



LOCH ROAG SEASEARCH 2002

MARCH 29TH – APRIL 4TH 2002

REPORT

CHRISTINE HOWSON & CALUM DUNCAN

FEBRUARY 2003

A REPORT TO SCOTTISH NATURAL HERITAGE



Photo: Calum Duncan

Seasearch participants, Loch Roag March 2002



LOCH ROAG SEASEARCH 2002

March 29th – April 4th 2002

**Report to
SCOTTISH NATURAL HERITAGE**

Christine M. Howson
'Amisfield'
Main Street
Ormiston
East Lothian
EH35 5HS

Tel. 01875 613256

Calum Duncan
Marine Conservation Society
3 Coates Place
EDINBURGH
EH3 7AA

Tel. 0131 226 6360

SURVEY TEAM

SURVEY ORGANISERS

Marion Perutz, Katy Nicholson,
Ben Panter
Calum Duncan

Edinburgh University Sub-Aqua Club
Marine Conservation Society

SURVEY MEMBERS

Expedition Leader

Marion Perutz

EUSAC

Diving Supervisors

Katy Nicholson, Safety Officer
Ben Panter, Logistics Officer
Fiona Mathers, Diving Officer

EUSAC
EUSAC
BS-AC South Scotland Coach

Divers

Ken Brown
Sandra Castro
Calum Duncan, photographer
Jan Gold
Jason Hall-Spencer, photographer
Ken Ingles
Sheena Ingles
Alan McIlwaine
Jonathan Phillips, photographer
Graham Saunders, photographer
Paul Tyler, photographer

Civil Engineer
BSAC 21/North Berwick RNL
Marine Conservation Society
Lewis and Harris S-AC
University of Glasgow
Lewis and Harris S-AC
Lewis and Harris S-AC
Lewis and Harris S-AC
BSAC 21/North Berwick RNL
Scottish Natural Heritage
Lewis and Harris S-AC

CONTENTS

SYNOPSIS.....	4
1 INTRODUCTION	5
1.1 Background to survey	5
1.2 Loch Roag	5
1.3 SEASEARCH	6
2 PREVIOUS WORK in the area	7
3 METHODS.....	7
3.1 Survey facilities.....	7
3.2 Site selection and position fixing	8
3.3 Survey techniques	8
3.4 Data analysis	9
4 RESULTS	9
5 DISCUSSION	16
5.1 Biotope codes.....	16
5.2 Distribution of biotopes	16
5.2.1 Rocky infralittoral.....	16
5.2.2 Rocky circalittoral	18
5.2.3 Sediments	20
5.3 Interesting species.....	21
6 CONCLUSIONS	21
7 REFERENCES	21
8 ACKNOWLEDGEMENTS.....	22
APPENDIX 1.....	23
APPENDIX 2.....	26
APPENDIX 3.....	29
APPENDIX 4.....	30

SYNOPSIS

Seasearch is a programme of Phase 1 marine biological survey, developed by the Marine Conservation Society and the Joint Nature Conservation Committee, designed to give sports divers an opportunity to participate in marine biological surveys, and to contribute to the information from an area by recording habitats and species. Following a successful Seasearch weekend in Loch Goil in 2001, members of Edinburgh University Sub-Aqua Club (EUSAC) wanted to mount a Seasearch expedition to a more remote region of Scotland and the Isle of Lewis and in particular the outer parts of Loch Roag were selected.

The survey was carried out by 15 divers, from EUSAC, Lewis and Harris Sub-Aqua Club, Edinburgh, Glasgow and North Berwick between March 29th – April 4th 2002. Seasearch recording forms were completed for 42 sites; 37 of these were in and around Loch Roag and the remaining 5 were outside Stornoway Harbour. 23 biotopes were recognised, and their distribution mapped. A species list has been compiled and CD-Roms of photographs produced.

The range of biotopes recorded is typical for sheltered sealoch systems, with a gradation from outer, wave-exposed sites with *Laminaria hyperborea* forest to the sheltered inner loch with *Laminaria saccharina* forest. At the loch entrance there are cliffs with jewel anemones, plumose anemones and rich turfs of bryozoans and ascidians ending in coarse sandy sediments at about 30 m depth, whilst in the inner areas silted rock slopes support encrusting algae and ascidians, and give way to mixed muddy sediments at a fairly shallow depth.

Interesting species recorded on the survey include the cotton spinner *Holothuria forskali*, a sea cucumber with a predominantly southern distribution in the British Isles which is found only sporadically on the west coast of Scotland. The starfish *Stichastrella rosea* was also recorded. This is a starfish with a northern distribution in the British Isles which is occasionally found on exposed western coasts.

This survey successfully filled in a number of the gaps in survey coverage in Loch Roag, with a particular emphasis on the outer loch and open coast. The survey was not designed to collect detailed information on species distributions. However, it has proved possible to assign at least provisional biotopes to most of the records. These compare well with those recorded from earlier surveys with the project extending considerably the distribution of the more exposed biotope categories in the area.

1 INTRODUCTION

1.1 Background to survey

The Isle of Lewis contains a spectacular variety of unspoilt marine communities. From rocky coasts exposed to the full might of the Atlantic swell to the sheltered lagoon complexes of Loch Roag, Lewis offers excellent examples of a range of marine habitats. A number of surveys of both the shores and subtidal zones have been carried out in Loch Roag since the late 1970's but none of these managed to survey many of the more exposed outer parts of the loch. Following a successful Seasearch weekend in Loch Goil in 2001, Edinburgh University Sub-Aqua Club wanted to mount a Seasearch expedition to a more remote region of Scotland and the Isle of Lewis and in particular the outer parts of Loch Roag were selected.

1.2 Loch Roag

Loch Roag on the west coast of Lewis is the largest loch system in the Western Isles and is broadly composed of five subsidiary lochs and a large number of islands. There are a number of lagoonal systems attached to Loch Roag, from almost fully saline basins such as Tob Valasay, to a number of brackish sites such as Loch Shader and Ob Cheannullag, and these provide examples of a wide range of salinities and salinity gradients. These lagoons, grouped as the East and West Loch Roag lagoon system, are of particular conservation importance and the system has been proposed as a candidate marine Special Area of Conservation (SAC). The loch complex includes shores with every grade of wave exposure from the fully exposed sandy beaches and steep cliffs outside the loch, to fully sheltered mud and rock in the inner reaches, where there is local brackish influence. There are numerous tidal channels of varying current strengths which add considerably to the interest.

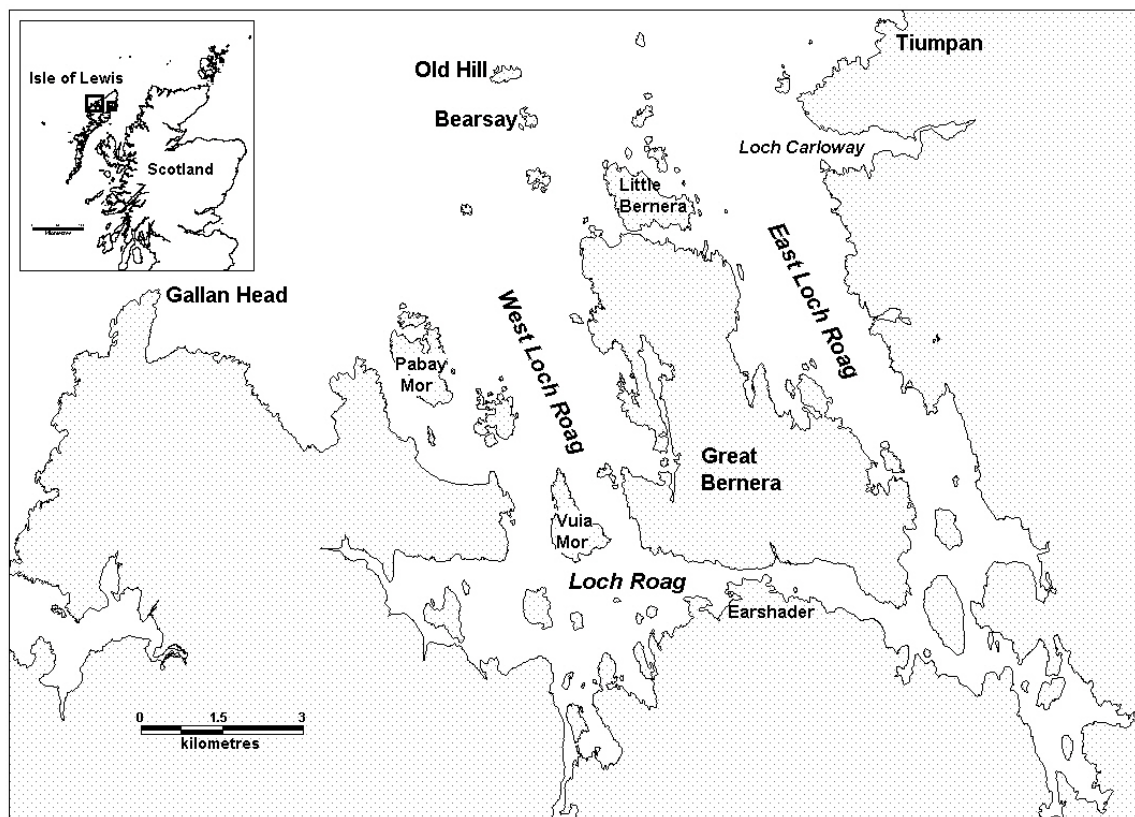


Figure 1 Location of survey area

The loch complex contains a wide variety of sublittoral habitats, many of which are good representatives of typical Scottish types. Several narrow channels with strong currents are of particular interest and support between them many important communities. The sponge *Halichondria panicea* and the anemones *Sagartia elegans* and *Metridium senile* are frequent and the channel beneath Bernera bridge supports a horse mussel *Modiolus modiolus* bed with many red algae and hydroids. A wide range of sublittoral sediment habitats are found in Loch Roag supporting the algae *Chorda filum* and *Laminaria saccharina* in shallow water with the tubeworms *Lanice conchilega* and *Chaetopterus variopedatus*, the sea pen *Virgularia mirabilis* and the top shell *Gibbula magus*, and the bivalve *Arctica islandica* in deeper water. There are rich examples of eel grass *Zostera marina* and tasselweed *Ruppia* sp. in the sheltered shallow areas within the loch complex, and a maerl bed on tide-swept coarse sediments in the narrows of Tob Valasay. Within the sheltered inner loch complex, the shores of Loch Ceann Hulavig and Little Loch Roag support beds of the unattached form of knotted wrack *Ascophyllum nodosum* *ecad mackaii*.

The more exposed outer areas of the loch are characterised by boulder and rock reefs often forming vertical faces supporting rich hydroid and bryozoan turf communities with abundant *Alcyonium digitatum* and *Corynactis viridis* dropping to coarse sediment plains. The sponge *Axinella infundibuliformis* is present attached to the rock and boulders, while the crawfish *Palinurus elephas* has been observed on the open cliff faces.

1.3 SEASEARCH

Seasearch is an underwater habitat surveying project for recreational SCUBA divers in the UK, extending to approximately five miles off the coast within depths of about 30 m. With over 16,000 km of coastline in Scotland alone, vast tracts of our inshore seabed remain unsurveyed. Simple but accurate seabed observations recorded by divers can help map the various kinds of habitats and marine life surrounding Scotland. Through Seasearch, recreational divers can therefore make a real contribution to marine conservation in Scotland. Collation of baseline habitat data from Seasearch volunteers can form the precursor to specialised professional surveys in newly identified areas of interest.

With a growing baseline of knowledge gathered into a national database it is possible to identify which seabed types are most widespread, where there are unusual or important underwater features, and which species of marine wildlife are rarest or most abundant. Records from frequently visited sites will also help to identify where changes may be occurring. This information is vital in providing a framework for management decisions and conservation activities to protect and enhance our marine environment.

A National Seasearch Steering Group (NSSG) was established in 1999 to develop the potential of the project. The NSSG members include statutory conservation bodies (Scottish Natural Heritage, English Nature, Countryside Council for Wales and Joint Nature Conservation Committee), the Environment Agency, Non-Governmental Organisations (Marine Conservation Society and The Wildlife Trusts), the Marine Biological Association (MarLIN), diver training organisations (BSAC, SSAC, PADI and SAA), the Nautical Archaeology Society and independent marine life experts. The Marine Conservation Society with the support of Scottish Natural Heritage is responsible for coordinating Seasearch activities in Scotland. The Loch Roag expedition was an excellent opportunity to use the Seasearch Surveyor and Observer forms also being piloted throughout the UK in 2002.

2 PREVIOUS WORK IN THE AREA

The Underwater Conservation Society carried out a survey of Loch Roag in 1982, sampling 43 sites in the area (Dipper, 1983). A further 10 sites were surveyed by the Oil Pollution Research Unit (Rostron, 1984) and the Marine Nature Conservation Review lagoons study (Thorpe *et al.*, 1998). These surveys visited some sites at the loch entrance but concentrated on the central and inner parts of the loch, perhaps due to the considerable wave exposure of the outer loch. They found a wide range of types of kelp forest, with tide-swept forest in some of the inner channels as well as on the outermost headlands. Kelp forest in the central part of the loch was a mixture of grazed and non-grazed *Laminaria hyperborea* forest whilst in the inner loch there was a forest of mixed kelp species with *L. hyperborea* and *Laminaria saccharina* growing as cape-form plants. At several moderately exposed sites in the outer loch, where rock bordered sand, there were scoured variants of kelp forest with *Halidrys siliquosa* present (HalXK, XKScrR). This distribution of kelp forest types is highly characteristic of sea lochs, with a transition from wave-exposed to wave-sheltered conditions.

There was relatively little circalittoral rock recorded, perhaps due to the difficulties of reaching the more exposed sites where deeper rock is more extensive. At the loch entrance, rock faces reached 30 m where a sand plain began. Within the loch, this rock-sediment boundary became rapidly shallower with increasing shelter, being in the region of 10–15 m at a few sites in the central loch and generally only a few metres deep in the innermost sections. Rock within the loch was generally species-poor, dominated by species such as the cup coral *Caryophyllia smithii*, the tube worm *Pomatoceros triqueter*, encrusting coralline algae and the ascidians *Asciidiella aspersa* and *Ciona intestinalis*. Rock faces in the outer loch supported the jewel anemone *Corynactis viridis*, plumose anemones *Metridium senile* and large sponges such as *Pachymatisma johnstonia* and *Cliona celata*.

Sediments became increasingly muddy with distance into the loch. At the loch entrance, there was coarse sand at the base of the rock whilst in the central and inner loch there was mixed muddy sediment supporting seapens *Virgularia mirabilis*. The horse mussel *Modiolus modiolus* was found at a number of sites in channels in the inner loch. Other features of note found during these surveys included a bed of *Zostera marina* at Kyles Pabay in West Loch Roag and another in the eastern part of the Tob Valasay lagoon. Maerl was recorded from the Tob Valasay narrows.

3 METHODS

3.1 Survey facilities

The Seasearch survey was carried out over the period of 28 March – 6 April 2002, with a team of divers from Edinburgh University Sub-Aqua Club (EUSAC) joined by other divers from Edinburgh, Glasgow and Lewis. Some of the team had previous experience of Seasearch, and three were professional marine biologists. An introduction to Seasearch and the recording methods to be used, aimed primarily at those with no prior experience, was given to the team members by Calum Duncan at the start of the survey.

Two rigid inflatable boats (RIB) were used, provided and coxed by Ken Brown and Alan McIlwaine. Air was supplied by the Lewis and Harris Sub-Aqua Club. Visitors in the survey team stayed in caravan accommodation at the Laxdale Holiday Park, Stornoway. The project was part-financed by a grant from the Edinburgh University Alumni Fund, on the basis of a grant proposal refereed and supported by Calum Duncan of the Marine Conservation Society.



Photo: Calum Duncan

Survey boats in Loch Roag

3.2 Site selection and position fixing

Sites from the earlier surveys of the area were plotted to provide a basis for selecting further sites from Admiralty Chart no. 2515, with the primary aim of filling in unsurveyed gaps whilst providing a spread of sites around the main habitat types. Weather conditions influenced the site selection and enabled many of the more exposed areas of the outer loch and loch entrance to be visited. In addition, five sites were visited on the east of the island at the entrance to Stornoway Harbour.

Positions were taken with GPS on the RIBs and were also marked onto copies of the Admiralty chart.

3.3 Survey techniques

Divers worked in pairs with the divers descending to the deepest depth of the dive where they then began recording the main habitat features and prominent species, using underwater writing boards. Ascending up the slope in a predetermined direction, usually directly towards the shore, they stopped to record different habitats and the most conspicuous species, noting the depth at which changes occurred. Species were recorded according to the diver's capabilities. The information was later transferred to Seasearch Stage 1 Observer forms (Appendix 1) which have since evolved into the Seasearch Observer form. This is the basic Seasearch survey form, requiring details of the site location, a sketch of the underwater terrain and some basic information about the types of seabed and plant or animal cover present. It also allows divers to record as many species as they are able and asks for the presence of selected key species. More details of these methods are included in the Seasearch Observer Course participant pack.

Few specimens were collected as logistics on this survey did not include facilities for identification or specimen preservation. However, field guides were available to assist with species recognition and biologists on the survey were able to help with identifying specimens in the field. Underwater photographs were taken by Calum Duncan, Jonathon Phillips, Paul Tyler and Graham Saunders whilst video footage was taken at some sites by Jason Hall-Spencer.

3.4 Data analysis

During the evening following the dives, a list of sites surveyed with their location was compiled and species recorded were entered into an Excel spreadsheet. Upon completion of the survey depths on the recording forms were corrected to Chart Datum using a Windows tidal programme. The survey forms were examined and biotope codes according to the Marine Nature Conservation Review (MNCR) manual (Connor *et al.*, 1997) were assigned to habitat descriptions where possible, although sometimes the data were inadequate for this task (see discussion). Biotopes from the MNCR database which had previously been recorded in the area were used to help in this task.

The following series of Excel spreadsheets was compiled from the information recorded on the survey forms as presence/absence, the species recorded and the biotopes allocated:

- Site information including site location and biotope codes;
- Species list;
- Seabed types;
- Life forms;
- Important species.

These lists were imported into the MapInfo® Geographical Information System (GIS), along with locations of biotopes recorded at previous survey sites. This enabled the sites and features recorded to be mapped and compared directly with earlier data.

4 RESULTS

Survey forms were completed for 42 sites; 37 of these were in and around Loch Roag and the remaining 5 were outside Stornoway Harbour. Their positions are listed in Appendix 2 and are shown in Figures 2 and 3, which also show sites surveyed by previous workers.

Twenty three biotopes (Connor *et al.*, 1997) were assigned provisionally to habitats at the sites surveyed. As this exercise was based on limited information, the biotope identifications should be treated with caution. These are listed in Appendix 3; the site list in Appendix 2 lists the sites with their associated biotopes and other data. More detailed descriptions of the biotopes are given in Connor *et al.* (1997) and are not repeated here. Appendix 4 lists the species recorded.

Figures 4 and 5 show the distribution in the loch of the major biotopes, and compare these with previous records. The recording forms ask surveyors to record the presence of several key species. The following were found during the survey:

- *Necora puber*
- *Echinus esculentus*
- *Holothuria forskali*
- *Crossaster papposus*
- *Sabella pavonina*
- *Marthasterias glacialis*
- *Porania pulvillus*

Their distribution is shown in Figure 6. Finally, Figure 7 shows the distribution of substrata types as recorded on the survey forms.



Photo: Paul Tyler

Black sea cucumber, *Holothuria forskali* (Site 42, East Loch Roag)



Photo: Graham Saunders

Spiny starfish *Marthasterias glacialis* on infralittoral rock (Site 17, E of Berasay)



Photo: Calum Duncan

Velvet swimming crab *Necora puber* (Site 19, Old Hill)

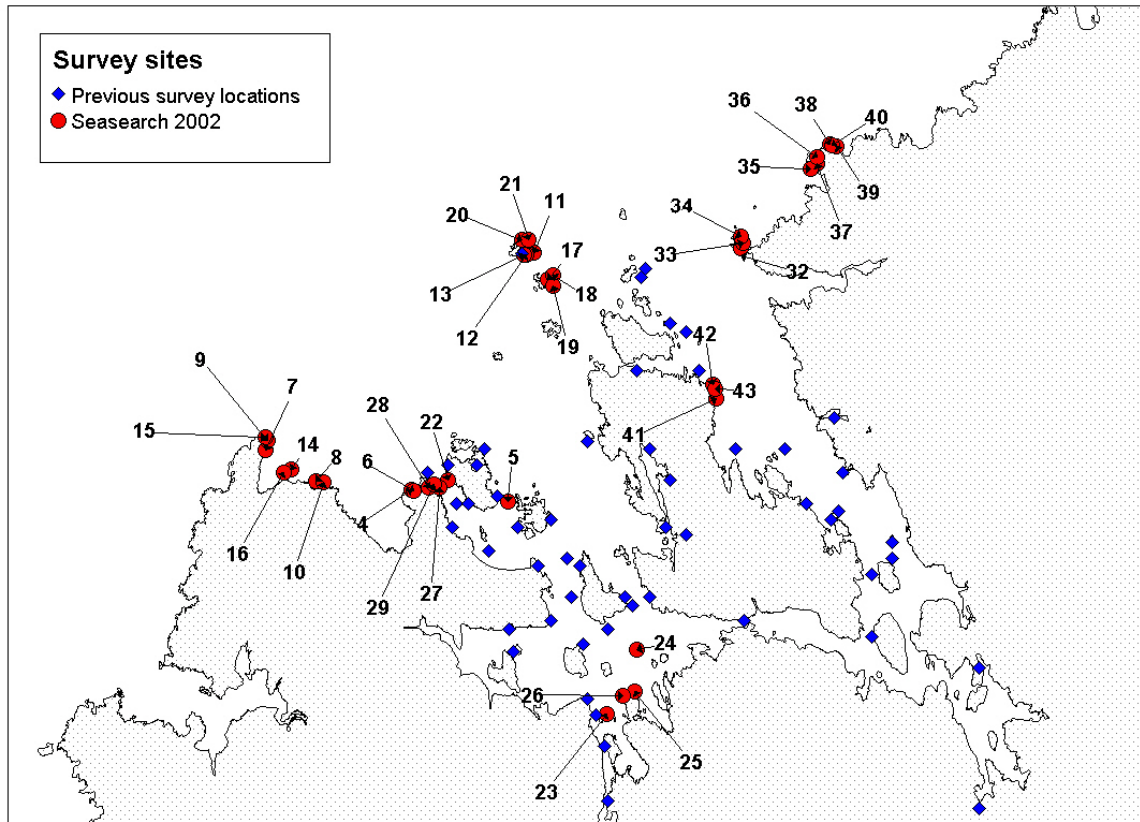


Figure 2 Survey sites in Loch Roag

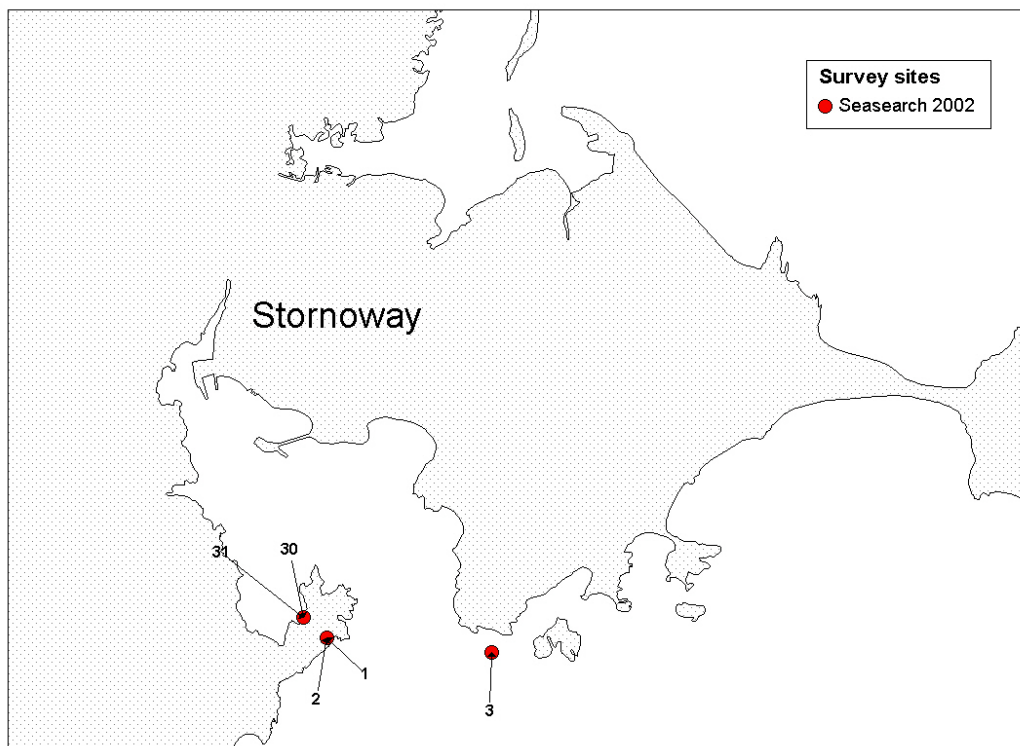


Figure 3 Survey sites at Stornoway

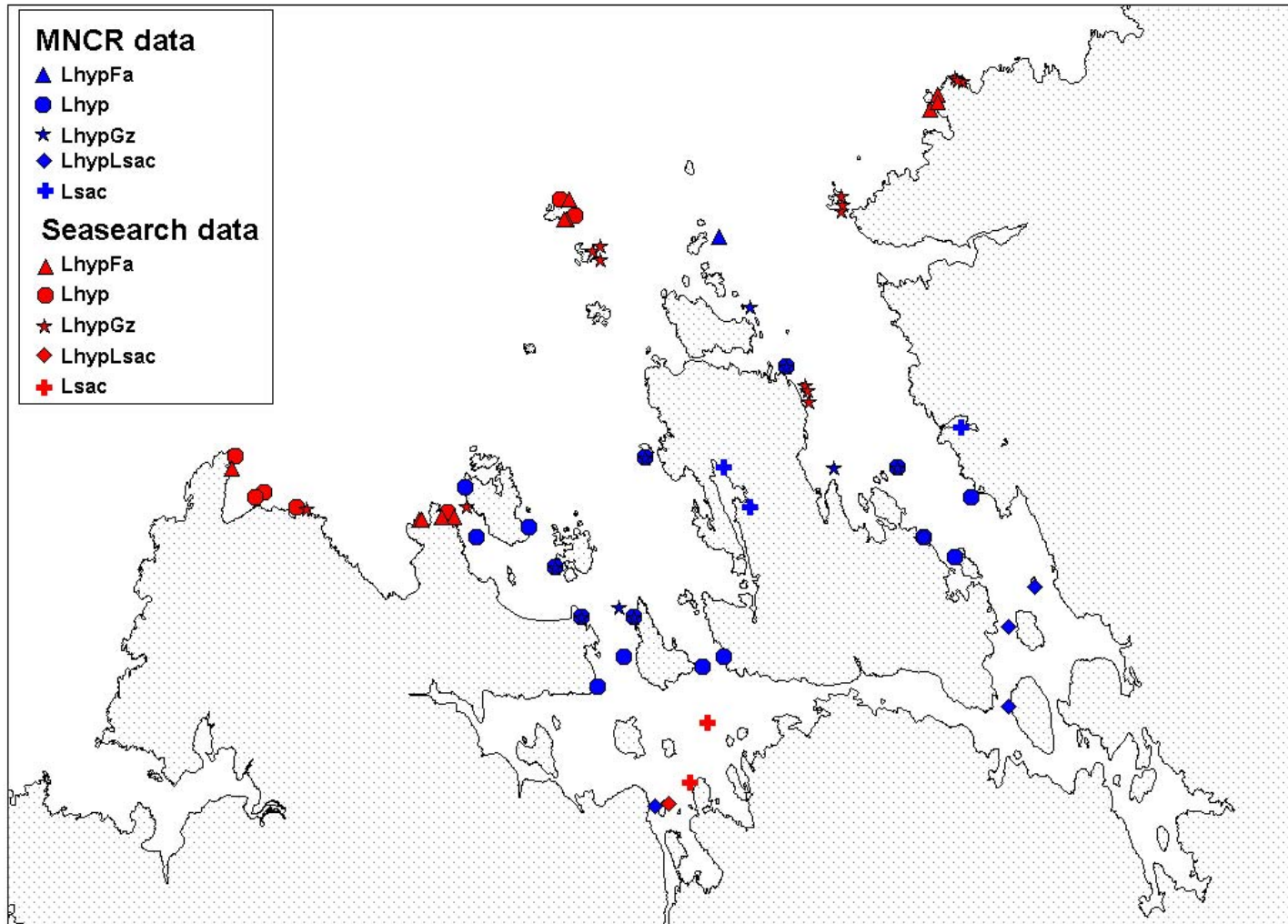


Figure 4 Distribution of major kelp forest biotopes

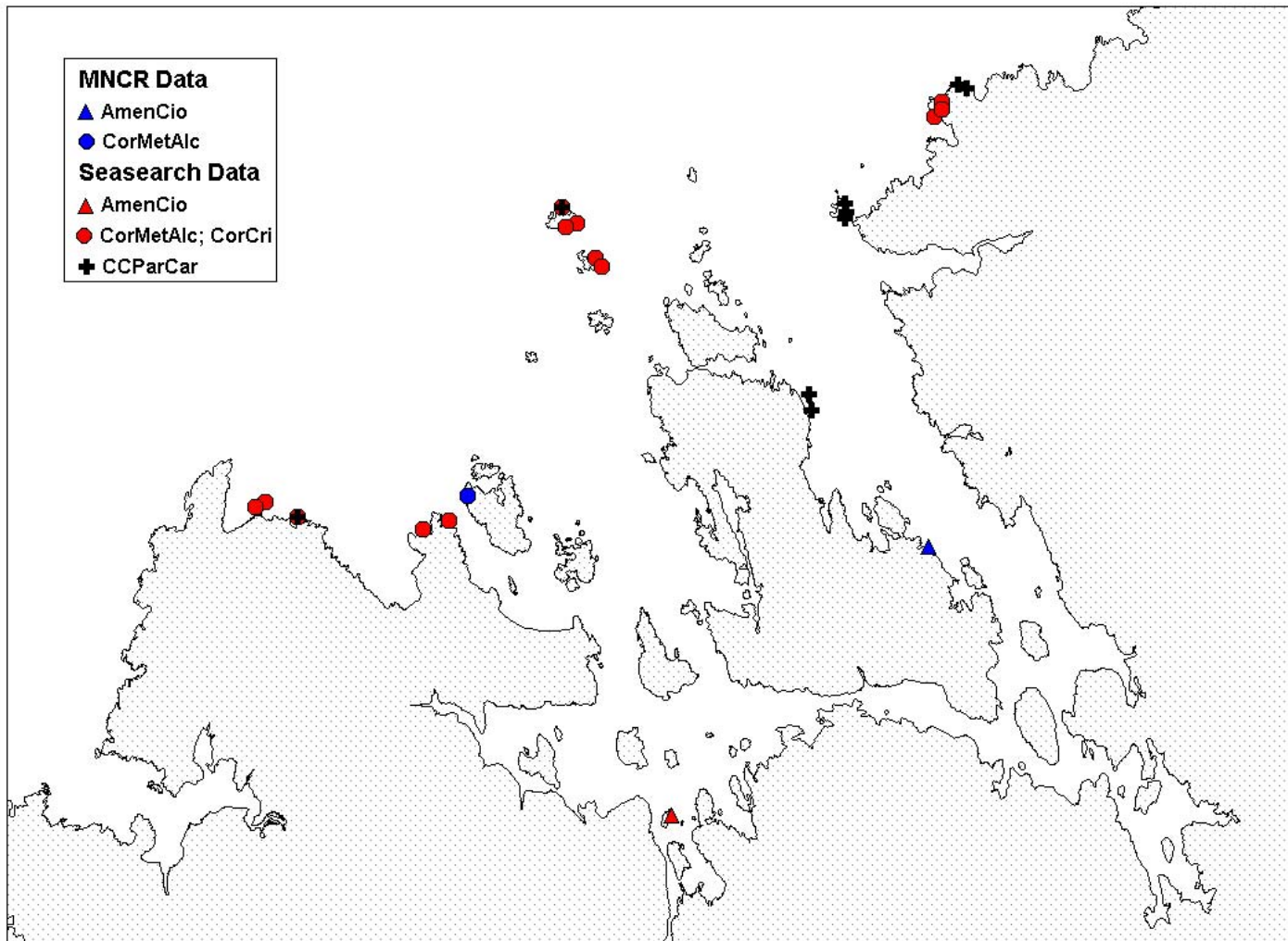


Figure 5 Distribution of major circalittoral biotopes

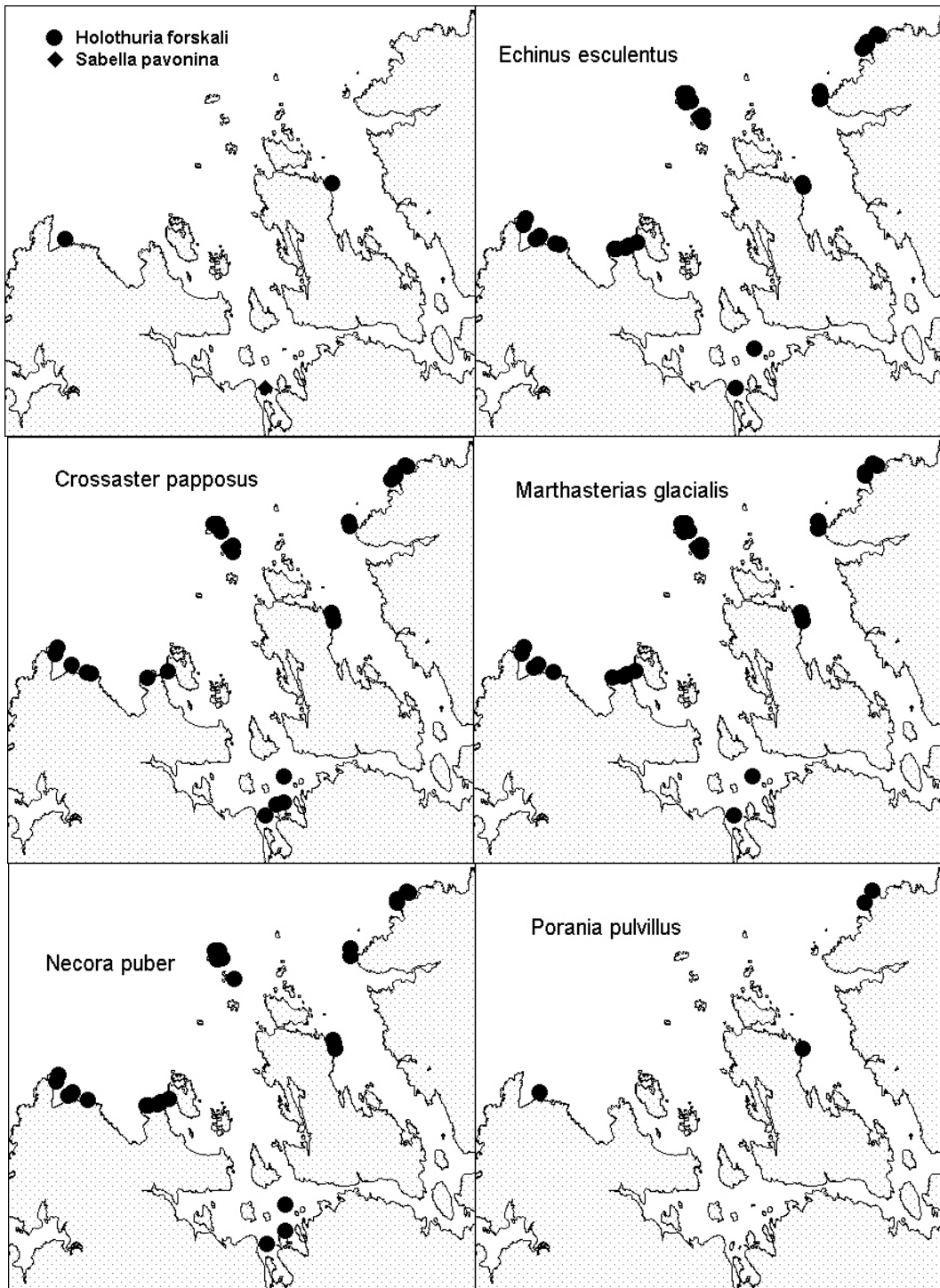


Figure 6 Distribution of important species recorded on Seasearch forms

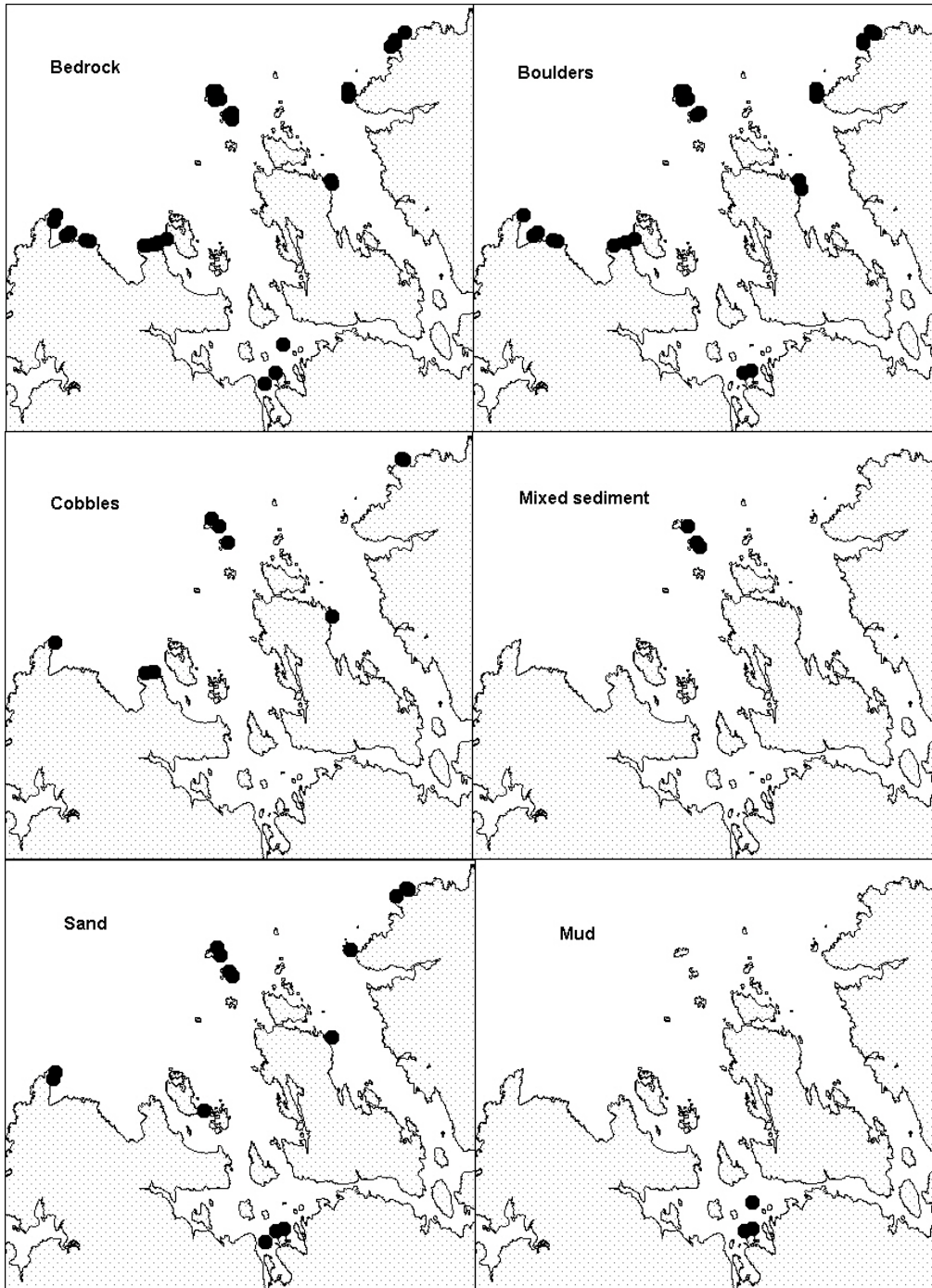


Figure 7 Distribution of main substratum types as recorded on the Seasearch forms

5 DISCUSSION

5.1 Biotope codes

Biotope codes have been assigned to the habitats described or drawn in the recording forms according to the descriptions in the MNCR manual (Connor *et al.*, 1997). However, the information available on many of the forms was very limited and the Seasearch Observer forms are not really designed for such detailed interpretation. The application of the codes in this case relied partly on personal knowledge of sealoch systems and the likelihood of particular biotopes being present as well as knowledge of biotopes previously recorded in the area. In some cases, where no species were listed for a habitat, no biotope could be assigned. The biotope codes assigned should be taken as an indication only, and in many cases are a 'best guess'.

5.2 Distribution of biotopes

The majority of the west coast sites surveyed during this Seasearch project were in the outer parts of Loch Roag or outside the entrance on the open west coast. Four sites were surveyed in the inner very sheltered part of Loch Roag itself. The majority of biotopes and habitat types surveyed were therefore characteristic of wave exposed conditions, with few examples of wave sheltered biotopes. Another feature of the survey is that, on expeditions such as this which are partly holiday, partly survey, there is a tendency to avoid diving on sublittoral sediments and these are consequently poorly represented in the data. Several of the sites surveyed were probably swept by strong tides; however, as the recording forms do not ask for this information it was not easy to discern at which if any sites the tides were a major influence.



Photo: Graham Saunders

Dahlia anemone *Urticina felina* amongst rich ascidian turf (Site 29, W Loch Roag)

5.2.1 Rocky infralittoral

The infralittoral zone was dominated by kelp forest, with the predominant kelp species at each site dependent on the degree of wave exposure. Kelp was recorded to a maximum depth of 22 m on the outer side of Old Hill (Site 21), one of the most exposed sites dived but only reached 4 m at Glas Eilean (Site 24) in the very sheltered Loch Roag itself. At the most exposed sites, the dense kelp forest generally extended to 11 to 13 m, with the smaller, more sparsely distributed plants of the park continuing to 17 m. Just inside the entrance to the loch, the lower limit of the forest was reduced to 6 to 8 m but the park still continued to 17 m where substratum allowed. In many cases, steep bedrock limited the depth to which the forest penetrated although there was frequently kelp park on boulders at the base of cliffs. The depth of kelp was not recorded in the central parts of the system but could be expected to shallow gradually with increasing shelter.

The dominant kelp species was *Laminaria hyperborea* and three main types of *L. hyperborea* forest were found:

- LhypFa Kelp forest with a rich animal and plant turf beneath the canopy;
- Lhyp.Ft and Lhyp.Pk Kelp forest with a less rich understory, mostly of foliose red algae, and no animal turf;
- LhypGz.Ft and LhypGz.Pk Grazed forest with few red algae on stipes or rock, coralline crusts abundant.

It was not always possible from the records to separate the 3 types, as this depended on how much detail was included on the drawings, and when there was any doubt, the records were classified as Lhyp. However, a general pattern emerged with the more exposed sites mostly supporting LhypFa.Ft or Lhyp.Ft whilst the grazed forests were more common at slightly more sheltered sites, such as the east side of islands or headlands and in East Loch Roag. In shallow water above the main forest at the most exposed locations the sublittoral fringe was frequently dominated by the surge-tolerant *Alaria esculenta*, in some cases with a mat of mussels *Mytilus edulis* on the rock beneath the plants. As this biotope is restricted to very shallow water, it may well have been missed at other locations.

Species that were generally conspicuous in the kelp forest included the red alga *Delesseria sanguinea*, the elephant's ear sponge *Pachymatisma johnstonia*, the painted top shell *Calliostoma zizyphinum* and the cowry *Trivia monacha*. In the richer LhypFa, there was generally a red algal turf with colonial ascidians, bryozoans, the boring sponge *Cliona celata*, jewel anemones *Corynactis viridis* and dead men's' fingers *Alcyonium digitatum*. These were species that were also conspicuous on wave-exposed circalittoral rock. Kelp forests grazed by sea urchins *Echinus esculentus* were recorded at a number of sites where it was noted that coralline algal crusts, *Echinus* and cup corals *Caryophyllia smithii* were common. Several sites where kelp park was present, particularly adjacent to sand, had brittlestars *Ophiocomina nigra*, feather stars *Antedon bifida* and the erect bryozoans *Flustra foliacea* and *Securiflustra securifrons* on the sides of boulders amongst the kelp.



Photo: Calum Duncan

Ascidians and algae around kelp holdfast (Site 19, Bearasay)

In the more sheltered areas surveyed, the dominant kelp species shifted from *Laminaria hyperborea* to *Laminaria saccharina*. A forest of mixed *L. hyperborea* and *L. saccharina* (LhypLsac.Ft) was found at Garbh Eilean (Site 23), the most sheltered site surveyed on the

west coast. Plants were described as cape-form, having large, undivided fronds, and conspicuous species beneath the kelp included the red alga *Delesseria sanguinea*, the ascidian *Ascidiella sanguinea*, the sponge *Suberites carnosus*, and the starfish *Asterias rubens*. This is a group of species very characteristic of the silty rock found in such sheltered conditions in sealochs. At adjacent sites (Sites 24, 26) cape-form *L. saccharina* was recorded as the only kelp species (Lsac.Ft) but the associated fauna was similar. Kelp species are notoriously difficult to identify in sheltered sealoch conditions and it is possible that both species may have been present at these sites.

The sea oak *Halidrys siliquosa* was recorded at three sites in the outer loch (Sites 7, 27, 42), forming a band at the bottom of the lower infralittoral where the rock slope gave way to boulders and sand (HalXK). There was generally kelp park above, and the *Halidrys* zone was a mixture of sparse *Laminaria hyperborea* and *Halidrys*. This biotope is characteristic of habitats where sand scour is significant. At Site 27, at the entrance to the Kyles of Pabay, there were large numbers of the brittlestar *Ophiocomina nigra* on the rock amongst the *Halidrys*, with the dahlia anemone *Urticina felina* at the rock-sediment boundary and urchins frequent on the rock. *Laminaria saccharina* frequently grows at the bottom of the kelp park in exposed situations on the west of Scotland, and it was recorded from one site (Site 32) although with no indication of its abundance or distribution.

Maps are not shown for the east coast biotopes as there was no kelp forest recorded at the more exposed sites at Beests of Holm, Arnish Point. A sheltered site (Sites 30, 31) had a shallow boulder, pebble and sediment slope with *Laminaria saccharina* and the green algae *Ulva lactuca* and *Cladophora* sp. growing on stones on the sediment with *Arenicola marina* and *Sabella pavonina* in the sediment (LsacX).

5.2.2 Rocky circalittoral

Circalittoral rock was less frequently surveyed than infralittoral rock, and was mostly confined to the exposed outer loch. The rock-sediment boundary ranged from at least 27 m at Tiumpan on the open coast to 4 to 8 m at Glas Eilean in the inner loch. However, in many cases the lower limit of the rock was not reached during the dive partly because divers using tables to time their dives were generally restricted to working above 20m.



Photo: Graham Saunders

Turf of anemones (?*Phellia gausapata*), hydroids and bryozoans (Site 29, W Loch Roag)

Below the lower limit of kelp, a relatively small range of biotopes was encountered and these reflected the emphasis of the survey on the more exposed sites. At many of the most exposed sites there was steep or vertical rock, often cut by gullies with cobble floors. These

walls were subject to considerable swell and were dominated by sheets of the jewel anemone *Corynactis viridis* with the plumose anemone *Metridium senile* common. These species formed a major part of a rich animal turf which completely covered the rock surface (CorMetAlc), with other conspicuous species including dead men's fingers *Alcyonium digitatum*, the anemone *Sagartia elegans*, the sponges *Pachymatisma johnstonia* and *Cliona celata*, feather stars *Antedon bifida* and hydroids such as *Tubularia indivisa* and *Sertularia argentea*. Mobile species included the sunstar *Crossaster papposus* and the spiny starfish *Marthasterias glacialis*, the cushion star *Porania pulvillus* and crabs such as *Necora puber* and *Cancer pagurus*. Crevices contained dahlia anemones *Urticina felina* and the sea cucumber *Pawsonia saxicola*. The biotope CorMetAlc was also dominant at Arnish on the east coast where a vertical wall dropped to 10 – 15 m depth (Sites 1, 2, 3).

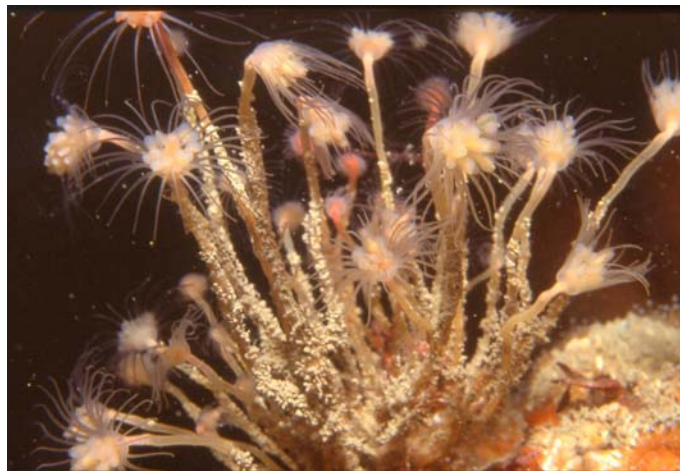


Photo: Graham Saunders

Hydroid *Tubularia indivisa* (Site 4, W Loch Roag)

Sites on the headland of Tiumpán (Sites 35, 36, 37), which was perhaps the most exposed area surveyed, had vertical bedrock in shallow water which was dominated by a short turf of crisiid bryozoans, sponges, small ascidians and *Corynactis viridis* (CorCri). Beyond 20 m, where the surge was less, the steep to vertical rock was dominated by *C. viridis* with *A. digitatum* and *M. senile* (CorMetAlc).

Circalittoral boulders or a more gradual rock slope at the base of steep or vertical rock were characterised by species such as the cup coral *Caryophyllia smithii*, coralline algal and bryozoan crusts, patches of jewel anemones, sponges such as *Cliona celata* and *?Haliclona simulans* and occasionally brittlestars and feather stars. These regions were relatively bare compared to the turf-covered shallower rock and were classed as CCParCar, a commonly encountered biotope of the open west coast. This biotope was not recorded on earlier surveys of the loch but this almost certainly reflects the lack of wave-exposed sites surveyed.

Sheltered circalittoral rock was recorded only at Glas Eilean (Site 23) in the inner loch. Rock here continued beyond the kelp forest to a sediment slope, with boulders lying on the mud. The rock and boulders supported the ascidian *Asciidiella aspersa*, the sponges *Polymastia mamillaris* and *Suberites carnosus*, large plumose anemones *Metridium senile* and scattered hydroids including *Nemertesia* sp. and *Kirchenpaueria pinnata*. This habitat was classified as AmenCio, a common circalittoral biotope in the sheltered part of the sealochs.



Photo: Calum Duncan

Dahlia anemone *Urticina felina* on algal-encrusted rock (Site 13, Old Hill)

Mobile, clean cobbles were a feature of many sites particularly where there were surge gullies in the cliff faces (CC.Mob). There were few species recorded as associated with these cobbles although brittlestars and *Urticina felina* were present in places.

5.2.3 Sediments

A range of sediment types were recorded from coarse shell gravel outside the loch to sandy mud in the sheltered inner loch. The coarse sand and shell gravel was formed into large ripples at some of the more exposed sites (eg. Site 27); few species were recorded and these records were classified as CGS. At the sheltered sites within Loch Roag (Sites 23, 24, 25, 26), sandy mud supported a rich community with large numbers of the turret shell *Turritella communis*, the burrowing anemone *Cerianthus lloydii*, the brittle star *Ophiura albida*, clumps of ascidians *Ascidella aspersa* and the sponge *Suberites carnosus* (VirOph; VirOph.Has). There were some *Arenicola marina* present and patches of the filamentous red alga *Trilliella imbricata*. Mobile species present included the hermit crab *Pagurus bernhardus*, the shore crab *Carcinus maenas* and the spider crabs *Inachus* sp. and *Macropodia* sp.



Photo: Graham Saunders

Burrowing anemone *Cerianthus lloydii* on soft, sheltered mud (Site 17, E of Bearasay)

5.3 Interesting species

The focus of this project was on describing habitats rather than species and therefore there were relatively few species recorded (Appendix 4). However, the survey forms ask the divers to record the presence with an indication of abundance of a list of 16 Important Species. Seven of these were recorded from Loch Roag and their distributions are shown in Figure 6. Four were recorded throughout Loch Roag:

- *Necora puber*
- *Echinus esculentus*
- *Crossaster papposus*
- *Marthasterias glacialis*.

Two species were confined to the entrance of the loch

- *Holothuria forskali*
- *Porania pulvillus*

One species was found only in the sheltered sediments of the inner loch:

- *Sabella pavonina*.

Holothuria forskali was not recorded on the east coast, *Sabella pavonina* was found only at the sheltered site, *Necora puber* was present at both the sheltered and the exposed sites, and the other species were all found only at the exposed sites.

Of these species, the presence of the black sea cucumber *Holothuria forskali* is of particular note. This species has a predominantly southern distribution in the British Isles and is found only sporadically on the west coast of Scotland.

Stichastrella rosea: This is a starfish with a northern distribution in the British Isles. It is occasionally found on exposed western coasts.

Calyptreaea chinensis: This small gastropod is not uncommon but is generally under-recorded by divers due to its cryptic habit.

6 CONCLUSIONS

This survey successfully filled in a number of the gaps in survey coverage in Loch Roag, with a particular emphasis on the outer loch and open coast. The survey was not designed to collect detailed information on species distributions. However, it has proved possible to assign at least provisional biotopes to most of the records. These compare well with those recorded from earlier surveys with the project extending considerably the distribution of the more exposed biotope categories in the area.

7 REFERENCES

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

Dipper, F. A. (1983). Sublittoral survey of habitats and species in and around Loch Roag, Lewis, Outer Hebrides. *Nature Conservancy Council, CSD Report*, No. 505. Peterborough.

Rostron, D. (1984). Western Isles Sea Loch Survey. July 1984. Volume 1. Summary habitat descriptions and site locations. *Nature Conservancy Council, CSD report*, No. 594. Peterborough.

Thorpe, K., Dalkin, M. J., Fortune, F. and Nichols, D. M. (1998). *Marine Nature Conservation Review Sector 14. Lagoons in the Outer Hebrides: area summaries*. Joint Nature Conservation Committee, Peterborough. 289 pp.

8 ACKNOWLEDGEMENTS

The hard work of the EUSAC survey organisers Marion Perutz, Ben Panter, and Katy Nicholson ensured the success of the survey. The dive team worked until all hours to fill in Seasearch forms, and we are grateful to them for cheerfully compiling much useful data. Thanks are due to Ken Brown and Alaln McIlwaine for the use of their boats, and to Ken Ingles of Lewis and Harris Sub-Aqua Club for providing air each evening. Further thanks are due to Ken and other members of Lewis and Harris Sub-Aqua Club for their invaluable local knowledge of dive sites. In particular, we would like to thank Edinburgh University Alumni Fund for their financial support, without which the survey would not have been possible and Scottish Natural Heritage.

APPENDIX 1
SEASEARCH SURVEY STAGE 1 FORM

SEASEARCH SURVEY STAGE 1

This survey asks for two types of information from your dive: what the seabed was like and what marine life you saw. Please read the accompanying **Guidance Notes** before completing as much of this form as you are able to.

SEASEARCH is being supported by the MCS, all the major diving organisations and the government's nature conservation agencies. By completing this form, you will be adding to our knowledge of the near-shore marine environment - helping it to remain fit for life!

Please complete the following sections in capitals

Name	JASON HALL-SPENCER + BEN PANTER
Address	GASGOW UN1 2002094
Tel. no.	0141 330 5985
e-mail:	gbs920@jocd.gla.ac.uk (HM/NK)

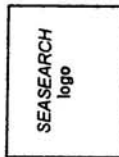
Site details

Site name (if known)	little Loch Roag (23) Entrance to Loch Roag	Date of dive:	1/4/02
General location (incl. county)	Loch Roag, entrance to little Loch Roag NW Lewis	Start of dive: 12 : 40 (24hr)	
Position of centre of site: DMS	58° 11' 07" N 6° 53' 09" W	Dive duration:	30 mins.
Position derived from (circle one):	<input checked="" type="radio"/> GPS	uwv visibility:	6 m (whole figure only)
Admiralty chart		sea temperature (if known)	8 °C
OS map		of OS grid-ref. (if known): DM	58° 11.167' N 6° 53.150' W
Other		drift dive?	YES / <input checked="" type="radio"/> NO
		night dive?	YES / <input checked="" type="radio"/> NO
Did you take any photographs [YES / <input checked="" type="radio"/> NO] or video footage [YES / <input checked="" type="radio"/> NO]?			

Thank you for completing this form. All that's left for you to do is to fold it into thirds along the dotted lines, tuck one part into the other, add a stamp and send it off.

The data you have supplied will be entered onto a database and used to help in the future management of near-shore areas. In time you will receive free Newsletters providing feedback about the Project, by e-mail if appropriate. Soon both Stage 1 (Introductory) and Stage 2 (Intermediate) Recording Forms will be able to be downloaded from the SEASEARCH web site (www.seasearch.co.uk/recording). In the meantime...

- Would you like to be sent another Stage 1 form? YES / NO
 Would you like to receive this form via e-mail? YES / NO
 Would you like details of the Stage 2 recording scheme? YES / NO



Please affix stamp here

SEASEARCH Pilot Scheme
 Marine Conservation Society
 9 Gloucester Road, Ross-on-Wye
 Herefordshire HR9 5BU

Please add any comments you may have on this draft form:

The SEASEARCH Stage 1 & Stage 2 pilot projects have been sponsored by English Nature, Environment Agency, the Countryside Council for Wales, Scottish Natural Heritage and PADI Aware.

23

What marine life did you see on your dive? LOTS!

Life forms (mark as Rare, Occasional or Common if seen - refer to the Guidance Notes)

Keelp forest	C	Animal turf on rocks:	short	C	tall	O	
Keelp park	C	Animal bed:	mussels	bristlestars	C	scallops	R
Encrusting pink algae	O	Sediment with life apparent (tubes, burrows etc.)					
Mixed seaweeds	C	Barren sediment (no life or structures apparent)					

Species you saw (e.g. seaweeds, sponges, anemones, hydroids, worms, topshells, whelks, sea slugs, bivalves, crabs, bryozoans, starfish, brittlestars, sea urchins, featherstars, sea cucumbers, sea squirts, fishes etc.). Make these identifications as accurate as you can - indicate approx. abundance with R, O or C.

<i>Tritella cornuensis</i>	C	<i>Suberites cornuensis</i>	C
<i>Cerianthus lloydii</i>	C	<i>Polydora isobryum</i>	O
<i>Cerianthus maenii</i>	O	<i>Ascidia mentula</i>	C
<i>Cerastoderma edule</i>	C	<i>Clavelina lepadiformis</i>	O
<i>Lutaria lutaria</i>	C	<i>Kiherpanavia nemorea</i>	C
<i>Atricularia marina</i>	O	<i>Holothuria abietina</i>	C
? <i>Callianassa</i>	C	<i>Pecten maximus</i>	R
<i>Laminaria hyperborea</i>	C	<i>Caryophyllis smithii</i>	O
<i>Dubautia sanguinea</i>	C	<i>Asterion rubens</i>	C
		<i>Metridium lanile</i>	O
		<i>Macropodia</i>	O

Important species (mark as R, O or C - refer to the Species ID sheet)

Pink sea fan <i>Eunicella verrucosa</i>		Northern sea fan <i>Swiftia pallida</i>	
Ross coral <i>Pentapora foliacea</i>		Cotton spinner <i>Holothuria forskali</i>	
Crawfish <i>Pallinurus elephas</i>		Sunstar <i>Crossaster papposus</i>	O
Triggerfish <i>Balistes carolinensis</i>		Peacock worm <i>Sabella pavonina</i>	O
Velvet swimming crab <i>Neora puber</i>	C	Spiny starfish <i>Marthasterias glacialis</i>	R
Anglerfish <i>Lophius piscatorius</i>		Spiny spider crab <i>Maia squinado</i>	
Cuttlefish <i>Sepia officinalis</i>		Red seafingers <i>Alcyonium glomeratum</i>	
Common sea urchin <i>Echinus esculentus</i>	O	Red cushion star <i>Porania pulvillus</i>	

Have you used a Guidebook to help you identify what you saw? If so, which book(s)? NO

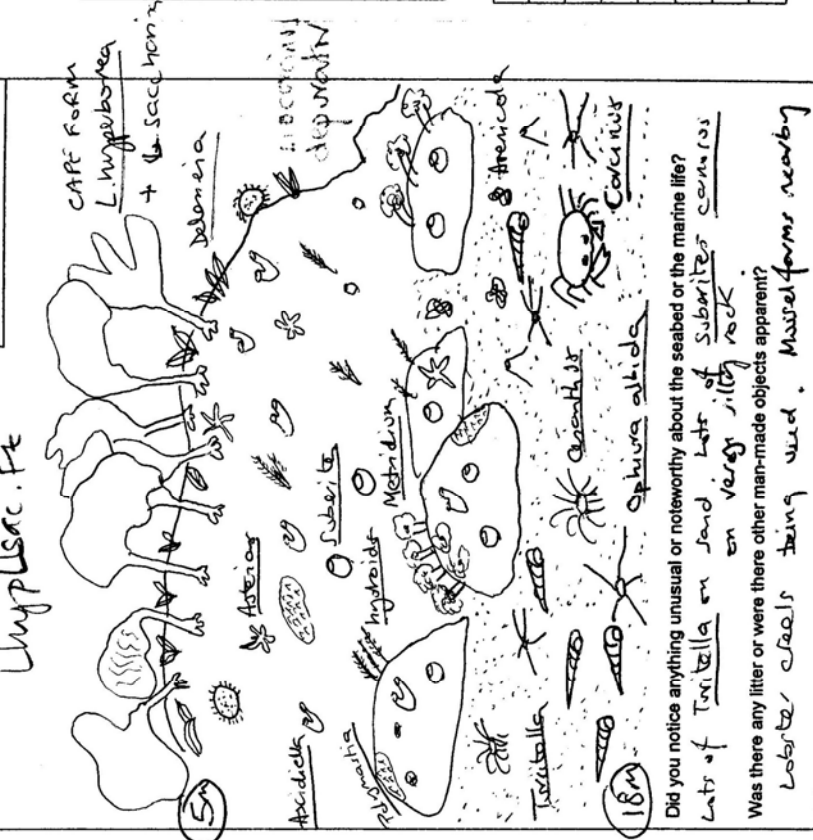
Draft: 12/07/2001

Description of the seabed

For the area of seabed you surveyed, what was the deepest depth? 18 m shallowest depth? 5 m

Please draw an approximate profile of the seabed (i.e. a side-on view) in the space below, labelling features and dominant life forms as appropriate. Remember to indicate the depth range and a distance scale.

Indicate which type(s) of seabed were present:
 rocky reef boulders
 cobbles sand
 mixed ground mud
 wreckage other
 (underline the dominant one)



Did you notice anything unusual or noteworthy about the seabed or the marine life?
Lots of Tritella on sand. Lots of Suberites cornuensis on very silty rock.

Was there any litter or were there other man-made objects apparent?
Lochlears being used. Mussel farms nearby

Lynplsaac. Fz; American, Virginia

APPENDIX 2

LIST OF SITES SURVEYED

Site No.	Date	Name of divers	Site Name	Latitude	Longitude	Min depth (m bcd)	Max depth (m bcd)	Substratum type	Site features	Biotope
1	29.03.02	Marion Perutz, Fiona Mathers	Arnish, East Lewis	58° 11.312N	006° 22.427W	-3.1	6.9	Bedrock;cobbles	Cliff;cobble plain	CorMetAlc;Cobble
2	29.03.02	Katy Nicholson, Fiona Mathers	Arnish, East Lewis	58°11.312N	006° 22.427W	-0.33	9.67	Bedrock;boulders;sand	Cliff;boulder slope;sand plain	CorMetAlc;Boulders
3	29.03.02	Marion Perutz, Katy Nicholson	Beest Holm, Stornoway	58°11.246N	006° 21.051W	-2.13	12.87	Bedrock	Cliff	Ala.Myt;Lhyp.Pk;?CorMetAlc
30	02.04.02	Marion Perutz, Katy Nicolson	Arnish Point, East Lewis	58°11'40" N	006° 22'62"W	-2.3	-0.3	Mixed	Gradual mud & pebble slope	LsacX
31	02.04.02	Ben Panter, Jan Gold	Arnish Point, East Lewis	58°11'40" N	006° 22'62"W	-4.3	-0.3	Boulders;cobbles;sand;mud	Gradual boulder & cobble slope;gradual sandy-mud slope	LsacX
4	30.03.02	Graham Saunders Sandra Castro	Loch Roag	58°13.975N	006° 57.895W	5.5	18.5	Bedrock;	Steep rock	LhypFa.Ft;LhypFa.Pk
5	30.03.02	Marion Perutz, Calum Duncan, Jon Philips	Loch Roag	58°13.829N	006° 55.531W	17.49	17.49	Sand	Sand plain	CGS
6	30.03.02	Jason Hall-Spencer, Katy Nicholson	Outer Loch, West Loch Roag	58°13.970N	006° 57.829W	4.4	20.4	Bedrock;boulders;cobbles	Gullies;boulder plain	CorMetAlc;LhypFa;CC.Mob
7	30.03.02	Jason Hall-Spencer, Katy Nicholson	Entrance, Loch Roag	58°14.482N	007° 01.434W	-0.9	19.1	Bedrock;	Steep rock;rippled sand & shell plain	Ala;LhypFa;HalXK;CC.Mob
8	30.03.02	Jon Phillips, Marion Perutz	Loch Roag	58°14.093N	007° 00.214W	9.5	18.5	Bedrock;boulders	Steep rock	Lhyp.Pk;CorMetAlc;?CCPar Car
9	30.03.02	Graham Saunders Ben Panter	Loch Roag	58°14.606N	007° 01.370W	-0.8	17.2	Bedrock;boulders;cobbles;sand	Rock ridges & boulders; boulder & coarse sand plain	Lhyp.Ft;Lhyp.Pk
10	30.03.02	Calum Duncan, Fiona Mathers	Loch Roag	58°14.076N	007° 00.021W	-0.9	18.1	Boulders;bedrock	Gradual boulder slope	LhypGz.Pk
11	31.03.02	Graham Saunders Sheena Ingles	Old Hill, Loch Roag	58°17.017N	006.54.917W	10.1	15.1	Bedrock;boulders;cobbles;sand;	Cliff;rock ridges & boulders;coarse sand plain	Lhyp.Ft;CorMetAlc;Lhyp.Pk; CGS
12	31.03.03	Katy Nicholson, Marion Perutz	Old Hill, Loch Roag	58°16.983N	006° 55.083W	20.7	22.7	Boulders	Cliff;level boulders	LhypFa.Pk

Site No.	Date	Name of divers	Site Name	Latitude	Longitude	Min depth (m bcd)	Max depth (m bcd)	Substratum type	Site features	Biotope
13	31.03.04	Calum Duncan, Ken Ingles	Old Hill Island, Loch Roag	58°16.983N	006°55.133W	7.4	18.4	Bedrock;boulders	Steep bedrock;large boulders	LhypFa.Ft;LhypFa.Pk;?CorMetAlc
14	31.03.05	Jon Phillips, Ben Panter	Outer Loch Roag	58°14.244N	007°00.816W	9.1	22.1	Bedrock;boulders	Steep rock;level boulders	Lhyp.Ft;Lhyp.Pk;CorMetAlc
15	31.03.06	Jason Hall-Spencer, Alan McIlwaine	Loch Roag	58°14.655N	007°01.419W			No form		
16	31.03.07	Sandra Castro, Fiona Mathers	Loch Roag	58°14.191N	007°00.991W	5.2	15.2	Bedrock;boulders	Cliff;Boulder slope	Lhyp.Ft;Lhyp.Pk;CorMetAlc
17	31.03.08	Graham Saunders Sheena Inglis	E. Berasay, Loch Roag	58°16.667N	006°54.583W	-0.7	17.3	Bedrock;boulders;cobbles;sand; mixed	Cliff;boulder slope;rippled sand and gravel plain	LhypGz.Ft;LhypGz.Pk;CorMetAlc;CGS
18	31.03.09	Katy Nicholson, Marion Perutz	Berasay, Loch Roag	58°16.717N	006°54.450W	2	9	Bedrock;boulders;sand	Large boulders on sand	LhypGz.Ft
19	31.03.10	Calum Duncan, Ken Ingles	Outer Loch Roag	58°16.583N	006°54.450W	4.45	10.45	Bedrock;sand;mixed	Bedrock ridges; coarse sand patches	LhypGz.Ft;LhypGz.Pk;CorMetAlc;CGS
20	31.03.11	Jonathon Phillips, Ben Panter	N of Old Hill, Loch Roag	58°17.175N	006°55.205W	14.3	24.3	Bedrock;boulders;cobbles	Cliff;gradual bedrock slope;cobble & boulder plain	Lhyp.Ft;Lhyp.Pk;CorMetAlc;CCParCar
21	31.03.12	Alan McIlwaine, Jason Hall-Spencer	Old Hill Island, Loch Roag	58°17.179N	006°55.042W	3.45	23.45	Bedrock;boulders;cobbles	Cliff;gullies;scoured cobbles	Ala;LhypFa.Ft;LhypFa.Pk;CC.Mob
22	31.03.13	Sandra Castro, Fiona Mathers	Southern Island, W Pabay Mor, Loch Roag	58°14.106N	006°56.995W	6.02	8.02	Bedrock;boulders;sand	Gradual boulder slope;sand plain	LhypGz.Ft
23	01.04.02	Jason Hall-Spencer, Ben Panter	Entrance to Little Loch Roag, Loch Roag	58°11.117N	006°53.150W	3	16	Bedrock;sand	Low-lying bedrock;sand plain;silty	LhypLsac.Ft;AmenCio;VirOph
24	01.04.02	Calum Duncan, Jan Gold	N Glas Eilean, Outer Little Loch Roag	58°11.933N	006°52.417W	4.5	8.5	Bedrock;mud	Low-lying bedrock;gradual mud slope	Lsac.Ft;VirOph.HAS
25	01.04.02	Katy Nicholson, Jon Phillips, Sandra Castro	Outer Little Loch Roag	58°11.393N	006°52.452W	5.31	15.31	Boulders;sand	Gradual sand slope;occasional boulders	VirOph.HAS
26	01.04.02	Fiona Mathers, Graham Saunders	Bhaltos, Loch Roag	58°11.341N	006°52.734W	13.37	13.57	Boulders;mud	Boulder plain;mud plain	Lsac.Pk;VirOph

Site No.	Date	Name of divers	Site Name	Latitude	Longitude	Min depth (m bcd)	Max depth (m bcd)	Substratum type	Site features	Biotope
27	01.04.02	Jason Hall-Spencer, Ben Panter	S Entrance, Loch Roag	58°14.000N	006°57.217W	1.6	8.6	Bedrock;sand	Steep rock;rippled sand plain;shell	Ala;LhypFa.Ft;HalXK;CGS
28	01.04.02	Calum Duncan, Jan Gold	N of Bhalto, Outer Loch Roag	58°14.000N	006°57.467W	2.5	9.5	Bedrock;cobbles	Gullies;scoured cobbles	Ala;LhypFa.Ft;CC.Mob
29	01.04.02	Graham Saunders Fiona Mathers, Marion Perutz	Rubha Brabaig, West Loch Roag	58°14.050N	006.57.335W	6.5	14.5	Bedrock;boulders	Cliff;boulder & cobble plain	Lhyp.Ft;CorMetAlc;CC.Mob
32	02.04.02	Fiona Mathers, Jan Gold	Craigeam Island, East Loch Roag	58°17.067N	006°49.867W	4.58	6.58	Bedrock;boulders	Steep rock;level boulders	LhypGz.Ft;CCParCar;CGS
33	02.04.02	Marion Perutz, Paul Tyler	Craigeam Island, East Loch Roag	58°17.133N	006°49.833W	4.58	16.58	Bedrock;boulders;sand	Gradual rock slope;small rock face;boulder & sand plain	LhypGz.Ft;CCParCar;CGS
34	02.04.02	Katy Nicholson, Ben Panter	Craigeam Island, East Loch Roag	58°17.217N	006°49.867W	1.6	16.6	Bedrock;boulders	Cliff;boulder slope	LhypGz.Ft;CCParCar;CGS
35	02.04.02	Fiona Mathers, Jan Gold	East Loch Roag	58°18.083N	006°48.183W	2.75	10.75	Bedrock	Gullies	LhypFa.Ft;CorCri;CorMetAlc; CGS
36	02.04.02	Marion Perutz, Paul Tyler	East Loch Roag	58°18.233N	006°48.030W	5	20	Bedrock;boulders;sand	Cliff;steep rock;sand plain	Ala.Myt;LhypFa.Ft;CorCri;Co rMetAlc;CGS
37	02.04.02	Katy Nicholson, Ben Panter	East Loch Roag	58°18.150N	006°48.030W	3.85	13.85	Bedrock;boulders	Steep rock	LhypFa.Ft;CorCri;CorMetAlc; CGS
38	04.04.02	Ben Panter, Alan McIlwaine	N Shore Bay, East Loch Roag	58°18.400N	006°47.717W	-2.9	17.1	Boulders;cobbles	Boulder slope	LhypGz.Ft;LhypGz.Pk;CCPar Car
39	04.04.02	Marion Perutz, Paul Tyler	N Shore Bay, East Loch Roag	58°18.367N	006°47.567W	18.05	18.05	Boulders;sand	Boulders on coarse sand	LhypGz.Pk;CCParCar;CGS
40	04.04.02	Katy Nicholson, Fiona Mathers	East Loch Roag	58°18.383N	006°47.650W	7.02	15.02	Bedrock;boulders;cobbles;sand	Cliff;boulder slope with sand	LhypGz.Ft;LhypGz.Pk;CGS
41	04.04.02	Ben Panter, Alan McIlwaine	East Loch Roag	58°15.150N	006°50.483W	-2.99	7.01	Boulders;cobbles	Boulder slope	LhypGz.Ft;LhypGz.Pk;CCPar Car
42	04.04.02	Marion Perutz, Paul Tyler	East Loch Roag	58°15.317N	006°50.550W	11.1	18.1	Bedrock;boulders;sand	Low-lying bedrock;boulders on muddy sand plain	LhypGz.Pk;HalXK;CCParCar ;CMS
43	04.04.02	Fiona Mathers, Katy Nicholson	East Loch Roag	58°15.267N	006°50.500W	7.12	12.12	Bedrock;boulders;sand	Gullies;rock slope;boulders on sand plain	LhypGz.Ft

APPENDIX 3

LIST OF BIOTOPES RECORDED

Biotope	Site numbers	Site numbers
Ala	<i>Alaria esculenta</i> on sublittoral fringe bedrock	7, 21, 27, 28
Ala.Myt	<i>Alaria esculenta</i> , <i>Mytilus edulis</i> and coralline crusts on very exposed sublittoral fringe bedrock	3, 36
LhypFa	<i>Laminaria hyperborea</i> forest & park with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed infralittoral rock	6, 7,
LhypFa.Ft	<i>Laminaria hyperborea</i> forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed infralittoral rock	4, 13, 27, 28, 36, 37
LhypFa.Pk	<i>Laminaria hyperborea</i> park with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed infralittoral rock	4, 12, 13, 21,
Lhyp.Ft	<i>Laminaria hyperborea</i> forest and foliose red seaweeds on moderately exposed infralittoral rock	9, 11, 14, 16, 20, 29
Lhyp.Pk	<i>Laminaria hyperborea</i> park and foliose red seaweeds on moderately exposed infralittoral rock	3, 8, 9, 11, 14, 16, 20
LhypGz.Ft	Grazed <i>Laminaria hyperborea</i> forest with coralline crusts on upper infralittoral rock	17, 18, 19, 22, 32, 33, 34, 38, 40, 41, 43
LhypGz.Pk	Grazed <i>Laminaria hyperborea</i> park with coralline crusts on lower infralittoral rock	10, 17, 19, 38, 39, 40, 41, 42,
HalXK	<i>Halidrys siliquosa</i> and mixed kelps on tide-swept infralittoral rock with coarse sediments	7, 27, 42
LhypLsac.Ft	Mixed <i>Laminaria hyperborea</i> and <i>Laminaria saccharina</i> on sheltered infralittoral rock	23
Lsac.Ft	<i>Laminaria saccharina</i> forest on very sheltered upper infralittoral rock	24
Lsac.Pk	<i>Laminaria saccharina</i> park on very sheltered lower infralittoral rock	26
LsacX	<i>Laminaria saccharina</i> , <i>Chorda filum</i> and filamentous red seaweeds on sheltered infralittoral sediment	31, 30
CorMetAlc	<i>Corynactis viridis</i> , <i>Metridium senile</i> and <i>Alcyonium digitatum</i> on exposed or moderately exposed vertical infralittoral rock	1, 2, 3, 6, 8, 11, 13, 14, 16, 17, 19, 20, 29, 35, 36, 37
CCParCar	Coralline crusts, <i>Parasmittina trispinosa</i> , <i>Caryophyllia smithii</i> , <i>Haliclona viscosa</i> , polyclinids and sparse <i>Corynactis viridis</i> on very exposed circalittoral rock	8, 20, 32, 33, 34, 38, 39, 41, 42
CorCri	<i>Corynactis viridis</i> and a crisiid/ <i>Bugula/Cellaria</i> turf on steep or vertical exposed circalittoral rock	35, 36, 37
AmenCio	Solitary ascidians, including <i>Ascidia mentula</i> and <i>Ciona intestinalis</i> , on very sheltered circalittoral rock	23
CC.Mob	Coralline crusts and crustaceans on mobile boulders or cobbles in surge gullies	6, 7, 21, 28, 29
CGS	Circalittoral gravel and sand	5, 11, 17, 19, 27, 32, 33, 34, 35, 36, 37, 39, 40
CMS	Circalittoral muddy sands	42
VirOph	<i>Virgularia mirabilis</i> and <i>Ophiura</i> spp. on circalittoral sandy or shelly mud	23, 26
VirOph.HAs	<i>Virgularia mirabilis</i> and <i>Ophiura</i> spp. with hydroids and ascidians on circalittoral sandy or shelly mud with shells or stones	24, 25
No biotope assigned		
Cobble		1
Boulders		2

APPENDIX 4

SPECIES LIST

MCS Code letter	MCS Code No	Species	Common name	Sites
Porifera				
C	11	<i>Clathrina coriacea</i>		17, 37
C	54	<i>Leucosolenia botryoides</i>		36
C	132	<i>Scypha ciliata</i>		28
C	233	<i>Pachymatisma johnstonia</i>	elephant's ear sponge	11, 14, 15, 16, 17, 18, 19, 23, 29, 33, 34, 36, 37, 39, 40, 42
C	322	? <i>Thymosia guernei</i>		19
C	358	<i>Polymastia boletiformis</i>		3, 23, 39
C	361	<i>Polymastia mammilaris</i>		9
C	416	<i>Suberites carnosus</i>		23, 24, 25, 26, 30
C	480	<i>Cliona celata</i>		1, 3, 4, 6, 8, 10, 11, 12, 14, 15, 16, 18, 19, 20, 27, 33, 34, 36, 42, 43
C	651	<i>Halichondria panicea</i>	bread-crumble sponge	18, 39
C	1422	<i>Haliclona cinerea</i>		4
C	1427	<i>Haliclona oculata</i>		7, 14,
C	540	<i>Haliclona simulans</i>		8
Hydrozoa				
D	48	<i>Aurelia aurita</i>		25,
D	166	<i>Tubularia indivisa</i>		4, 6, 7, 16, 19, 20, 29, 36
D	409	<i>Abietinaria abietina</i>		23
D	454	<i>Kirchenpaueria pinnata</i>		23
D	462	<i>Nemertesia</i> sp.		1, 3, 8, 10, 13, 17, 18, 29, 42
D	463	<i>Nemertesia antennina</i>		23
D	466	<i>Nemertesia ramosa</i>		15
D	517	<i>Obelia</i> sp.		29, 33, 42
D	597	<i>Alcyonium digitatum</i>	dead men's fingers	1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 27, 28, 29, 32, 33, 34, 36, 37, 39, 42, 43
D	632	<i>Cerianthus lloydii</i>		23, 25
D	675	<i>Actinia equina</i>	beadlet anemone	1, 3, 8
D	684	<i>Urticina felina</i>	dahlia anemone	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17, 18, 19, 20, 22, 27, 29, 32, 33, 34, 36, 37, 39, 40, 43
D	710	<i>Metridium senile</i>	plumose anemone	1, 3, 6, 7, 9, 11, 16, 20, 23, 24, 29,
D	713	<i>Sagartia elegans</i>		4, 6, 7, 9, 11, 13, 15, 16, 18, 19, 20, 29, 33, 36, 42
D	719	<i>Actinothoe sphyrodeta</i>		6
D	775	<i>Corynactis viridis</i>	jewel anemone	1, 3, 4, 6, 8, 10, 11, 13, 14, 15, 16, 17, 19, 20, 22, 27, 28, 29, 32, 36, 37
D	783	<i>Caryophyllia smithii</i>	devonshire cup coral	1, 2, 4, 6, 8, 9, 10, 14, 16, 17, 18, 22, 23, 27, 33, 34, 36, 37, 39, 43
Nemertea				
G	50	<i>Lineus</i> sp.	ribbon worm	13
G	54	<i>Lineus longissimus</i>	boot lace worm	36
Polychaeta				
P	931	<i>Arenicola marina</i>	lugworm	23, 31, 39
P	1179	Terebellidae sp.	terebellid worm	2, 14, 30, 31
P	1195	<i>Lanice conchilega</i>	sand mason	7
P	1320	<i>Sabella pavonina</i>	peacock worm	23, 30, 31
P	1339	<i>Pomatoceros</i> sp.	keelworm	3, 6, 15, 27, 30, 33
P	1343	<i>Serpula vermicularis</i>	tubeworm	1

MCS Code letter	MCS Code No	Species	Common name	Sites
P	1396	<i>Spirorbidae</i> indet.		3, 17, 30
Crustacea				
R	74	<i>Balanidae</i> indet	Barnacle	1, 3, 27, 30
S	1315	<i>Palaemon</i> sp.	shrimp	37,
S	1400	<i>Homarus gammarus</i>	common lobster	7,
S	1414	? <i>Callianassa subterranea</i>		23,
S	1445	<i>Paguridae</i> sp.	hermit crab	1, 5, 25
S	1457	<i>Pagurus bernhardus</i>	hermit crab	24, 30, 31
S	1471	<i>Galathea dispersa</i>		2
S	1476	<i>Galathea strigosa</i>		1, 2, 10, 13, 16, 22, 40, 43
S	1482	<i>Pisidia longicornis</i>	long-clawed porcelain crab	29,
S	1518	<i>Hyas araneus</i>	spider crab	1, 3, 7, 8, 20, 39, 40, 42,
S	1525	<i>Inachus</i> sp.		24,
S	1526	<i>Inachus dorsettensis</i>	scorpion spider crab	13, 20,
S	1532	<i>Macropodia rostrata</i>		23,
S	1533	<i>Macropodia tenuirostris</i>		25, 26,
S	1566	<i>Cancer pagurus</i>	edible crab	1, 3, 4, 6, 8, 10, 11, 13, 16, 22, 25, 26, 27, 29, 32, 34, 37
S	1580	<i>Liocarcinus depurator</i>	harbour crab	23, 24
S	1589	<i>Necora puber</i>	velvet swimming crab	1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 14, 15, 19, 20, 22, 23, 24, 25, 27, 28, 30, 34, 37, 39, 40, 43
S	1594	<i>Carcinus maenas</i>	common shore crab	23, 30, 31
S	1620	<i>Xantho pilipes</i>		10
Mollusca				
W	82	<i>Tonicella rubra</i>	chiton	1, 29
W	159	<i>Gibbula magus</i>	turban top shell	17, 26, 40
W	163	<i>Gibbula cineraria</i>	grey top shell	7, 33
W	182	<i>Calliostoma zizyphinum</i>	painted top shell	1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 22, 27, 31, 32, 33, 34, 37, 39, 40, 42, 43,
W	227	<i>Patella</i> sp.	limpet	1
W	234	<i>Helcion pellucidum</i>	blue-rayed limpet	7, 16, 18, 32, 33, 35, 40
W	270	<i>Turritella communis</i>	tower shell	23, 25, 26, 43
W	296	<i>Littorina littorea</i>	periwinkle	1, 30, 31
W	430	<i>Aporrhais pespelecani</i>	pelican's foot shell	42
W	436	<i>Calyptrea chinensis</i>	chinaman's hat	10
W	461	<i>Trivia monacha</i>	cowrie	1, 6, 9, 13, 16, 18, 19, 29, 32, 33, 34, 35, 39, 40
W	687	<i>Nucella lapillus</i>	dog whelk	1, 3, 30
W	708	<i>Buccinum undatum</i>	common whelk	24, 31, 33, 34, 42, 43
W	1250	<i>Tritonia hombergii</i>		22
W	1251	<i>Tritonia lineata</i>		20
W	1318	<i>Trapania pallida</i>		32
W	1349	<i>Polycera faeroensis</i>		32
W	1350	<i>Polycera quadrilineata</i>		42
W	1354	<i>Limacia clavigera</i>		43
W	1376	<i>Archidoris pseudoargus</i>	sea lemon	15, 16
W	1695	<i>Mytilus edulis</i>	mussel	3, 28
W	1771	<i>Pecten maximus</i>	king scallop	5, 23, 25, 26, 30, 42
W	1773	<i>Aequipecten opercularis</i>	queen scallop	24, 26
W	1961	<i>Cerastoderma edule</i>	common cockle	23
W	1984	<i>Lutraria lutraria</i>	Common otter shell	23
W	1998	<i>Ensis</i> sp.	razor shell	5

MCS Code letter	MCS Code No	Species	Common name	Sites
W	2398	<i>Eledone cirrhosa</i>	curled octopus	28
Bryozoa				
Y	170	<i>Membranipora membranacea</i>	hornwrack	8, 17, 19
Y	187	<i>Flustra foliacea</i>		9, 11, 13
Echinodermata				
ZB	9	<i>Antedon</i> sp.	feather star	10, 13, 14, 15, 20, 34, 37, 39, 43,
ZB	10	<i>Antedon bifida</i>	feather star	1, 2, 3, 4, 6, 7, 9, 10, 27, 29, 33, 36, 42,
ZB	22	<i>Luidia ciliaris</i>		1, 7, 14, 16, 33, 43,
ZB	54	<i>Porania pulvillus</i>	red cushion star	1, 2, 3, 14, 37,
ZB	72	<i>Solaster endeca</i>	sun star	1, 2, 8, 10, 13, 19, 34, 39, 42,
ZB	75	<i>Crossaster papposus</i>	purple sunstar	6, 7, 8, 9, 10, 11, 14, 15, 17, 19, 20, 22, 23, 24, 25, 26, 27, 33, 34, 35, 37, 39, 40, 43,
ZB	83	<i>Henricia</i> sp.	bloody henry	1, 2, 3, 7, 8, 10, 13, 14, 15, 18, 19, 20, 29, 32, 33, 34, 36, 37, 39, 42,
ZB	98	<i>Stichastrella rosea</i>	starfish	39, 42,
ZB	100	<i>Asterias rubens</i>	common starfish	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 18, 20, 22, 23, 24, 25, 26, 27, 33, 34, 36, 37, 39, 40, 42, 43,
ZB	104	<i>Marthasterias glacialis</i>	spiny starfish	1, 2, 3, 6, 7, 8, 9, 10, 11, 13, 14, 15, 17, 18, 19, 20, 23, 24, 27, 28, 29, 32, 33, 34, 37, 39, 43,
ZB	124	<i>Ophiothrix fragilis</i>	brittle star	8, 29,
ZB	128	<i>Ophiocomina nigra</i>	brittle star	1, 3, 6, 8, 9, 27, 29,
ZB	168	<i>Ophiura albida</i>	brittle star	23, 25,
ZB	193	<i>Psammechinus miliaris</i>	shore sea urchin	2
ZB	198	<i>Echinus esculentus</i>	common sea urchin	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 23, 24, 27, 28, 29, 32, 33, 34, 35, 37, 39, 40, 43
ZB	244	<i>Holothuria forskali</i>	cotton spinner	16, 42
ZB	260	<i>Pawsonia saxicola</i>	sea cucumber	16, 22, 36, 40, 43,
Asciidiacea				
ZD	7	<i>Clavelina lepadiformis</i>	light-bulb ascidian	23, 24, 40, 43,
ZD	61	<i>Diplosoma spongiforme</i>		10
ZD	22	<i>Polyclinum aurantium</i>		15, 19,
ZD	28	<i>Morchellium argus</i>		19, 28,
ZD	31	<i>Sidnyum turbinatum</i>		29,
ZD	40	<i>Aplidium punctum</i>		19,
ZD	65	<i>Lissoclinum perforatum</i>		4, 9, 28,
ZD	71	<i>Ciona intestinalis</i>		18, 25,
ZD	84	<i>Asciidiella aspersa</i>		22, 23
ZD	89	<i>Ascidia mentula</i>		23, 24,
ZD	126	<i>Botryllus schlosseri</i>		11, 24, 29,
Pisces				
ZG	17	<i>Conger conger</i>	conger eel	22,
ZG	144	<i>Trisopterus minutus</i>	poor-cod	20,
ZG	230	<i>Spinachia spinachia</i>	15-spined stickleback	1
ZG	283	<i>Taurulus bubalis</i>	sea scorpion	16, 19, 33, 37,
ZG	440	<i>Pholis gunnellus</i>	butterfish, gunnel	1
ZG	462	<i>Gobius</i> sp.	goby	35, 39,
ZG	479	<i>Pomatoschistus minutus</i>	sand goby	26, 30, 33,
Rhodophyceae				
ZM	148	<i>Trailliella (Bonnemaisonia hamifera)</i>		26, 30, 31,
ZM	170	<i>Palmaria palmata</i>	dulse	1, 18,

MCS Code letter	MCS Code No	Species	Common name	Sites
ZM	194	Enc. Corallinaceae sp.	pink coralline algae	1, 2, 4, 6, 7, 10, 13, 15, 16, 17, 18, 19, 22, 23, 24, 27, 28, 33, 34, 37, 39, 40, 43
ZM	205	<i>Corallina officinalis</i>		18, 28, 30,
ZM	237	<i>Lithothamnion glaciale</i>		24,
ZM	443	<i>Plocamium cartilagineum</i>		24, 28,
ZM	468	<i>Rhodymenia pseudopalmata</i>		42,
ZM	581	<i>Heterosiphonia plumosa</i>		30,
ZM	594	<i>Delesseria sanguinea</i>	Sea beech	4, 7, 8, 9, 10, 15, 18, 19, 20, 23, 24, 26, 28, 29,
ZM	653	<i>Osmundea pinnatifida</i>		1,
Phaeophyceae				
ZR	18	<i>Ectocarpaceae indet.</i>		1,
ZR	341	<i>Alaria esculenta</i>	Dabberlocks	1, 5, 6, 15, 28, 34, 37, 40, 43,
ZR	350	<i>Laminaria digitata</i>		1, 3, 4, 17
ZR	351	<i>Laminaria hyperborea</i>	cuvie	3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 23, 28, 29, 32, 33, 36, 37, 39, 40, 42, 43,
ZR	354	<i>Laminaria saccharina</i>	sugar kelp	23, 24, 26, 30, 32, 39,
ZR	372	<i>Halidrys siliquosa</i>	sea oak, pod	7, 27, 30, 33, 39, 42,
ZR	382	<i>Fucus serratus</i>	serrated wrack	1,
ZR	384	<i>Fucus vesiculosus</i>	bladder wrack	1, 30, 31
ZR	389	<i>Himanthalia elongata</i>	thong weed	8,
Chlorophyceae				
ZS	179	<i>Ulva lactuca</i>	sea lettuce	5, 30,
ZS	195	<i>Cladophora</i> sp.		30,