Pygospio elegans	1, 2, 3, 4, 5, 6
Scolelepis squamata	4, 5, 6
Spio filicornis	1, 2, 3, 4, 5, 6
Spio martinensis	1, 3
Spiophanes bombyx	3, 6

Spiophanes kroyeri	3
Streblospio shrubsolii	2
Magelona mirabilis	6
Chaetopterus variopedatus	1, 3, 4, 5, 6
Chaetozone sp.	1
Chaetozone setosa	1, 6
Cirratulus sp.	6
Cirratulus cirratus	2, 3, 4, 5, 6
Cirriformia sp.	2
Cirriformia tentaculata	5
Psammodrilus balanoglossoides	6
Flabelligera affinis	3
Pherusa plumosa	2, 6
Capitellidae indet.	6
Capitella capitata	1, 3, 5, 6
Mediomastus fragilis	3, 6
Notomastus latericeus	1, 6
Arenicola sp.	5, 6
Arenicola marina	1, 2, 3, 4, 5, 6
Maldanidae indet.	1, 5
Euclymene sp.	1
Euclymene oerstedii	6
Rhodine gracilior	3
Ophelia limacina	5
Ophelia rathkei	3, 5, 6
Travisia forbesii	5, 6
Ophelina acuminata	5
Ophelina modesta	6
Polyphysia crassa	5, 6
Scalibregma inflatum	6
Galathowenia oculata	1
Owenia fusiformis	1, 3, 5
Lagis koreni	2, 5, 6
Pectinaria belgica	1, 5
Sabellaria spinulosa	5
Melinna palmata	1, 2, 3
Ampharete sp.	1
Ampharete grubei	2
Amphicteis gunneri	3
Terebellides stroemi	1
Terebellidae indet.	1, 3, 5, 6
Amphitrite sp.	2
Amphitrite cirrata	3
Eupolymnia nebulosa	1, 2, 3, 5, 6
Eupolymnia nesidensis	1
Lanice conchilega	1, 2, 3, 4, 5, 6
Neoamphitrite figulus	2
Thelepus cincinnatus	3
Sabellidae indet.	1, 3, 5, 6
Branchiomma bombyx	6
Chone sp.	1, 3, 6
Fabricia sabella	2, 3, 4, 5, 6
Laonome kroyeri	3
Myxicola infundibulum	1, 3, 4, 5, 6
Pseudopotamilla reniformis	6
Sabella pavonina	1, 2, 3, 5, 6
Hydroides norvegica	5, 6
Pomatoceros triqueter	1, 2, 3, 4, 5, 6
Serpula vermicularis	3, 5, 6
Protula tubularia	3, 4, 5, 6
Salmacina dysteri	6
Spirorbidae indet.	1, 3, 5, 6
Spirorbis sp.	1, 2, 3, 4, 5, 6
Spirorbis inornatus	6
Spirorbis rupestris	3
Spirorbis spirorbis	6
Oligochaeta indet.	3, 6
Tubificidae indet.	1
Tubifex sp.	5
Tubificoides sp.	6
Tubificoides benedii	3
Tubificoides pseudogaster	3
Lumbricillus lineatus	5

Pycnogonida

Pycnogonida indet.	1, 6
Phoxichilidium femoratum	5
Pycnogonum littorale	5

Crustacea

Cirripedia indet.	5, 6
Verruca stroemia	3, 4, 6
Chthamalus montagui	1, 3, 5, 6
Chthamalus stellatus	2, 3, 4, 5, 6
Semibalanus balanoides	1, 2, 3, 4, 5, 6
Balanus balanus	3, 5, 6
Balanus crenatus	1, 2, 3, 4, 5, 6
Balanus perforatus	2
Elminius modestus	2, 4, 6
Sacculina carcini	2, 3, 5, 6
Copepoda indet.	1, 6
Mysidae indet.	1, 2, 3, 5, 6
Hemimysis lamornae	6
Amphipoda indet.	1, 5, 6
Perioculodes longimanus	3, 5, 6
Pontocrates arenarius	5, 6
Leucothoe lilljeborgi	1
Hyale prevostii	5, 6
Hyale stebbingi	5
Orchestia sp.	2, 3, 4, 5, 6
Urothoe marina	5, 6
Harpinia crenulata	1
Perrierella audouiniana	6
Iphimedia sp.	6
Dexamine spinosa	3
Ampelisca brevicornis	1, 2, 3, 5, 6
Ampelisca tenuicornis	1
Bathyporeia sp.	1, 3, 5, 6
Bathyporeia guilliamsoniana	6
Bathyporeia pelagica	6
Bathyporeia pilosa	5
Haustorius arenarius	5
Gammaridae indet.	1, 2, 3, 4, 5, 6
Echinogammarus marinus	6
Echinogammarus stoerensis	6
Gammarus sp.	2, 6
Gammarus finmarchicus	5
Gammarus locusta	5, 6
Gammarus zaddachi	3, 5, 6
Megaluropus agilis	6
Melita sp.	3
Gammaropsis maculata	6
Gammaropsis nitida	6
Photis longicaudata	1
Ericthonius punctatus	6
Aora gracilis	6
Corophium sp.	1, 5, 6
Corophium crassicorne	3, 5, 6
Corophium volutator	1, 2, 3, 4, 5, 6
Caprellidae indet.	1, 4, 5, 6
Isopoda indet.	6

Eurydice affinis	6
Eurydice pulchra	5, 6
Jaera sp.	6
Jaera albifrons	2, 3, 5, 6
Idotea sp.	3, 5, 6
Idotea granulosa	4, 5, 6
Idotea neglecta	3
Idotea pelagica	5
Ligia oceanica	1, 3, 4, 5, 6
Tanaidacea indet.	1
Cumacea indet.	6
Eudorella truncatula	1
Campylaspis costata	6
Pseudocuma longicornis	6
Lamprops fasciata	2, 5, 6
Diastylidae indet.	6
Caridea indet.	1
Palaemon elegans	3, 5
Palaemon longirostris	5
Hippolyte varians	5, 6
Pandalina brevirostris	6
Pandalus montagui	3, 6
Crangon sp.	6
Crangon crangon	1, 2, 3, 4, 5, 6
Nephrops norvegicus	2, 3, 4, 5, 6
Calocaris macandreae	6
Jaxea nocturna	5
Callianassa subterranea	5, 6
Lithodes maia	3, 6
Paguridae indet.	6
Pagurus bernhardus	1, 2, 3, 4, 5, 6
Pagurus cuanensis	3, 5, 6
Pagurus prideaux	1, 3, 5, 6
Pagurus pubescens	5, 6
Galathea sp.	3
Galathea dispersa	3, 4, 6
Galathea intermedia	3, 4, 5, 6
Galathea nexa	6
Galathea squamifera	3, 5, 6
Galathea strigosa	1, 2, 3, 5, 6
Munida rugosa	3, 5, 6
Pisidia longicornis	1, 3, 4, 5, 6
Porcellana platycheles	1
Hyas sp.	5
Hyas araneus	2, 3, 4, 5, 6
Hyas coarctatus	3, 6
Inachus dorsettensis	5, 6
Inachus phalangium	1
Macropodia rostrata	1, 3, 5, 6
Eurynome aspera	4
Cancer pagurus	1, 2, 3, 5, 6
Liocarcinus sp.	2, 3, 4, 5, 6
Liocarcinus depurator	1, 2, 3, 4, 5, 6
Liocarcinus holsatus	1
Liocarcinus marmoreus	1
Liocarcinus pusillus	2, 3, 5
Necora puber	1, 2, 3, 4, 5, 6
Carcinus maenas	1, 2, 3, 4, 5, 6

Insecta

Insecta indet.	2, 6
Strigamia maritima	3
Petrobius maritimus	6
Anurida maritima	1, 2, 3, 4, 5, 6

Mollusca

Leptochiton asellus	2, 3, 4, 5, 6
Ischnochiton albus	3, 5, 6
Lepidochitona cinerea	1, 2, 3, 4, 5, 6
Tonicella sp.	3, 6
Tonicella marmorea	1, 3, 5, 6
Tonicella rubra	2, 3, 4, 5, 6
Callochiton septemvalvis	3
Emarginula sp.	6
Emarginula crassa	6
Emarginula fissura	5
Tectura sp.	6
Tectura testudinalis	1, 2, 3, 4, 5, 6
Tectura virginea	1, 2, 3, 4, 5, 6
Patella sp.	3, 6
Patella depressa	5
Patella ulyssiponensis	2, 3, 4, 5, 6
Patella vulgata	1, 2, 3, 4, 5, 6
Helcion pellucidum	1, 6
Osilinus lineatus	5
Jujubinus miliaris	6
Gibbula magus	6
Gibbula tumida	1, 3, 4, 5, 6
Gibbula cineraria	1, 3, 4, 5, 6
Gibbula umbilicalis	1, 3, 5, 6
Calliostoma zizyphinum	6
Lacuna pallidula	6
Lacuna vincta	1, 6
Littorina littorea	1, 2, 3, 4, 5, 6
Littorina mariae	3, 4, 5, 6
Littorina obtusata	1, 2, 3, 4, 5, 6
Littorina neglecta	1, 5
Littorina nigrolineata	3
Littorina saxatilis	1, 2, 3, 4, 5, 6
Melarhaphe neritoides	2, 3, 5, 6
Hydrobia ulvae	1, 2, 3, 4, 5, 6
Rissoa parva	5
Turritella communis	2, 3, 6
Aporrhais pespelecani	1, 2, 3, 5, 6
Capulus ungaricus	1, 3, 6
Trichotropis borealis	6
Calyptraea chinensis	5
Trivia arctica	5
Trivia monacha	5
Lamellaria perspicua	3
Velutina velutina	3
Polinices pulchellus	5, 6
Nucella lapillus	1, 2, 3, 4, 5, 6
Buccinidae indet.	3
Buccinum undatum	1, 2, 3, 4, 5, 6
Neptunea antiqua	3, 5, 6
Colus gracilis	6
Colus jeffreysianus	6
Hinia incrassata	5, 6
Hinia pygmaea	6
Hinia reticulata	1, 5, 6
Cylichna cylindracea	3
Philine sp.	1
Philine aperta	1, 3, 6
Retusa obtusa	2, 5
Pleurobranchus membranaceus	5, 6
Berthella plumula	3, 5
Tritonia hombergii	3, 6
Tritonia lineata	3, 6
Tritonia plebeia	3, 6

Dendronotus frondosus	1
Doto sp.	6
Doto coronata	6
Doto dunnei	6
Goniodoris nodosa	1
Onchidoris bilamellata	2, 3, 6
Onchidoris muricata	5
Limacia clavigera	1, 3, 6
Polycera quadrilineata	1
Cadlina laevis	5, 6
Doris verrucosa	5
Archidoris pseudoargus	1, 2, 3, 4, 5, 6
Geitodoris planata	5
Jorunna tomentosa	1
Janolus cristatus	1, 6
Hero formosa	6
Coryphella sp.	3
Coryphella browni	2, 3, 6
Coryphella gracilis	3
Coryphella lineata	2, 3, 5, 6
Flabellina pedata	3
Cuthona caerulea	6
Cuthona concinna	6
Tergipes tergipes	5
Eubranchus pallidus	6
Eubranchus tricolor	1, 6
Facelina sp.	6
Facelina bostoniensis	1, 2, 5, 6
Aeolidia papillosa	1, 4
Pelecypoda indet.	1, 5, 6
Nucula nitidosa	1, 3
Nucula sulcata	3
Nuculoma tenuis	3
Mytilus edulis	1, 2, 3, 4, 5, 6
Musculus sp.	1
Modiolus barbatus	3
Modiolus modiolus	1, 2, 3, 4, 5, 6
Limaria hians	6
Ostrea edulis	1
Palliolum striatum	3
Palliolum tigerinum	6
Pseudamussium septemradiatum	3, 6
Chlamys distorta	6
Chlamys varia	1, 3, 5, 6
Aequipecten opercularis	1, 2, 3, 4, 5, 6
Pecten maximus	1, 5, 6
Anomiidae indet.	3, 5, 6
Anomia ephippium	1, 6
Pododesmus patelliformis	3, 4, 5
Lucinoma borealis	5, 6
Thyasira flexuosa	1, 3
Mysella bidentata	2, 3
Tellimya ferruginosa	3
Astarte sulcata	2, 3
Tridonta elliptica	2, 3
Cardiacea indet.	1
Acanthocardia tuberculata	5
Parvicardium minimum	6
Cerastoderma edule	1, 2, 3, 4, 5, 6
Spisula elliptica	1
Spisula subtruncata	6
Lutraria lutraria	5
Ensis sp.	1, 3, 5, 6
Ensis arcuatus	5, 6
Ensis siliqua	6
Tellinacea indet.	1
Angulus tenuis	1, 2, 3, 5, 6
Fabulina fabula	3, 5, 6
Macoma balthica	2, 3, 4, 5, 6
Donax vittatus	6
Scrobicularia plana	1
Abra sp.	3, 5
Abra alba	1, 3
Abra nitida	1, 3
Arctica islandica	2, 3, 5
Circomphalus casina	5, 6
Dosinia sp.	6
Dosinia exoleta	5
Venerupis senegalensis	5, 6
Chamelea gallina	1, 5, 6
Clausinella fasciata	6
Mya sp.	6
Mya truncata	3, 5, 6
Mya arenaria	1, 2, 3, 5, 6
Corbula gibba	1
Hiatella arctica	1, 3, 5, 6
Thracia sp.	6
Thracia phaseolina	6
Cochlodesma praetenue	5
Sepiola atlantica	6
Rossia macrosoma	6

Brachiopoda

Neocrania anomala	3, 5, 6
Terebratulina retusa	6

Bryozoa

Crisiidae indet.	6
Filicrisia geniculata	6
Crisidia cornuta	5
Crisia aculeata	6
Crisia eburnea	1, 5
Alcyonidium diaphanum	1, 6
Alcyonidium gelatinosum	3, 4, 5, 6
Alcyonidium hirsutum	3, 5, 6
Flustrellidra hispida	3, 5, 6
Vesicularia spinosa	1
Bowerbankia imbricata	5, 6
Bowerbankia pustulosa	2, 3, 6
Ascophorina indet.	6
Umbonula littoralis	3, 5
Escharoides coccinea	6
Smittoidea sp.	6
Parasmittina trispinosa	1, 5, 6
Schizoporella unicornis	2
Schizomavella linearis	3, 6
Microporella ciliata	6
Celleporella hyalina	6
Cellepora pumicosa	1, 6
Celleporina hassallii	3, 5, 6
Turbicellepora avicularis	6
Eucratea loricata	1
Membranipora membranacea	1, 2, 3, 4, 5, 6
Electra pilosa	1, 3, 4, 5, 6
Flustra foliacea	1
Cellaria sp.	6
Cellaria fistulosa	6
Scrupocellaria sp.	1, 6
Scrupocellaria reptans	5
Scrupocellaria scruposa	4, 5, 6
Bicellariella ciliata	1

Bugula plumosa	1, 6
Bugula turbinata	1
Bryozoa indet. (crusts)	3, 4

Phoronida

Phoronis sp.	5, 6
Phoronis muelleri	3

Echinodermata

Antedon bifida	1, 5, 6
Antedon petasus	5, 6
Astropecten irregularis	5, 6
Luidia ciliaris	6
Porania pulvillus	5, 6
Asterina gibbosa	5
Anseropoda placenta	5
Solaster endeca	1, 5, 6
Crossaster papposus	1, 5, 6
Henricia sp.	1, 3, 5, 6
Henricia oculata	1, 3, 5, 6
Asterias rubens	1, 2, 3, 4, 5, 6
Leptasterias muelleri	2, 3
Marthasterias glacialis	1, 5, 6
Ophiothrix fragilis	1, 2, 3, 4, 5, 6
Ophiocomina nigra	3, 5, 6
Ophiactis balli	5
Ophiopholis aculeata	3, 4, 5, 6
Amphiura chiajei	3
Amphiura filiformis	3, 5, 6
Amphiura chiajei/filiformis	3, 5
Amphipholis squamata	1, 5, 6
Ophiura affinis	3, 6
Ophiura albida	1, 3, 4, 5, 6
Ophiura ophiura	3, 5, 6
Psammechinus miliaris	1, 2, 3, 4, 5, 6
Echinus esculentus	1, 3, 4, 5, 6
Echinocyamus pusillus	6
Echinocardium cordatum	1, 3, 5, 6
Brissopsis lyrifera	5
Leptopentacta elongata	3, 5
Paracucumaria hyndmani	3, 5
Pawsonia saxicola	5
Aslia lefevrei	1
Ocnus lacteus	6
Ocnus planci	3, 6
Thyone fusus	5
Neopentadactyla mixta	1, 6
Thyonidium drummondii	5
Psolus phantapus	3, 5
Leptosynapta inhaerens	6
Labidoplax digitata	5

Enteropneusta

Enteropneusta indet.	5

Tunicata

Clavelina lepadiformis	1, 3, 5, 6
Sidnyum turbinatum	6
Aplidium punctum	1, 6
Didemnidae indet.	3, 6
Trididemnum cereum	5, 6
Didemnum maculosum	6
Diplosoma listerianum	1, 3, 4, 5, 6
Diplosoma spongiforme	3
Ciona intestinalis	1, 2, 3, 4, 5, 6
Diazona violacea	6
Corella parallelogramma	3, 4, 5, 6
Ascidiella aspersa	1, 3, 4, 5, 6
Ascidiella scabra	1, 2, 3, 4, 5, 6
Ascidia conchilega	1, 3, 5, 6
Ascidia mentula	3, 4, 5, 6
Ascidia virginea	3, 4, 5, 6
Styela sp.	6
Styela clava	1
Styela gelatinosa	3
Polycarpa sp.	3
Polycarpa pomaria	3, 4, 6
Dendrodoa grossularia	1, 2, 3, 5, 6
Botryllus schlosseri	1, 2, 3, 5, 6
Botrylloides leachi	1, 2, 3, 4, 5, 6
Boltenia echinata	3, 6
Pyura microcosmus	5
Molgula manhattensis	6

Pisces

Scyliorhinus canicula	1, 3, 4, 5, 6
Raja batis	6
Conger conger	1, 5, 6
Apletodon dentatus	6
Diplecogaster bimaculata	6
Gadidae indet.	3
Ciliata mustela	3
Gadus morhua	3, 6
Pollachius sp.	3
Pollachius pollachius	3, 6
Pollachius virens	1, 3, 6
Raniceps raninus	3
Trisopterus luscus	1, 3, 6
Trisopterus minutus	6
Spinachia spinachia	3, 6
Syngnathus sp.	3
Syngnathus acus	1, 5
Syngnathus rostellatus	1
Myxocephalus scorpius	1, 2, 3, 4, 5, 6
Taurulus bubalis	2, 3, 5, 6
Agonus cataphractus	5, 6
Liparis sp.	6
Liparis liparis	5
Liparis montagui	5
Centrolabrus exoletus	3, 6
Crenilabrus melops	3
Ctenolabrus rupestris	1, 3, 5, 6
Labrus bergylta	1, 3, 6
Labrus mixtus	1, 6
Lipophrys pholis	1, 3
Parablennius gattorugine	3
Chirolophis ascanii	5, 6
Lumpenus lumpretaeformis	2, 3, 5, 6
Zoarces viviparus	3, 5
Pholis gunnellus	2, 3, 4, 5, 6
Ammodytes sp.	3
Ammodytes tobianus	1, 6
Callionymus sp.	3, 6
Callionymus lyra	1, 2, 3, 4, 5, 6
Callionymus reticulatus	2, 5
Gobiidae indet.	1, 2, 3, 6
Gobius sp.	3
Gobius niger	3, 6
Gobius paganellus	6
Gobiusculus flavescens	1, 2, 3, 5, 6
Lesueurigobius friesii	2, 3, 5, 6
Pomatoschistus sp.	1, 2, 3, 4, 5, 6

Pomatoschistus minutus	1, 2, 3, 5, 6
Pomatoschistus pictus	2, 3, 4, 5, 6
Thorogobius ephippiatus	1, 3, 5, 6
Scomber scombrus	6
Phrynorhombus norvegicus	2, 3, 5
Phrynorhombus regius	3, 6
Zeugopterus punctatus	3, 6
Pleuronectidae indet.	1, 2, 3, 5, 6
Hippoglossoides platessoides	6
Limanda limanda	2, 3, 5
Microstomus kitt	5
Platichthys flesus	2, 3, 5
Pleuronectes platessa	1, 3, 5, 6
Cyanophycota	
Beggiatoa sp.	2, 3, 4, 6
Rhodophycota	
Porphyropsis coccinea	5
Porphyra sp.	3, 4, 5, 6
Porphyra leucosticta	2, 5
Porphyra miniata	5
Porphyra purpurea	4, 5
Porphyra umbilicalis	1, 2, 3, 4, 5, 6
Audouinella sp.	1, 3, 6
Asparagopsis armata (*Falkenbergia*)	6
Bonnemaisonia asparagoides	1, 5, 6
Bonnemaisonia hamifera	6
Trailliella intricata	1, 3, 5, 6
Gelidium latifolium	6
Gelidium pusillum	1, 3, 5, 6
Palmaria palmata	2, 3, 4, 5, 6
Rhodophysema elegans	3
Dilsea carnosa	1, 5, 6
Dudresnaya verticillata	5
Dumontia contorta	1, 5
Callophyllis cristata	6
Callophyllis laciniata	1, 6
Peyssonnelia dubyi	3
Hildenbrandia sp.	1, 3, 4, 5, 6
Corallinaceae indet. (crusts)	1, 2, 3, 4, 5, 6
Corallina officinalis	1, 3, 4, 5, 6
Lithothamnion sp.	5, 6
?Lithothamnion corallioides	3, 6
Lithothamnion glaciale	1, 2, 3, 4, 5, 6
Phymatolithon calcareum	3
Phymatolithon lenormandii	2, 6
Gracilaria gracilis	1, 6
Ahnfeltia plicata	1, 3, 6
Phyllophora crispa	1, 6
Phyllophora pseudoceranoides	6
Erythrodermis traillii	6
Coccotylus truncata	6
Schottera nicaeensis	1, 6
Mastocarpus stellatus	1, 2, 3, 4, 5, 6
Chondrus crispus	1, 2, 3, 4, 5, 6
Polyides rotundus	1, 6
Plocamium cartilagineum	1, 6
Furcellaria lumbricalis	1, 6
Catenella caespitosa	5, 6
Cystoclonium purpureum	1, 6
Rhodophyllis sp.	6
Rhodophyllis divaricata	1, 6
Cruoria sp.	6
Cruoria pellita	3
Haemescharia sp.	5
Chylocladia verticillata	1, 3
Lomentaria sp.	6
Lomentaria articulata	1, 5, 6
Lomentaria clavellosa	1, 2, 3, 5, 6
Lomentaria orcadensis	1, 6
Antithamnion sp.	3, 5, 6
Antithamnionella sp.	3
Antithamnionella floccosa	4
Antithamnionella spirographidis	3, 4, 5, 6
Callithamnion sp.	3, 5, 6
Callithamnion corymbosum	3
Aglaothamnion hookeri	3
Callithamnion tetragonum	5
Callithamnion spp. (spongy)	4, 6
Ceramium sp.	1, 3, 5, 6
Ceramium nodulosum	1, 3, 4, 5, 6
Ceramium shuttleworthianum	3, 4, 6
Ceramium strictum	3
Compsothamnion thuyoides	1, 6
Griffithsia corallinoides	1, 6
Halurus flosculosus	1
Monosporus pedicellatus	3
Plumaria plumosa	5, 6
Pterothamnion plumula	1, 3, 5, 6
Ptilota gunneri	6
Scagelia boreale	3
Sphondylothamnion multifidum	6
Spyridia filamentosa	1
Acrosorium reptans	1
Apoglossum ruscifolium	6
Cryptopleura ramosa	1, 5, 6
Delesseria sanguinea	1, 3, 5, 6
Hypoglossum hypoglossoides	1, 6
Membranoptera alata	1, 3, 5, 6
Nitophyllum punctatum	1, 6
Phycodrys rubens	1, 2, 3, 4, 5, 6
Erythroglossum laciniatum	1
Heterosiphonia plumosa	6
Brongniartella byssoides	1, 4, 5, 6
Laurencia sp.	1
Osmundea hybrida	1, 4, 6
Osmundea pinnatifida	1, 6
Odonthalia dentata	1, 5, 6
Polysiphonia sp.	1, 2, 4, 5, 6
Polysiphonia atlantica	5, 6
Polysiphonia elongata	1, 2, 3, 5, 6
Polysiphonia lanosa	1, 2, 3, 5, 6
Polysiphonia fucoides	1, 2, 3, 4, 6
Polysiphonia stricta	3, 5, 6
Polysiphonia violacea	2, 3
Pterosiphonia parasitica	1, 5, 6
Rhodomela sp.	6
Rhodomela confervoides	1, 3, 6
Rhodophycota indet. (non-calcareous crusts)	1, 2, 3, 4, 5, 6
Chrysophycota	
Diatoms - film	1, 2, 3, 5, 6
Chromophycota	
Ectocarpaceae indet.	1, 3, 4, 5, 6
Ectocarpus fasciculatus	6
Pilayella littoralis	2, 3, 5, 6
Spongonema tomentosum	3
Pseudolithoderma extensum	3, 5

Ralfsia sp.	4
Elachista sp.	1, 3, 4, 5, 6
Elachista fucicola	1, 3, 6
Leathesia difformis	5, 6
Chordaria flagelliformis	5, 6
Eudesme virescens	5
Cutleria multifida	1, 3, 6
Aglaozonia sp. (asexual *Cutleria*)	1, 5, 6
Sphacelaria sp.	1, 3, 6
Sphacelaria cirrosa	4
Sphacelaria fusca	3
Halopteris filicina	6
Cladostephus spongiosus	1, 3, 6
Dictyota dichotoma	1, 5, 6
Sporochnus pedunculatus	1
Desmarestia sp.	6
Desmarestia aculeata	1, 3, 4, 5, 6
Desmarestia ligulata	1, 6
Desmarestia viridis	5, 6
Arthrocladia villosa	1
Asperococcus fistulosus	3, 5, 6
Petalonia fascia	3, 5, 6
Scytosiphon lomentaria	1, 3, 5, 6
Chorda filum	1, 3, 5, 6
Laminaria sp.	4, 5, 6
Laminaria digitata	1, 2, 3, 5, 6
Laminaria hyperborea	1, 2, 3, 5, 6
Laminaria saccharina	1, 2, 3, 4, 5, 6
Saccorhiza polyschides	1, 6
Alaria esculenta	5, 6
Ascophyllum nodosum	1, 2, 3, 4, 5, 6
Fucus sp.	6
Fucus ceranoides	3, 5, 6
Fucus serratus	1, 2, 3, 4, 5, 6
Fucus spiralis	1, 2, 3, 4, 5, 6
Fucus vesiculosus	1, 2, 3, 4, 5, 6
Pelvetia canaliculata	1, 2, 3, 4, 5, 6
Himanthalia elongata	6
Halidrys siliquosa	1, 2, 3, 5, 6
Chromophycota indet. (crusts)	3, 5

Chlorophycota

Enteromorpha sp.	1, 3, 4, 5, 6
Enteromorpha intestinalis	5, 6
Enteromorpha linza	5
Ulva sp.	1, 2, 3, 5, 6
Ulva rigida	3, 4
Prasiola stipitata	3, 4, 5
Spongomorpha sp.	3, 5
Chaetomorpha sp.	5, 6
Chaetomorpha capillaris	1, 6
Chaetomorpha melagonium	6
Cladophora sp.	1, 3, 5, 6
Cladophora pellucida	5
Cladophora rupestris	1, 3, 4, 5, 6
Rhizoclonium sp.	4, 6
Rhizoclonium riparium	3, 5
Bryopsis plumosa	1, 3, 5, 6
Codium sp.	1

Angiospermae

Zostera sp.	1
Zostera marina	1, 6
Zostera angustifolia	1
Zostera noltii	3

Lichens

Anaptychia fusca	1, 3
Caloplaca sp.	6
Caloplaca marina	1, 3, 4, 5, 6
Caloplaca thallincola	1, 3, 4, 6
Lecanora atra	1, 3, 6
Lichina confinis	1, 6
Lichina pygmaea	5, 6
Ramalina sp.	1, 3, 5, 6
Verrucaria maura	1, 3, 4, 5, 6
Verrucaria microspora	6
Verrucaria mucosa	1, 3, 4, 5, 6
Xanthoria parietina	1, 3, 4, 5, 6
Grey lichens indet.	1, 3, 4, 5, 6

References

Howson, C.M., & Picton, B.E. *eds.* 1997. *The species directory of the marine fauna and flora of the British Isles and surrounding seas.* Belfast/Ross-on-Wye, Ulster Museum and Marine Conservation Society. (Ulster Museum Publication, No. 276.)

Purvis, O.W., Coppins, B.J., Hawksworth, D.L., James, P.W., & Moore, D.M., *eds.* 1992. *The lichen flora of Great Britain and Ireland.* London, Natural History Museum and British Lichen Society.

Stace, C. *ed.* 1991. *New flora of the British Isles.* 1st ed. Cambridge, Cambridge University Press.