

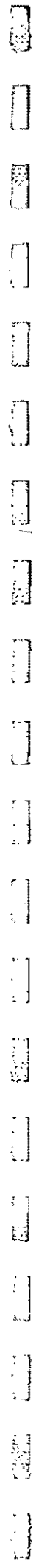
UNDERWATER
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SUBLITTORAL SURVEY OF HABITATS AND SPECIES IN AND AROUND
LOCH ROAG, LEWIS, OUTER HEBRIDES

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Sublittoral survey of habitats and species in and around Loch Roag,
Lewis, Outer Hebrides.

Underwater Conservation Society expedition with
assistance from the Nature Conservancy Council.

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by

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1. INTRODUCTION

1.1 Aims of Survey

The two main aims of the survey were firstly to describe the range of sublittoral habitats and species present in and around Loch Roag on the west coast of Lewis, Outer Hebrides; and secondly to give interested members of the Underwater Conservation Society the opportunity of taking part in and learning the techniques of a marine biological survey. The area is one of interest to the Nature Conservancy Council in the context of their marine nature conservation review of the Inner and Outer Hebrides and the west coast of Scotland, and was chosen with this in mind. An extensive survey of the shores was also carried out by Dr Shelagh Smith and is reported separately (Smith, 1983).

1.2 Location and area

The area studied is shown in Maps 1 and 2. Loch Roag is an extensive loch complex situated about halfway along the west coast of Lewis between Carloway and Uig. It is divided into east and west lochs by the large island of Great Bernera and there are numerous other islands and rocks scattered throughout the area. The loch has a total length of coastline of approximately 190 km and extends inwards from the open sea a distance of 10 to 15 km. Little Loch Roag penetrates a further 8 km inland. Valtos, in west Loch Roag is over an hours drive from Stornaway and the car ferry which connects with Ullapool; it is over 2 hours drive from Tarbert where the ferry leaves for Uig in Skye and Lochmaddy in North Uist. In a survey of the Outer Hebrides carried out in 1978 for NCC by the Intertidal Survey Unit of the Scottish Marine Biological Association (SMBA) and Marine Biological Association (MBA), Loch Roag was graded as a Grade 1 site of marine biological importance because of its wide range of habitats.

1.3 Previous marine studies

The remoteness of the Outer Hebrides from centres of population and marine laboratories has resulted in relatively few marine studies of the area. No previous published studies of the sublittoral of Lewis or Harris could be found, apart from a short account in George (1979). The latter provides a general account based on single visits to a variety of sites. Some records sent in by participants of the Habitat, Species Recording Scheme and Observation Scheme projects, are also held by UCS. The intertidal has fared rather better. As mentioned in the previous section, Loch Roag was covered in an NCC funded survey of the Outer Hebrides (Powell et al 1979). The report of this survey also lists other intertidal work covering the Outer Hebrides. Several useful papers are contained in the report of a Symposium held in 1977 entitled 'The Natural Environment of the Outer Hebrides', (Proc. Roy. Soc. Edinb. 77 B)

2. ENVIRONMENTAL CONDITIONS

2.1 Bathymetry and seabed characteristics

The bathymetry of the area is fairly complex and Admiralty Charts 3381 and 3422 should be referred to for details. Throughout most of the loch, the

substratum is sediment with muds and muddy sands in the inner sheltered parts and clean sands and gravels in wave exposed areas. Clean sediments also occur in areas of strong tidal streams such as the entrance to Little Loch Roag and the channel between Eilean Kearstay and Great Bernera. In the inner parts of the loch, rock slopes are short and give way to sediment at between 5-10m. More extensive rock slopes to 20-30m occur in the outer exposed parts of the loch from about $\frac{1}{3}$ to $\frac{1}{2}$ way along Great Bernera outwards. Very deep water (30m +) extends close inshore (within 100m) around the headlands north of Valtos (although shallow water is shown on the chart), Pabay Mor and Pabay Beag, the east side of Vacsay and the north tip of Uvia Mor, and probably elsewhere in the outer parts of the loch and the Outer Islands. No extensive areas of circalittoral rock were found offshore, the rock slopes being mostly steep and meeting sediment close inshore. The charts indicate offshore rock amongst the Outer Isles but these sites could not be dived due to high winds.

2.2 Exposure to wave action

The west coast of Lewis is open to the prevailing winds and is subject to maximum wave exposure. Loch Roag itself, however extends for some considerable distance inland and provides shelter from wave action. Map 3 (reproduced from Powell et al, 1979) indicates the approximate wave exposure of the shore which varies from very exposed on the open coast, to very sheltered in Little Loch Roag and other innermost parts of the Loch. In general the outer islands and headlands are very exposed; the outer parts of the lochs, especially west facing shores are exposed and moderately exposed and the innermost parts are sheltered and very sheltered. It proved impossible to dive the west coast of Great Bernera and the west coast of East Loch Roag due to the prevailing winds.

2.3 Exposure to tidal streams

Tidal streams throughout the area are generally weak apart from a few areas where there are narrows resulting in rapids. The complex nature of the loch and all its islands and rocks means that tidal flows cannot be entirely predicted. From the admiralty charts it appears that the flood tide passes into the loch down both sides of the Great Bernera and passes through Bernera Bridge from west to east ebbing from east to west. However, since some flood is liable to come in to the bridge from east to west as well, a complex situation would be expected. Low water slack at Bernera Bridge was confused with the current apparently changing direction several times or being different in different areas. Tidal flows between the islands either side of Great Bernera reach a maximum of only about half a knot apart from the channel between Eilean Kearstay and Great Bernera (site 36). Here the flow may reach $1\frac{1}{2}$ knots and this site was particularly rich in species supporting a Modiolus bed and many hydroids. The rapids under Bernera Bridge attain 2 knots but the shallow depths make them less interesting than the rapids leading into Little Loch Roag (no tidal information) and between Little Bernera and Great Bernera (no tidal information). In the Outer Isles tidal currents of up to one knot occur and this may explain the particular richness of site 39 where a maximum current of 0.8 knots runs between Campay and Kealabay.

3. METHODS

The expedition was a joint UCS/NCC survey run along similar lines to previous surveys (Dipper, 1980, 1981). Participants were all amateur naturalists apart from the leader, and the expedition was entirely self financing. The NCC funded Frances Dipper to lead the expedition and also provided most of the equipment including compressor, engines and boats.

The expedition was based at the Valtos Outdoor Centre. This is an old school and proved ideal for the job. The accommodation is basic but there is plenty of room with several dormitories, central heating, a drying room and large canteen and dining area which also served as a laboratory. The situation is remote and the expedition was self-sufficient in stores and supplies. Petrol and bread were available 5 miles away. Two inflatable boats were used. These were moored at the jetty in Valtos for the first few days; the beach at Reef for a further few days and the jetty at Kirkibost for the remaining time. With 6 divers to each boat, it was not possible to plane with a full load and some complicated logistics involving boats and vehicles were necessary to cover the whole of this large area. The narrow bumpy roads increased the time spent travelling to sites. The weather was extremely bad throughout the two weeks with gale force winds on most days. The direction and strength of the wind heavily influenced the choice of dive sites. Long boat trips were avoided wherever possible because those in wet suits soon became very cold. It was only possible to get to the outermost islands on two days - a disappointment since these seem to support rich clear water populations.

Within the limitations outlined above, sites were chosen from the charts to include locations throughout the loch exposed to as great a variety of environmental conditions as possible and four sites were covered on most days. Depths were determined prior to diving using an echosounder - a necessary precaution since the charts were found to be very innaccurate in some areas. All diving was kept within 'no-stop' times. Safety precautions were of great importance because of the remoteness of the area.

The recording methods used were the same as in previous surveys. Field records were made on formica writing boards and transferred each evening to standard check lists (Appendix II). Everyone was able to record habitats; species were recorded to the best of the individual's ability and specimens were collected for further identification. Each person was given responsibility for a particular group of animals or algae and was asked to collate species records for their group from each site, and to identify or preserve specimens collected. For this purpose completed species check lists were hung each evening on a 'washing line' with site numbered pegs to allow easy access to the data. This collation of species records saves considerable time for the final report writer when constructing a species/site list; and it allows individuals to become familiar with a particular group.

A photographic record of species and particularly of habitats was made by Frances Dipper, Sarah Fowler and Viv Pearson, and the collection is held by NCC. For the first few days films were developed on the spot by Viv Pearson which ensured that adequate habitat photographs were obtained. It also allowed immediate feedback to participants who could learn from the slides.

Although the emphasis during the survey was necessarily on the collection of qualitative data, subjective estimates of abundance were made wherever possible using the notations, dominant, abundant, common, frequent, occasional and rare. A chart datum correction table was prepared by Dave Moss prior to the survey and all depths are given relative to Chart Datum.

4. RESULTS

4.1 Introduction

Sites were numbered in the order in which they were visited and are shown in Map 2 and summarized with grid references in Table 1. A description of the main features of each site was prepared from the habitat recording sheets and is given in Table 2 where the sites are grouped together in areas.

Appendix I is an annotated species list showing species present at each site and the distribution and habitat preference of individual species as far as is possible. The main plant and animal populations and communities are described below. The term 'community' is used here in the loose sense as defined in Hiscock and Mitchell (1980) to include any group of organisms present in a particular habitat. Raw data sheets are bound under separate cover as is a catalogue describing the colour slides held by NCC.

4.2 Description of plant and animal communities

The populations and communities of plants and animals present were related primarily to the exposure to wave action, and to the extent of sublittoral rock. Wave action was very severe in the outer parts of the loch, and here deep circalittoral rock occurred. Shelter and the amount of silt present increased progressively with distance into the loch, and rock slopes became shorter (Section 2.1). West facing coasts were more exposed than east facing ones and little work could be done on these west facing coasts or in the outer isles. In particular it was only possible to look at the infralittoral fringe in the inner sheltered parts of the loch. It was only possible to visit a few sites in the outer parts of the loch where rock occurred in the circalittoral and so it was not possible to clearly define infralittoral and circalittoral zones for comparison with other areas. The outermost sites supported rich circalittoral populations of bryozoa and hydroids not found in the inner sites, and the records of this type of community are incomplete. Sediment communities were also affected by wave exposure with coarse sediments in the outer loch and fine muds in the deep parts of the inner loch. The series of rapids and high current areas result in further distinct communities. Populations, particularly of algae were considerably influenced by the very heavy grazing action of the innumerable Echinus.

4.2.1 Kelp forest and algal populations

A well developed kelp forest of Laminaria hyperborea was present on bedrock and large stable boulder slopes throughout the exposed outer and middle parts of the loch. In the inner sheltered parts, L. hyperborea

was still the predominant kelp forest species even on small boulder slopes since the lack of wave action results in a stable situation. At exposed sites in the outer loch where rock extended to at least 30m, a kelp forest generally extended to between 10-12m (although sometimes interrupted by vertical cliffs) and kelp plants extended to a maximum of between 17-23m. In the inner sheltered parts of the loch, kelp forest generally extended the length of the rock slope since this was mostly less than 10m. The L. hyperborea plants in sheltered situations tended to be of the 'cape' variety with wide, mostly undivided fronds heavily encrusted with epiphytic bryozoa and tunicates. In the deep rapids at sites 20 and 41, the L. hyperborea plants were very tall (2m +).

Algal populations both within and below (in the outer parts of the loch) the kelp forest were sparse. Rocky substrata throughout the loch were very heavily grazed by Echinus in some cases to such an extent that virtually no foliaceous algae remained (6, 34), and the rock surface was dominated by 'Lithothamnion' and other encrusting algae. Foliaceous algal populations within the kelp forest tended to be sparse and scattered, with slightly greater numbers of plants surviving as kelp stipe epiphytes, and often individual plants were tatty and partly eaten. The commonest and most widespread algae throughout the loch (excluding kelp species) were Plocamium cartilagineum found at 34 sites, Phycodrys rubens (20 sites), Odonthalia dentata (18 sites), Cryptopleura ramosa (18 sites), Delesseria sanguinea (17 sites), Desmarestia aculeata (23 sites) and Dictyota dichotoma (23 sites). The richest populations of foliaceous algae in and below the kelp forest were found at the exposed sites in the outer parts of the loch - sites 38 and 39 (21 species recorded). Here red algae were abundant both on the rock surface and on the kelp stipes and Echinus were few in numbers. Algae were also common at the exposed site 32 (21 species) where more urchins were present. The moderately sheltered kelp forest at site 40 in a little bay supported a wide variety of species, again with fewer Echinus (20 species). Cobble and pebble on sand in the shallow (10m) moderate rapids at site 41 allowed a fairly wide variety of algae to develop (13 species).

4.2.2 Communities on hard substrata

4.2.2.1 Cobble (1, 2, 6, 20, 41)

Areas of thick cobble overlying sand were found in deep water off the exposed headlands north of Valtos (1, 2), and in the centre of the rapids in Little Loch Roag (20) and between Little Bernera and Great Bernera (41). At some other sites smaller amounts of cobble overlay muddy sand (6). Off the exposed headlands the cobble supported a variety of hydroids and small bryozoa particularly Nemertesia sp., Abietinaria abietina, Securiflustra securifrons and Kirkenpaweria pinnata. The sides and undersides of the cobble were colonized by Pomatoceros triqueter, Spirorbis sp and encrusting bryozoa, and the tops by Lithothamnion. Brittle stars, Ophiothrix fragilis and Ophiocomina nigra were common hidden under the cobble but not forming beds on top. The cobble in the rapids situation supported very few hydroids probably because of its mobility and was dominated by 'Lithothamnion' and by Balanus sp.

4.2.2.2 Exposed boulder slopes (6, 33, 34)

Very extensive boulder slopes reaching depths of 25m or so occurred at some sites in the middle, moderately exposed parts of both East and West Loch Roag. These slopes were similar to many of those found around the Summer Isles (Dipper, 1981) and were extremely heavily grazed by Echinus. Above about 10m the substratum generally changed to grazed bedrock. The dominant cover was 'Lithothamnion' giving the rocks a beautiful pink colouration. Other species able to withstand the grazing pressure were Caryophyllia smithii, Pomatoceros triqueter, encrusting bryozoa and occasional isolated clumps of Alcyonium digitatum, ascidians and Metridium senile. Cucumaria saxicola was common hidden between the boulders and the larger spaces were used extensively by cuckoo wrasse (Labrus mixtus), goldsinny wrasse (Ctenolabrus rupestris) and poor cod (Trisopterus minutus). A kelp forest extended to about 13m with plants down to 17m or so, with an extremely sparse undergrowth. A few red algae managed to survive as epiphytes on kelp stipes.

4.2.2.3 Sheltered boulder slopes (13, 27, 28, 31; 14, 18, 21, 22)

Boulder slopes in the sheltered parts of the middle of the loch extended to between 10-15m. Again the predominant rock cover was 'Lithothamnion' and other encrusting algae with a fine cover of silt over everything, and grazing by Echinus was fairly heavy. The dominant species were ascidians mainly Ascidiella aspersa and Ciona inte stinalis attached both to the rock surface and to the kelp stipes. Otherwise the undergrowth was fairly poor consisting of sparse foliaceous algae mainly Dictyota dichotoma, Bonnemaisonia asparagoides, Traliella, Plocamium cartilagineum and Delesseria sanguinea; and scattered sponges (Myxilla spp., Cliona celata), Caryophyllia smithii, Pomatoceros triqueter, Spirorbis sp. (undersides) and Cucumaria sp. A L. hyperborea kelp forest extended to about 8-10m with individual plants to the edge of the rock at about 15m. The kelp fronds were usually very heavily encrusted with Diplosoma listerianum, Membranipora membranacea and Scrupocellaria sp. Boulder slopes in the very sheltered parts of the inner loch (21, 14, 22, 18) were very similar but often shorter and with more silt. Often bedrock and boulder slopes were mixed in together at the same site or in nearby areas and in these cases, the bedrock supported similar species to the boulders which appeared stable.

4.2.2.4 Exposed bedrock slopes and cliffs

Extensive and spectacular bedrock slopes and cliffs occurred in the outer exposed parts of the loch with bedrock often reaching 30m before the sediment plain was encountered. In some cases, very large boulder blocks were present rather than bedrock but these were obviously stable and acted like bedrock. The species present depended on the water movement, the steepness of the slope and the grazing action of Echinus. The latter was considerably less abundant in these exposed areas particularly on very steep rock.

Vertical cliffs were present at many sites (39, 38, 36, 2, 8, 10, 7) often with horizontal or sloping rock above and below them. The truly vertical surfaces were typically colonized by Alcyonium digitatum, Metridium senile, Sagartia elegans, Corynactis viridis,

Pachymatisma johnstonia, Myxilla sp. Clathrina coriacea, Aplidium nordmanni, Pomatoceros triqueter, occasional hydroids and Clavelina lepadiformis. They were visually very spectacular. Similar but shorter cliffs occurred at site 36 which is sheltered from wave action but exposed to strong currents.

Extensive bedrock slopes occurred at several outer sites (39, 11, 29, 30, 42) and supported a greater variety of species than the vertical rock including kelp forest and kelp to about 20m, red algae, Antedon bifida, large sponges such as Myxilla sp., Cliona sp and Pachymatisma johnstonia, hydroids, Ciona intestinalis, Securiflustra securifrons, Cucumaria sp., Alcyonium digitatum, Metridium senile and Sagartia elegans. Echinus grazing tended to reduce the diversity here, and some bedrock was fairly bare apart from Pomatoceros triqueter and Lithothamnion.

Rich circalittoral populations (39) At one site in the outer exposed part of the loch very rich turfs of bryozoa and hydroids were present on a bedrock and boulder slope between about 14-19m. Above 14m there was a vertical cliff to 7m followed by horizontal rock and below 19m was a sand plain. Rich growths of foliaceous algae were also present both on the rock slope and especially in the kelp forest on horizontal rock above 7m. Very few Echinus were present, and this, together with the position of the site in the lee of an island and in a sound with some current may be the reason for the rich growths.

4.2.2.5 Sheltered bedrock slopes and cliffs (15, 19, 31)

Bedrock slopes and cliffs also occurred in the inner sheltered parts of the loch, although extending to only 10m or less before meeting the sediment plain. These supported very similar populations to the sheltered boulder slopes (Section 4.2.2.3) with ascidians predominating, and a silty kelp forest.

4.2.2.6 Current exposed areas and rapids (20, 35, 36, 41)

The four 'rapids' sites that were looked at were all different due to variation in speed of current, substratum and depth. None of them supported the very rich populations of sponges, bryozoa, hydroids and anemones found in some other Scottish rapids. All were visually beautiful. The substratum in these rapids was mostly cobble, sand and small boulders rather than bedrock or stable boulders and it is probably the instability of the substratum that limits the richness of the sites. Most supported some typical current loving species such as Halichondria panicea, Sagartia elegans, Alcyonidium spp. (on kelp), and on stable rock (20, 36) Metridium senile. The middle of the channel at site 36 supported a Modiolus bed and the current here was not as rapid as the other sites allowing the development of a fairly rich community on the Modiolus - mainly red algae, hydroids and anemones. Again few sponges were present.

4.2.3 Communities on soft substrata

4.2.3.1 Clean sand (1, 7, 8, 9, 3, 4, 12, 10, 13, 32, 33, 34, 40, 41, 29, 30, 39, 36, 38). The main substratum in the outer exposed parts of both West and East Loch Roag was sand. This extended right through the Kyles Pabay between the mainland and Pabay Mor as a fine sand with little life in shallow water. A fairly extensive Zostera bed was present at site 12 just off the long, moderately exposed sandy beach of Traigh na Berie, near Valtos. The Zostera did not support a particularly rich community of other species attached to or associated with it apart from a variety of small red algae, Anemonia viridis and Obelia geniculata. The Zostera itself however, was very healthy and was fruiting. The sand itself contained large numbers of Ensis sp. shells and at several sites live Ensis were common. Other species associated with clean sand included Lanice conchilega, Liocarcinus marmoreus, Crangon crangon, Venus sp., Arctica islandica, Pomatoschistus pictus, Callionymus lyra, Natica sp. Clean sand was also present in deeper water to the east of Vacsay in West Loch Roag and north of Loch Risay in East Loch Roag. In the exposed parts the sand was ridged even below 25m or so (e.g. site 10 and 1).

4.2.3.2 Muddy sand (11, 6, 23-25, 14, 15, 16, 18, 21, 31, 28, 27, 37) Muddy sand was present over large areas in the sheltered inner parts of the loch south of a line running east/west very approximately from Stung (at the east end of Traig na Berie beach) across Great Bernera to Vacasay Island. The proportion of mud to sand varied according to shelter (and depth which is equivalent to increased shelter) and there was often a large percentage of broken shell. Pebbles overlying the sediment (e.g. site 6) increased the diversity of species present by allowing attachment of algae (shallow water) and hydroids. This type of sediment was characterised by large numbers of Pecten maximus although this species was also present in smaller numbers in other sediments. Other characteristic species included Cerianthus lloydi (in small numbers), Chaetopterus variopedatus, Ophiura albida, Nassarius sp., Turitella communis (often only dead shells), Gibbula magus (especially common at site 22), Pagurus bernhardus (common), Urticina felina, Pomatoschistus pictus, Callionymus lyra, Trisopterus minutus (over the sediment adjacent to the base of the rock slope), Mya sp., Chorda filum and L. saccharina (attached to shells and pebbles). Sites along the east coast of Great Bernera (31, 37, 27) also often supported dense beds of Virgularia mirabilis in addition to the other species mentioned. Virgularia was not recorded in West Loch Roag.

4.2.3.3 Mud (22, 18, 21, 16)

Muddy sands graded into muds in the inner parts of the loch, and at some sites the sediment was composed mainly of firm mud with much shell debris (eg 22, 16, 18) and with a similar fauna to the muddy sand. Soft mud was found in deeper water in the inner parts of the loch (eg site 15) and probably also extends into shallow water in the very sheltered inner reaches including Little Loch Roag which were not investigated.

4.2.3.4 Shell gravel (19, 5, 36, 35)

In areas where fairly strong currents were present, the sediment was of very coarse shell sand or shell gravel. This was found in the sounds between the mainland and Uvia Mor (5) and between Great Bernera and Eilean Kearstay (36); in the entrance to Little Loch Roag (19) and the rapids under Bernera Bridge (35) with smaller amounts elsewhere. Considerable amounts of shell debris were present in all sediments including mud, throughout the loch. These sediments were too mobile to support many species.

5. DISCUSSION

5.1 General

The appalling weather conditions under which the team had to operate with constant strong winds and rain everyday meant that a complete coverage of sites throughout the loch was impossible; in particular, of exposed west facing coasts and the outer islands. The great length of the total coastline within the loch (approximately 190 km) also made a complete coverage impossible in the time, and with the equipment available. Nevertheless, 43 sites were examined in eleven days diving, scattered throughout the loch.

The loch as a whole exhibits a fairly wide diversity of habitats as a result of the great complexity of the numerous islands, headlands and inlets. Thus sites varied from those extremely exposed to wave action to those completely sheltered from wave action, with attendant differences in habitat and species. Sediments varied from coarse, mobile sand, through fine sand supporting populations of Ensis and Zostera to muddy sands and muds. Rocky habitats varied from steep and vertical cliffs, through extensive boulder slopes to short muddy boulder slopes and bedrock slopes and areas of cobble and pebble. The diversity of species, however, was not as great as might have been expected, particularly amongst the algae. One major cause of this was the predominance of the sea urchin Echinus esculentus whose grazing action was very severe. The lack of deep circalittoral rock also restricts the diversity of species and communities. However, this type of habitat occurred mainly in the Outer part of the loch which could not be fully investigated.

The richest sites in terms of numbers of species were those in the outer isles particularly on the lee sides of the islands where the very strong wave action is slightly moderated, and the water is extremely clear (no fully exposed sites were actually dived). The existence of moderate tidal currents between these small islands probably also contributes to the richness of the sites. These were similar to rich populations found on steep rock off Canna, Sanday and Coll in the Inner Hebrides (Dipper 1981) but lacked the variety of sponges and 'southern' species (eg Holothuria). The extensive, heavily grazed boulder slopes and cliffs in the middle and outer parts of the loch closely resemble those found extensively around the Summer Isles. No rich growths of sponges and ascidians typical of very heavy wave exposure and mainly found in surge gullies and sea caves were found. This may be because such sites were inaccessible to the team. Ascidians, mainly Ascidiella spp. and Ciona intestinalis,

predominated over large areas in the sheltered parts of the loch especially in the kelp forest. Similar situations have been found in the extensive sea-lochs off the east coasts of the Uists (Dipper, 1980). The sediments were in general rather poor in terms of epifauna and epiflora. However, analysis of collected samples by Dr Shelagh Smith suggests that they are fairly rich in terms of infauna (separate report on the shores; Smith 1983).

5.2 Species of particular interest

Antiopella hyalina: Two specimens of this rare nudibranch were collected, one from material from a shallow bedrock site in the kelp forest; and the other an offshore bedrock plateau with scattered hydroids and algae. The only previous record of this species from Scottish waters was a single specimen collected from the Summer Isles by the UCS/NCC expedition in 1981 (Dipper, 1981).

Eurynome spinosa: Several small specimens of this crab were collected amongst algal material and were identified by Mr Paul Clarke at the British Museum (Natural History). The previous most northerly record was the Isle of Man. However, in the past, some specimens may have been identified as Eurynome aspersa which has a much wider recorded distribution.

Liocarcinus corrugatus: This may be a further most northerly record for this fairly widespread species. Specimens of this species were collected in the Summer Isles and at the time this was thought by Mr Paul Clarke (BM NH) to be a northerly record.

Luidia sarsi: In the authors experience, this fairly widespread starfish is rarely recorded by divers unlike its very common relative L. ciliaris. L. sarsi was also recorded in the Summer Isles.

Escharella labiosa (bryozoan): Probably a new northern record.

* SEE
BELOW

5.3 Comparison of shore and adjacent sublittoral sites

Some of the present survey sites were adjacent to shore sites investigated by Powell et al (1979). The latter sites are indicated in Map 4. It is perhaps interesting to compare these areas.

Little Bernera Narrows (UCS site 41). The shores in this area were described as interesting because they supported unusual species normally found in deeper water such as Clavelina lepadiformis, Echinus esculentus, Nitophyllum punctatum and Cryptopleura ramosa. All the latter except Cryptopleura were recorded sublittorally here.

Croir Bay (UCS site 40). This is described as a sheltered cove with Laminaria covered boulders and a rich fauna. The sublittoral kelp forest within this cove was found to be fairly rich in species although just outside, Echinus grazing was heavy.

Entrance to Little Loch Roag (UCS site 19) and narrows (UCS site 20). The steep shores in this area were dominated by Balanus balanoides and mussels with few other species. This belies the sublittoral interest of the rapids, which although not very rich supported a colourful variety of species.

* Achaeus cranchii: Specimens collected amongst hydroid material and found by Roger Bamber whilst looking for pycnogonids. Identified by Paul Clarke and Ray Ingle (BM NH). This is a northern record; Clyde and Argyll previous furthest north.

Teinish (UCS site 5 is near). This sedimentary shore was described as being qualitatively and quantitatively rich in animal species with a diverse infauna. The sublittoral sediment in the centre of the channel opposite this shore is fairly poor in species consisting mainly of a coarse shell sand with occasional hydroids attached to old shells.

5.4 Conservation interest

It is very difficult to assess the conservation interest of a large area such as Loch Roag on the basis of a single incomplete survey. A preliminary survey of the shores carried out by the Intertidal Survey Unit of the SMBA and MBA for NCC, identified the loch as a Primary Site of marine biological importance. This assessment was based on the great variety of shore types some of which supported a rich flora and fauna. (Powell et al, 1979). Smith (1977) found the mollusca of the rocky shores to be rich in numbers and species and her present work during this survey extends and confirms this impression (Smith, 1983). There is certainly a wide variety of sublittoral habitats in the area, many of which represent the "typical" Scottish situation (eg grazed boulder slopes, Zostera beds etc). The number and variety of species was not all that high except in the outer islands but this again is typical of many other sites off the Scottish west coast. The rapids that were looked at (and not all those present were visited) were interesting but not particularly rich in species. For instance they do not compare favourably in terms of richness with the Linne Mhurich rapids in Loch Sween or those in Loch Tarbert in Jura. However, they represent a particular type of rapid with little stable rock as a substratum. The Zostera bed found in the shallow Kyles Pabay was very healthy with fruiting plants and was typical of others found in clean sand in the Inner Hebrides (eg Rhum, Tiree, Skye), with only a limited variety of other species associated with it. The Modiolus bed in the current exposed channel between Great Bernera and Eilean Kearstay provided a hard substratum for many species that would otherwise not have survived there. This site was consequently very interesting and fairly rich in species. However, the extent of the live bed appears to be limited with much of the area consisting only of dead shells. It would be an interesting exercise to map the boundaries of the bed and to see if further beds occur in this part of the loch. Modiolus beds in other areas such as Strangford Lough support much richer communities of sponges and hydroids but this is partly due to biogeographical factors.

Powell et al (1979) suggests that economically Loch Roag could be very important to the Hebrides because it provides a large safe anchorage for ships with relatively easy access. This is a fairly rare situation in the Outer Hebrides particularly on the west coast. A pier and factory for the processing of Blue Whiting (Gadus poutassou) have been built at Breasclate in the hope of attracting this new fishing industry. The possible pollution effects from this factory are unknown to the author and no diving was carried out in this vicinity. There is also a slipway and a natural harbour on the east side of Great Bernera near Kirkibost where fishing boats can unload; and a small pier near Uigen.

Scallop dredging within the loch could cause damage. However, most of the scallop beds seen were on soft sediments with no low rocky reefs with interesting fauna around such as are found off Skomer Island in Pembrokeshire. Here scallop dredges can damage sea fans and other life on the reefs. The extent of scallop dredging is not known. The Modiolus beds which were near good scallop areas, would certainly be damaged by dredging. Scallops are collected by clam divers who were seen operating in the area. This method is non-destructive apart from the scallops themselves. Potting for crabs is also carried out but is again essentially non destructive.

Mussel rafts were seen in the inner western arm of the loch.

The rich populations found off the outer islands have their own natural protection because they are so exposed and dangerous to shipping.

Comment on the conservation interest of the shores is given by Smith, 1983.

ACKNOWLEDGEMENTS

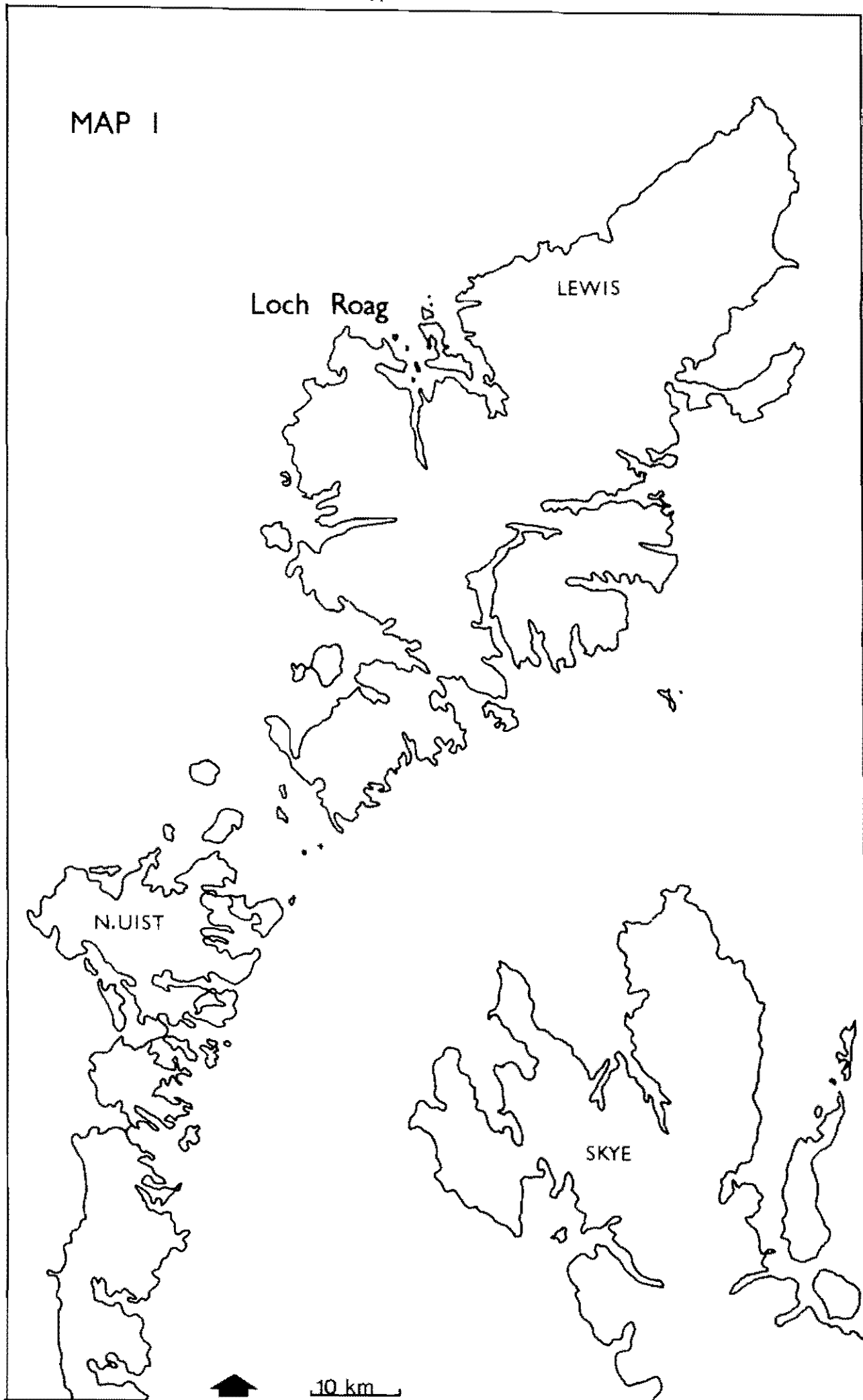
We would like to thank all those who made this expedition possible particularly the western Isles Islands Council for making the Valtos Outdoor Centre available to us and the caretaker Mr John Buchanan who looked after us during our stay. We would like to thank Andrew Currie (NCC ARO, Skye) for the loan of his NCC inflatable boat and engine and Paul Tyler for local advice. We would like to thank the following people for help in the identification of specimens: Mr Paul Clarke (crabs); Ms Joan Ellis (amphipods); Miss Ailsa Clarke (echinoderms); Miss Christine Maggs (algae); Ms Sue Chambers (worms); Dr Shelagh Smith (molluscs); Dr Ray Ingle, and Ms E Allen (hermit crabs); John Rubin (bryozoa); Mr Bernard Picton (sponges, tunicates, hydroids). The expedition was partly funded by the Nature Conservancy Council who contracted Frances Dipper to lead the expedition and write the report and who provided much of the necessary equipment.

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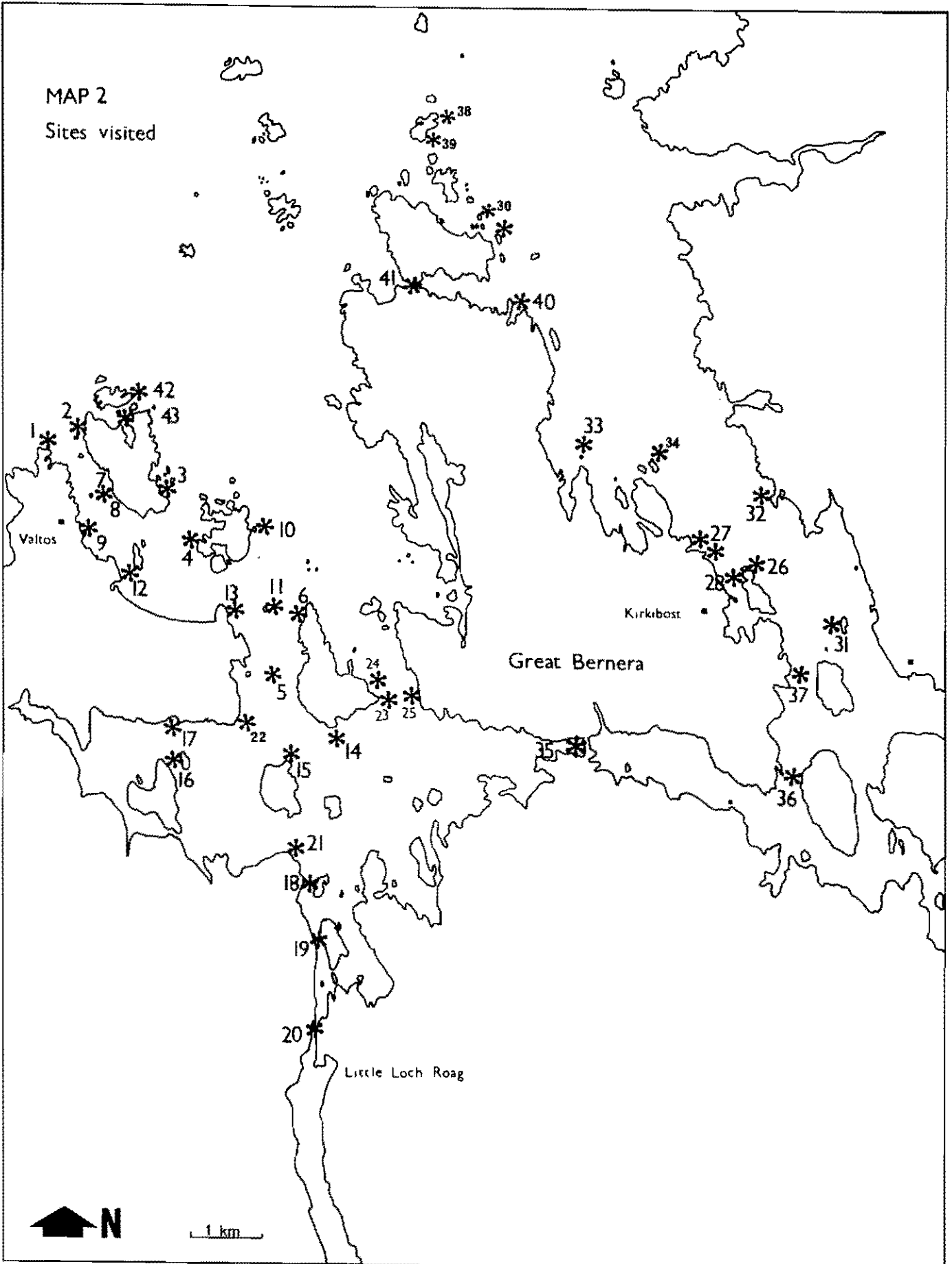
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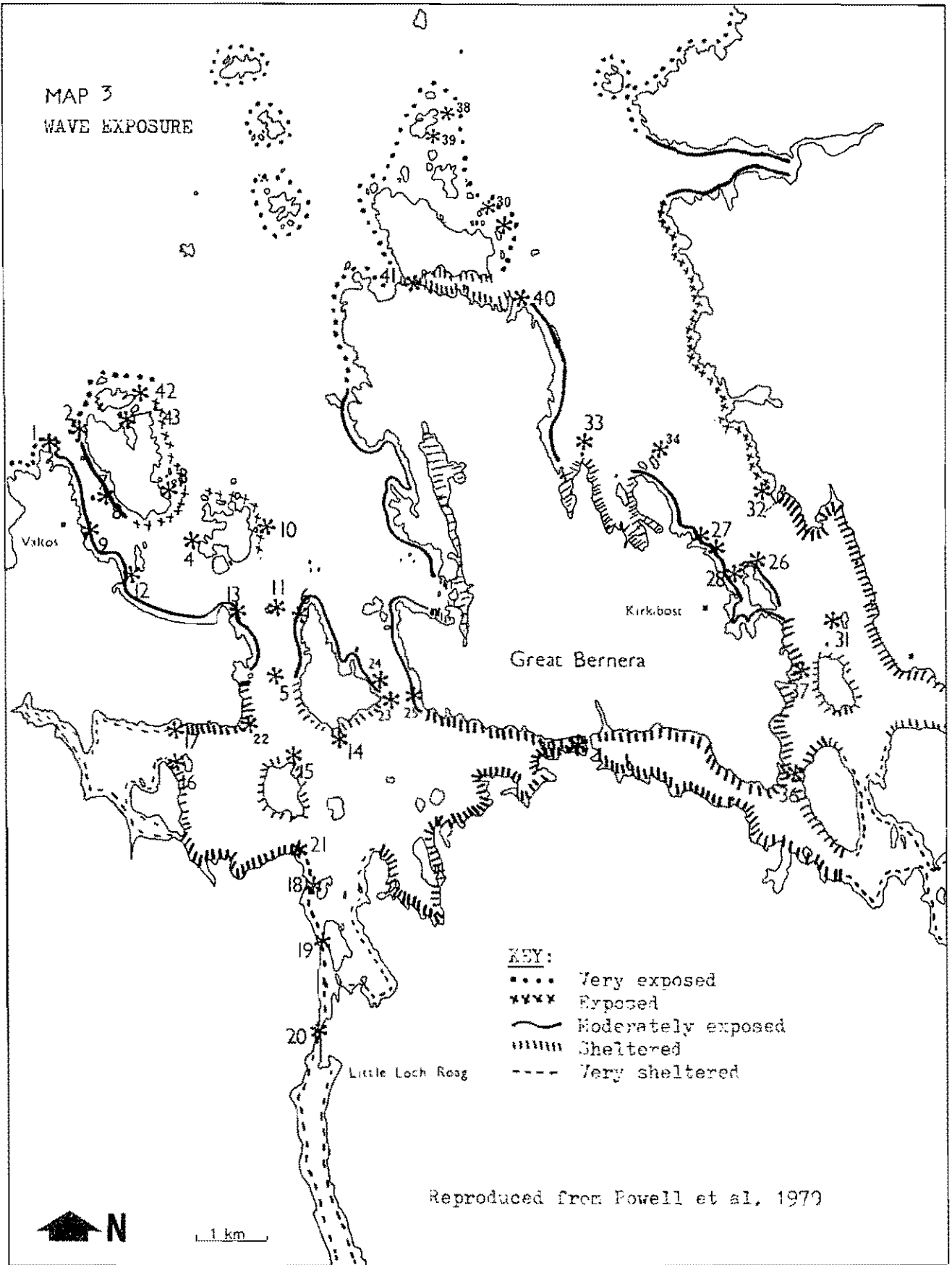
MAP I



MAP 2
Sites visited



MAP 3
WAVE EXPOSURE



MAP 4.

Intertidal sites
visited by Powell
et al. 1979.

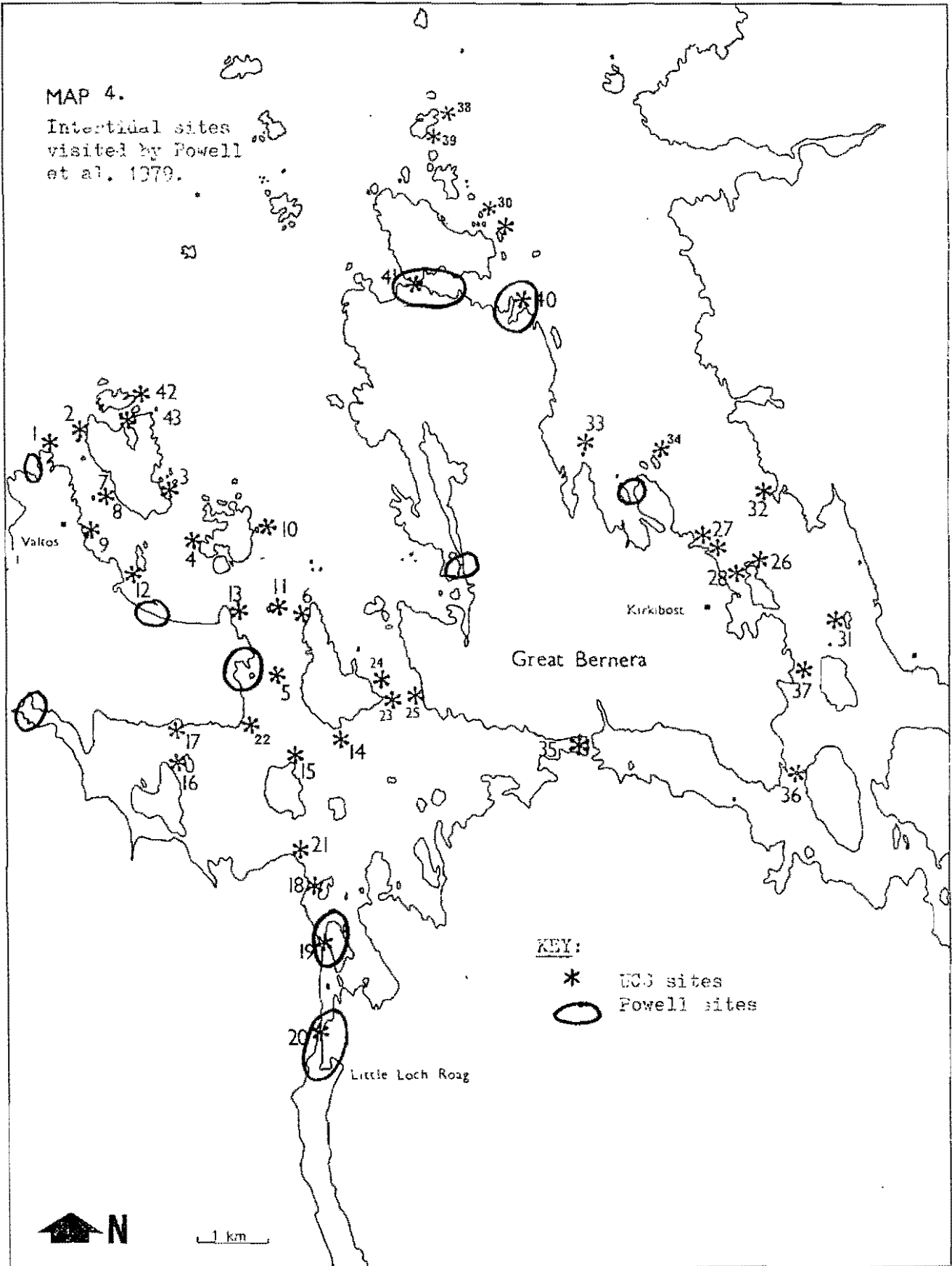




TABLE 1. DIVING SITES

Site Number	Site Name	Date	Grid. Ref.	Divers
	WEST LOCH ROAG			
1	Eala Sheadha	6.9.82	NB 090384	AS,TH; RS,VP; GD,DM
2	N.W. Pabay Mor	6.9.82	NB 095385	FD,GB; NB,SF; DC,BS
3	S.E. Pabay Mor	6.9.82	NB 106377	AS,TH
			NB 107375	RS,VP; GD,DM
4	Tearbasco, Vacsay	6.9.82	NB 1113689	FD,GB; NB,SF; DC,BS
5	Bogha na Muilne	7.9.82	NB 122351	GB,VP; RS,AS; BS,SF
6	North Vuia Mor	7.9.82	NB 125359	FD,TH; NB,DM; DC,GD
7	Iola Sgeir	7.9.82	NB 096375	GB,UP
			NB 098375	AS,RS
8	West Pabay Mor	7.9.82	NB 099376	BS,TH; DC,GD
9	Valtos Harbour	7.9.82	NB 095369	SF,NB
10	Liacam, Vacsay	8.9.82	NB 119370	UP,GD; BS,NB; DM,AS
11	Geile Sgeir	8.9.82	NB 122360	FD,RS; SF,GB,DC
12	Kyles Pabay	8.9.82	NB 103364	FD,RS; GB,DC
13	Stung	8.9.82	NB 115359	UP,GD; BS,SF; DM,AS
14	Rubha na Moine, Vuia Mor	9.9.82	NB 130343	UP,RS; GB,AS
15	Rubha nan Sidhean, Vuia Beag	9.9.82	NB 124340	NB,BS; FD,GD; DC,SF
16	North Floday	9.9.82	NB 107339	GB,AS; UP,RS
17	Reef beach	9.9.82	NB 107344	NB,BS
21	Gob Sgrithir	10.9.82	NB 124326	SF,GB; AS,GD; DM,RS
22	Linish Point	10.9.82	NB 117345	FD,BS; VP,DC
23	Sgeir na h-Adaig, Vuia Mor	11.9.82	NB 137348	TH,GD
24	Knock Dibick, Vuia Mor	11.9.82	NB 135350	VP,BS
25	S.W. Great Bernera	11.9.82	NB 141349	RS,AS
42	Sgeir a'Chais, Pabay Mor	17.9.82	NB 103388	All divers
43	Kyles Pabay Beag	17.9.82	NB 102387	FD,BS,UP
	LITTLE LOCH ROAG			
18	Entrance Little Loch	10.9.82	NB 126323	AS,GD
			NB 127323	SF,GB
19	Aird Orasay	10.9.82	NB 127315	DM,RS
20	Little Loch Roag Narrows	10.9.82	NB 127303	FD,BS; UP,NB
	EAST LOCH ROAG			
26	Vacasay Island East	11.9.82	NB 187366	FD,NB; PT,Jim; SF,DC; GB,DM
27	Mol an Droighinn	11.9.82	NB 179369	AS,RS
			NB 182367	BS,UP; TH,GD
28	Vacasay Island West	11.9.82	NB 185365	DM,GB,PT,DC,SF
			NB 185366	FD,WB
31	Greinan	13.9.82	NB 199358	FD,DC: GD,GB: UP,TH
32	Eilean Blianish	13.9.82	NB 189376	BS,RS,; SF,AS; DM,NB
33	Sgeir Bhan, Great Bernera	14.9.82	NB 164383	BS,GD; UP,GB; DM,TH
34	Eilean Mor, Great Bernera	14.9.82	NB 175382	FD,AS; DC,RS,NB
35	Bernera Bridge	15.9.82	NB 163342	UP,AS; DM,DC
36	Eilean Kearsay Channel	15.9.82	NB 193337	All divers
37	Kyles Keava	15.9.82	NB 194352	BS,GB; FD,RS,GD

TABLE 1. Contd.

Site Number	Site Name	Date	Grid. Ref.	Divers
	OUTER LOCH ROAG			
29	Sgeir a'Mhurain, Little Bernera	13.9.82	NB 150414	FD,DC,UP; GD,GB
30	Gaisgeir, Little Bernera	13.9.82	NB 154412	BS,RS; DM,NB; SF,AS
38	Campay, Natural Arch	16.9.82	NB 145427	PT,SF,GD; TH,NB; GB,RS
39	Campay, S.E. Corner	16.9.82	NB 144425	FD,DM; AS,DC; BS,UP
40	Rubha Thorab, Croir	16.9.82	NB 156402	PT,SF,GD; TH,NB; GB,RS
41	Little Bernera Narrows	16.9.82	NB 142404	FD,DM; AS,DC; BS,UP
42	N.E. Pabay Mor	17.9.82	NB 104388	All divers
43	Pabay Lagoon	17.9.82	NB 102385	FD,BS,UP

TABLE 2. Description of Sites

WEST LOCH ROAG

1. Eala Sheada NB 090384

Exposed headland site, with deep water extending close in to the shore. Cobble overlying coarse sand close in to the cliff, with little on the cobble apart from Pomatoceros. Further offshore, sand thrown up into ripples. A species poor site.

/25-29m/

2. N.W. Pabay Mor NB 095385

Exposed site with deep water close inshore. Plain of cobbles and pebbles with coarse sand in between, dominated by hydroids especially Abietinaria abietina, and Kirchenpaueria pinnata; Alcyonium frequent securiflustra and Flustra common. Ophiothrix and Ophiocoma common. Steep cliff face led up from the plain (extension of small island) dominated by Corynactis and Pomatoceros with scattered Alcyonium, Pachymatisma, Cliona and other large sponges. Kelp extended to 21m and formed a forest at 12m where the rock flattened out. Red algae extended to 27m.

/22-30m/

3. S.E. Pabay Mor NB 106377, NB 107375

In this area the rock slope was short consisting of small cliffs and boulders meeting a shell sand plain by 6-9m. Mixed kelp forest present, species depending on stability of the rock, with some undergrowth algae. Typical rock species were Alcyonium, Caryophyllia, Sagartia elegans, Echinus and Cliona. In a small shallow cave, a variety of sponges were present especially Pachymatisma johnstonia, Clathrina coriacea and Halichondria.

/0-9m/

4. Tearbasco, Vacsay NB 111368/9

In this area the rock slope was short ending in a coarse sand plain with broken shells by 6-9m. The rock slope varied from steep cliff and sloping bedrock to steep boulder slopes, dominated by kelp forest. Folioseous algae were thick on the boulders but heavily grazed by Echinus on the bedrock. Cliffs provided crevices for Galathea, Thorogobbius, scyphistomae of Aurelia and Cucumaria sp. Pomatoceros, Alcyonium, Metridium, Antedon and tunicates common on the verticals. Sediment with many old shells; Ensis and Echinocardium common; Pomatoschistus sp. and small Pecten frequent. Drift algae and Zostera fronds frequent.

/0-9m/

7. Iola Sgeir NB 096375, NB 098375

The channel between Pabay Mor and the mainland is shallow with a fine shell sand substratum with little life in it. The rock, Iola Sgeir, is dominated by kelp with an undergrowth of folioseous algae, lithothamnion and Sagartia elegans.

/5-6m/

8. West Pabay Mor NB 099376

This was the edge of the channel described in 7. A short bedrock and boulder slope reaches the sediment at 6-7m. Rock slope dominated by kelp forest and cliff faces by Antedon and large Alcyonium.

/0-7m/

9. Valtos harbour NB 095369

Low rocky reefs with clean coarse sand in between. Kelp forest of mixed L. hyperborea, L. saccharina and Sacchariza polyschides, with a turf of Plocamium, Odonthalia and Cryptopleura. Echinus common; Urticina (Tealia) common.

/0-1m/

12. Kyles Pabay NB 103364

This site was just offshore from the extensive sandy beach to the east of Valtos. The substratum was of clean medium fine sand and in shallow water, supported a healthy Zostera bed. The Zostera was fruiting. Small algae such as Cryptopleura, Gracilaria, Plocamium and Phycodrys were attached to the Zostera and to stones and shells. Ensis shells common, Liocarcinus marmoreus, Crangon and gobies frequent.

/1-2m/

13. Stung NB 115359

A short boulder slope to between 5-10m giving way to a sand and muddy sand slope. Boulder slope dominated by a L. hyperborea kelp forest with sparse algal undergrowth grazed by Echinus. Encrusting algae and Pomatoceros common. Ascidians - Ascidiella sp., Ciona intestinalis and Polycarpa sp? Common. Sediment with Ensis shells, worm casts and tubes and some Pecten.

/5-18m/

10. Liacam, Vacsay NB 119370

Very steep, stepped cliff faces close inshore the deepest reaching 30m before giving way to a coarse, ridged shell sand plain. In some parts there was a boulder slope at the base of the bedrock. There was a L. hyperborea forest above 11m especially on horizontal ledges and kelp park to 16m where the rock was not too steep. On the steepest cliff, a zone of small foliose red algae and Dictyota dichotoma extended from 11-13m with only 'Lithothamnion' below this. Cliff faces were dominated by ascidians - Ciona and Ascidiella sp. and by Antedon bifida. Occasional scattered sponges - Cliona, Myxilla sp, Haliclona sp.

/11-29m/

5. Bogha na Muilne NB 122351

Submerged rocks in middle of channel surrounded by coarse shell sand. The rock ended at between 9-12m although it dipped down to 15m in places. Rock dominated by kelp (L. hyperborea) forest with some foliaceous algae, Alcyonium, Cucumaria sp., Caryophyllia, ascidians and abundant Antedon. Sediment with some hydroids attached to shells, and old Modiolus and Ensis shells.

/3-15m/

6. North Vuia Mor NB 125359

Broken irregular steep bedrock slope with numerous crevices and small cliffs with a jumble of angular boulders below it becoming muddy coarse shell sand overlain by pebbles and with scattered boulders at about 17m. The rock and boulders were extremely bare and very heavily grazed by numerous Echinus. Only Pomatoceros, Caryophyllia, encrusting bryozoa and lithothamnion survived, along with large patches of Ciona and Ascidiella aspersa. Goldsinny and cuckoo wrasse were common amongst the boulders, and there were occasional large clumps of Alcyonium and Metridium. L. hyperborea forest to about 12m and park to 15m. Pebbles on sediment supported tatty Nemertesia and Tubularia and abundant Pecten.

7-21m

11. Geile Sgeir NB 122360

Steep bedrock slope with vertical cliffs and ledges covered in muddy shell sand with sediment even on the steep parts. Very muddy shell sand slope at between 17-27m. Kelp extended to 16m with a forest to about 12m. Forest undergrowth grazed by Echinus with many Antedon, Ascidiella, Palanus sp. and 'Lithothamnion.' Circalittoral with fairly wide variety of species but scattered and definitely grazed by Echinus. Ciona, Ascidiella, Securiflustra, Halecium, Nemertesia, Caryophyllia, and Sagartia typical. Sediment with many Pecten.

11-22m

14. Rubha na Moine, Vuia Mor NB 130343

Steeply sloping bedrock and boulder slopes with small vertical cliffs and sediment between the boulders. Gave way to gently sloping soft muddy sand plain with shell remains at 11-15m. Rock dominated by L. Saccharina and ascidians. Crossaster frequent. Sediment with many Turitella shells and Pecten common.

2-13m

15. Rubha nan Sidhean, Vuia Beag NB 124340

Sediment slope of mud at 30m extended quite close inshore becoming muddy sand in shallower water. Rock began at anything from 23m to 10m and there were scattered large boulders in the sediment. Boulder slope with steep cliffs in places dominated by the cape form of L. hyperborea forming forest on bedrock to about 10m and L. saccharina on the boulders, all with heavy epiphytic cover of Obelia and Scrupocellaria. Modiolus frequent on the sediment slope and colonised by hydroids and tunicates (also abundant on the rock). Pecten frequent.

3-30m

22. Linish Point NB 117345

Boulders extending only to 2.5m dominated by L. hyperborea. Sediment slope of shell gravel followed by mud becoming progressively softer with depth. Debris of shells, stones etc covered in Ascidiella aspersa. Hermit crabs, Gibbula magus, Turitella shells and painted gobies common.

16. North Floday NB 107339

Flat mud and muddy sand plain with scattered clumps of L. saccharina, and Chorda filum. Worm casts, Pecten and Lioëarcinus depurator frequent.

/5-10m/

17. Reef beach NB 107344

This was a shore dive in very bad weather. Small boulders intertidally covered in Fucus sp., Ascophyllum nodosum and Chorda filum. Boulders gave way to medium fine sand sublittorally with scattered stones with Ceramium. Chondrus and slimy greens.

/0-3m/

21. Gob Sgrithir NB 124326

Very short bedrock slope to 5m giving way to soft muddy sand slope. Boulder slope at 4m in some parts covered in silty cape form L. hyperborea. Mud at 12m soft with 'volcanoes' and a cover of diatoms.

/0-15m/

18. Entrance Little Loch Roag NB 126323

This area consists of a mud plain with areas of white fungus on rotting material; some Pecten; worm tubes and casts and Modiolus shells. Either side of the channel there was a short boulder slope from about 9m upwards with a heavy covering of silt, and a forest of L. hyperborea (cape form). Asciidiella aspersa abundant on rock and kelp.

/0-11m/

19. Aird Orasay NB 127315

This site was in the first narrow part of the entrance to Little Loch Roag and although not a true rapids, showed indications of current. The sides of the channel were of steep bedrock and boulders to 12m and the channel bottom was a hard sediment of mixed sand, gravel and shell remains. Rock cover of L. hyperborea to 12m. Asciidiella and Ciona abundant on rock and scattered hydroids and Alcyonium. Modiolus was present in the centre of the channel and occasional Pecten.

/0-12m/

23. Sgeir na h-Adaig, Vuia Mor NB 137348

Outer side of a small rock. Short, moderate bedrock slope leading down to a sand plain by 3m. Rock dominated by a dense kelp, L. hyperborea, forest with a variety of foliaceous algae underneath. Few animals, mostly Asciidiella, Antedon, Pomatoceros; and barnacles and limpets near the surface.

/0-3m/

24. Knock Dibick, Vuia Mor NB 135350

Flat muddy shell sand plain, close in at only 5m. Hermit crabs and dragonets common. Pecten and Ensis shells frequent.

/5m/

25. S.W. Great Bernera NB 141349

Short boulder slope to 3m becoming muddy sand plain. Boulders dominated by L. saccharina forest with some undergrowth algae and a lot of 'Lithothamnion'. Variety of small crustacea and echinoderms. Pecten common on sediment.

1-5m

EAST LOCH ROAG

36. Eilean Kearstay Channel NB 193337

Several dives were done in this interesting, current exposed channel, and a wide variety of habitats and species were present depending on the current exposure. The east side of the channel formed by the island of Eilean Kearstay consisted mainly of sheer cliff faces from about 6 - 16m covered in a wide variety of species mainly hydroids, Metridium, Sagartia elegans, Alcyonium, ascidians and Antedon. Horizontal rocky ridges above the cliffs were covered in shell sand and supported kelp forest. Towards the south where the channel widened, the cliffs became less steep. The bottom of the channel on the east side consisted of coarse sand covered in dead Modiolus valves with some live ones. The sand was thrown up into large banks in some areas and was obviously very mobile. Some Pecten present. On the west side of the channel formed by Great Bernera, there were no cliffs. Inshore the substratum was of boulder/rock patches surrounded by muddy sand with a lot of shell debris. L. hyperborea on the rock was covered in Asciidiella and Antedon. Further out into the channel there was a live Modiolus bed on the sediment forming a hard substratum for the attachment of a wide variety of algae (mainly Plocamium), Asciidiella, Antedon and large hydroids. In more tide sheltered parts on the west side, no Modiolus were present but a thick bed of Virgularia mirabilis.

37. Kyles Keava NB 194352

The channel between Keava and Great Bernera is wider than that between Eilean Kearstay and Great Bernera (36) and there is less current; no Modiolus bed was found. Both sides of the channel consisted of short, shallow bedrock or boulder slopes leading onto a muddy shell sand (east) or mud (west) plain with outcrops of rock. Rock heavily silted and covered in L. hyperborea (cape form). Mud on west side supported a very dense Pecten bed as well as Virgularia and Cerianthus.

/1-5m/

31. Greinnam NB 199358

The whole of the west side of this small island consisted of a steep bedrock slope with ledges, crevices and overhangs leading up from a muddy sand plain at 10m. Boulders lay on the bedrock and at the base of the rock slope. The rock was dominated by a kelp (L. hyperborea) forest festooned with epiphytes - Diplosoma listerianum, Asciidiella aspersa, Botryllus, Membranipora and Scrupocellaria. The rock surface itself was in contrast fairly bare and grazed by Echinus. Scattered sponges - Myxilla, Cliona and Pachymatisma; anemones - Sagartia and Urticina and hydroids - Sertularia, were present. The sediment supported a Virgularia mirabilis bed and occasional Pecten.

/0-10m/

26. Vacasay Island East NB 187366

Gently sloping area of flat bedrock and boulders with pockets of muddy sand from about 10-15m. At 20m a plain of coarse muddy sand with shell remains and occasional low lying bedrock areas. The site was very silty with very poor visibility and a low variety of species. A kelp park of single tall L. hyperborea extended to 15m, the stipes covered in Asciidiella and tatty red algae. Echinus was common and the rock surface grazed. Caryophyllia, Antedon, Cucumaria, Saxicola and ascidians were frequent.

/11-20m/

27. Mol an Droighinn NB 179369 and 182367

Mostly boulder slopes to about 15m followed by muddy sand slopes. Boulders covered by rather sparse L. hyperborea and much silt. In some places, boulders replaced by steep cliff covered in Ciona and Ascidiella. Virgularia and Pecten in sediment.

/9-19m/

28. Vacasay Island West NB 185365 and 185366

Sheltered site between Vacasay and Great Bernera. Both sides of channel consisted of steep bedrock and boulder slopes leading down to a muddy sand plain at about 14m. Thick kelp (L. hyperborea), forest from 8m upwards and kelp park on remaining slopes to edge of rock. Kelp growing on each other as well as the rock and covered in epiphytes especially Diplosoma, Membranipora and ascidians. Rock surface grazed by Echinus and encrusted by 'Lithothamnion': Cucumaria, Caryophyllia and ascidians frequent on the rock, and red algae sparse.

/3-14m/

32. Eilean Blianish NB 189376

An area of gently sloping bedrock and boulders with the rock decreasing in amount offshore and becoming sand and cobble by about 12m depth. Fairly thick L. hyperborea forest on the rock with tall plants. Surface grazed by Echinus but still a reasonable variety of red algae. Cucumaria frequent between boulders and Neopentadactyla in the coarse sand.

/0-12m/

34. Eilean Mor, Great Bernera NB 175382

Very extensive slope of large boulders rising up from a clean sand plain at 23m. Boulders very heavily grazed by Echinus and totally dominated by 'Lithothamnion.' Only other surviving species were Caryophyllia, Pomatoceros, encrusting bryozoa and Cucumaria saxicola between the boulders. Boulders changed to bedrock by 11m with cliffs, and deep, steep gullies. Very sparse kelp park extended to 17m and an open forest to 11m. Undergrowth sparse except some cliffs covered in Alcyonium, Metridium and Antedon. This clear water, clean site also supported many fish (similar to site 6).

/4-23m/

33. Sgeir Bhan, Great Bernera NB 164383

Extensive irregular slope of broken bedrock and boulders leading down to muddy sand plain at 23m. Boulders heavily grazed by Echinus and many small Echinus present between rocks. 'Lithothamnion' predominant and other species sparse. Kelp park extended to 16m. Similar to site 34 but slightly more sheltered.

/6-23m/

OUTER LOCH ROAG

29. Sgeir a' Mhurain, Little Bernera NB 150414

Irregular bedrock slope with gullies, crevices, small cliffs and horizontal areas rising up from very clean coarse sand plain at 19m. Kelp (L. hyperborea) extended to the edge of the rock but was thicker and formed a low forest by 17m. Rock cover sparse and again much 'Lithothamnion' and encrusting algae due to Echinus grazing. Site characterized by scattered large sponges mainly Cliona, Myxilla and Pachymatisma, and a few red algae. Another clean, clear water site with large shoals of pollack above the kelp.

[12-19m]

30. Gaisgeir, Little Bernera NB 154412

Irregular stepped bedrock cliffs with scattered large boulders rising up from a clean sand plain at about 20m, rippled in places. L. hyperborea to edge of rock becoming thicker at about 16m. Rock with scattered sponges - Cliona, Pachymatisma, Haliclona, Myxilla and others. Occasional Alcyonium, Metridium and hydroids and Corynactis viridis on overhangs. 'Lithothamnion' abundant, but other algae sparse.

[10-20m]

38. Campay, Natural Arch NB 145427

Very wave exposed site. Varied terrain depending on exact site. Typically steep slope of bedrock and boulders with cliffs leading down to clean sand plain at about 23m. Also areas of gently sloping bedrock and boulders extending beyond 16m. Kelp extending to 20m and undergrown algae rich especially Callophyllis lacineata and Plocamium. Echinus few in number probably due to the wave surge.

[8-23m]

39. Campay, S.E. Corner NB 144425

An extensive bedrock and large boulder slope filled in with clean sand led down to a clean sand plain at 20m. Boulders at the edge of the sediment were dominated by a beautiful Halidrys siligiosa forest the plants heavily covered with Obelia. The boulders from 19m - 14m were covered in a rich dense turf of hydroids and bryozoa with scattered sponges and fairly rich red algae, the algae mainly on the tops of the rocks and the animal turfs on the sides. At 14m there was a vertical bedrock cliff to 7m and then a bedrock plateau. The cliff was covered in Alcyonium, Sagartia elegans, Metridium and Corynactis. The bedrock plateau supported a dense L. hyperborea forest with rich algal epiphytes and undergrowth and few Echinus. Kelp plants extended to the edge of the rock slope but as kelp park. In nearby areas the slope was less steep with no dramatic cliff faces. This area is the richest and clearest water site found.

[7-22m]

40. Rubha Thorab, Croir NB 156402

This was a small sheltered bay surrounded by rocky cliffs and with rocky outcrops in the middle. Outside the bay and in the centre, the substratum was coarse, rippled sand with little life. Inshore on the west side bedrock and boulder outcrops occurred at about 16m, heavily grazed by very dense Echinus populations with only scattered kelp and algae. Inside the bay on the east side, a substratum of boulders occurred at 4m with a very dense L. hyperborea forest. The central rocks were also dominated by kelp forest with a reasonable algal undergrowth and scattered sponges.

/4-17m/

42. North-East Pabay Mor NB 104388

The coast in this area is exposed to considerable wave action and very large swells. Very dissected bedrock at 23m with gullies, crevices and cliffs and scattered kelp. Kelp thicker by 16m. Tatty foliaceous algae and scattered sponges. No detailed record as last dive. Bedrock extended to at least 28m

/24m/

43. Pabay Lagoon NB 102385

An extensive shallow lagoon system entered through a narrow rocky passage on the N.E. coast of Pabay. Bottom of clean sand with few species. In connecting lagoons many Cereus pedunculatus could be seen.

/2m/

RAPIDS AND NARROWS

20. Little Loch Roag Narrows NB 127303

Narrow channel forming the entrance to Little Loch Roag, the sides formed by bedrock cliffs and large boulders, covered by kelp forest. Boulder blocks on west side of channel covered in Metridium senile. Centre of channel mainly cobble covered in barnacles with scattered boulders, the latter supporting very tall L. hyperborea, Alcyonium digitatum, Sagartia elegans, ascidians and Nemertesia ramosa. Kelp stipes with only a few red algae but masses of Halichondria panicea and the hydroids Amphisbetia opercularis and Sertularia argentea. Cobble supported very many Asterias rubens probably feeding on the barnacles.

/0-10m/

35. Bernera Bridge NB 163342

Shallow rapids between mainland and Great Bernera. Substratum of large and small boulders with very coarse shell sand between. West of the bridge, the depth increased and sloped off to a muddy sand bottom. Boulders dominated by a thick L. hyperborea forest, the plants heavily encrusted with Membranipora membranacea and the stipes with large masses Halichondria panicea, ascidians and bryozoa. Sagartia elegans common on holdfasts and boulders. The pier pilings themselves were dominated by Mytilus edulis near the surface and small Metridium senile below, with patches of Halichondria and Amphilectus fucorum. Many Asterias below pilings.

/2-7m/

41. Little Bernera Narrows NB 142404

Narrow channel between Little Bernera and Great Bernera Sides of bedrock and some large boulders; bottom mainly coarse sand. Scattered small boulders with occasional massive ones. Pebbles common in the centre with areas of coarse broken shell. Kelp - L. saccharina - dominated the edges of the channel whereas very large Halidrys siliquosa covered the scattered boulders. Lithothamnion and foliaceous algae common on pebbles. Where the channel widened, the substratum was mainly sand dominated entirely by amphipod tubes.

3-8m

CONTRACT REPORTS

Report number: 505

File number: S5/05/108

Contract number: MF3/03/243

Date received: December 1983

Report title: Sublittoral survey of habitats and species in and around
Loch Roag, Lewis, Outer Hebrides

Contract title: Sublittoral survey of NW Lewis

Contractor: Dr F A Dipper

Comments: Synopsis attached

Restriction: None

Number of copies received: 1 (NCC duplicated 42 copies)

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cc Pauline Johnson for the file

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F.A. DIPPER, SUBLITTORAL SURVEY OF HABITATS AND SPECIES IN AND AROUND
LOCH ROAG, LEWIS, OUTER HEBRIDES. A report to the Nature Conservancy Council.

The aims of the survey were to describe the range of sublittoral habitats and species present in and around Loch Roag whilst giving members of the Underwater Conservation Society the opportunity of participating in a marine biological survey. Loch Roag is an extensive loch complex situated about halfway along the West coast of Lewis. It is divided into East and West lochs by the large island of Great Bernera and there are numerous other islands and rocks scattered throughout the area. The loch has a total length of coastline of approximately 190 km and extends inwards from the open sea a distance of 10-15 km. Little Loch Roag penetrates a further 8 km inland. The area is one of interest to the Nature Conservancy Council in the context of their marine nature review of the Inner and Outer Hebrides and the West coast of Scotland. An extensive survey of the shores was carried out at the same time by Dr. Shelagh Smith and is reported separately (Smith, 1983). Little sublittoral information was previously available for the area although a survey of Loch Roag had been carried out by the MBA/SMBA Intertidal Survey Unit, who considered it to be of Grade 1 importance on account of the wide range of habitats.

A fairly wide range of sublittoral habitats were recorded due to the great complexity of the loch topography. Soft sediments were predominant, ranging from muds and muddy sands in the inner sheltered parts to clean sands and gravels in wave or current-exposed parts. Throughout, rock slopes were steep giving way to sediment at 5-10 m depth in the inner loch and at 20-30 m and greater in the outer. No extensive areas of circalittoral bedrock were found offshore although weather conditions prevented a full survey. A wide range of exposure to wave action was represented and tidal streams, generally weak within the loch, increased in the narrows and around the outer islands.

Algal diversity was lower than anticipated, due to grazing pressure exerted by the large Echinus esculentus population. Highest species diversity was recorded in the outer islands where the water was extremely clear with moderate tidal currents. Populations were similar to those found on steep rock off Canna, Sanday and Coll in the Inner Hebrides. The extensive, heavily grazed boulder slopes and cliffs in the middle and outer parts of the loch resembled those of the Summer Isles. Ascidians predominated over much of the sheltered part of the loch, a situation similar to that found in the sea lochs on the East coasts of the Uists. The rare nudibranch Antiopella hyalina was recorded and new Northern records for Liocarcinus corrugatus and Escharella labiosa probably set.

The sublittoral adjacent to previously surveyed shore sites was investigated to compare their biological interests. Some shores were described as interesting due to an upwards extension of sublittoral species, these being more common in the sublittoral. However, at the entrance to Little Loch Roag, where the shores were of lesser interest, the rapids supported an interesting sublittoral population.

The Loch Roag area was found to contain a wide variety of sublittoral habitats, many of which represented 'typical' Scottish situations. The rapids surveyed were less species-rich than, for instance, Linne Mhuirich rapids in Loch Sween, but were nevertheless thought to be representative of rapid systems with little stable rock substratum. Good examples of Zostera and Modiolus beds were found.

Synopsis

C M Lumb
Chief Scientists Team

21 February 1984

APPENDIX I

List of all animals and algae observed, photographed and collected.

Nomenclature follows the "NCC checklist of sublittoral species recorded off the west coast of Scotland by NCC and UCS expeditions". The latter is based on that used by the Ulster museum who are currently preparing a complete British marine fauna list. Numbers in parentheses indicate the sites at which the species was found and reference should be made to Table 2 for habitat information on these sites.

Voucher specimens of algae were made by Norma Brandt and Sarah Fowler and are held in the NCC herbarium. Sponge specimens are held by B Picton in the Ulster museum; polychaetes and molluscs by the Royal Scottish Museum; crustacea and echinoderms by the British Museum.

The species lists were collated by the following people and were annotated by the author (FD).

Algae	: N. Brandt and S. Fowler
Sponges	: D. Moss
Hydroids	: F. Dipper
Anthozoa	: A. Snaddon
Worms	: F. Dipper
Crustacea	: B. Stark, T. Hawkes
Nudibranchs	: G. Brookes, V. Pearson
Molluscs	: F. Dipper
Bryozoa	: D. Counsell
Echinoderms	: R. Sykes, D. Counsell
Fish	: F. Dipper
Tunicates	: D. Moss
Shore records	: S. Smith

ALGAE

CHLOROPHYTA

Bryopsis plumosa: (9). Very shallow site.

Cladophora sp.: (4,9,12,16,20,23,25,26,28,34,38,40).

Codium sp.: (25).

Enteromorpha sp.: (22,25).

Ulva sp.: (4,9,12,40,41).

PHAEOPHYTA

Alaria esculenta: (9,11,13,38).

Chorda filum: (14,16,17,18,21,22,25,37). Sheltered sites in inner parts of the loch.

Cladostephus spongiosus: (9). Sand in shallow water.

Desmarestia aculeata: (4,5,8,9,10,11,13,15,18 - 20,27,29,30 - 38,40).
Widespread on bedrock and boulders in kelp forest and below.

Dictyota dichotoma: (3-6,9-11,13-15,19,20,26,28-34,40,41). One of the most common algae in the area, found throughout the loch in the kelp forest and below it where rock extended deeper.

Halidrys siligiosa: (9,12,23,30,32,39,40,41). Very large plants on boulders at 39 and in the rapids at 41. Scattered plants elsewhere often surrounded by sand.

Himantalia elongata: (9). Intertidal.

Laminaria digitata: (9,19,35). On rock to about 1m only.

Laminaria hyperborea: (2-11,13,15,18,19,20,21,23,24,26-40). The major kelp forest kelp throughout the loch on bedrock and stable boulders - see text.

Laminaria saccharina: (3,5,6,8,9,11,13-16,21-23,25?,27-31,35-41). Widespread but rarely forming a forest. Common on sides of rapids at 41.

Leathesia difformis: (25).

Sacchoriza polyschides: (5,8,9,13,15,19,23-25,38,40,41). Scattered plants found in the kelp forest.

RHODOPHYTA

Acrosorium uncinatum: (39). Common attached to other algae in undergrowth.

Ahnfeltia plicata: (9). Sand in shallow water.

Antithamnion plumula: (41). On pebbles on sand.

Bonnemaisonia asparagoides: (6,10,11,26,27,28,30,32,33,34,36,38). On rock in the kelp forest and on kelp stipes.

Bonnemaisonia hamifera (Trailiella phase): (11?,13?,18?,26,27,28,29,33,41). On rock, shells and sand in small amounts.

Brongniartella byssoides: (32,40)

Callophyllis laciniata: (3-6,9-11,13,15,20,23,26,28-30,32-34,36,38-41). One of the commonest kelp forest foliaceous alga on rock and kelp stipes.

Ceramium rubrum: (17,18,21?,23,25,26,28,29,31,32,36).

Ceramium sp.: (12,18,22).

Chondrus crispus: (9,13,15,17,23,31,32,38,40).

Corallina officinalis: (9).

Cruoria sp.: (2,4-6,9,11,13,30,34,38,40). Widespread and probably under-recorded.

Cryptopleura ramosa: (3-6,9-13,26,28-30,32,33,38-40). In kelp forest on rock and kelp stipes.

Delesseria sanguinea: (3,11,13,15,18,20,21,23,25,26,28,30,32,36,38,40). Widespread in kelp forest but often tatty and chewed.

Dilsea carnosus: (9,11,13,30,32,36,40,41). Very large plants on cobble and Modiolus at fast current sites 41 and 36 respectively.

Furcellaria lumbricalis: (9).

Gigartina stellata: (25).

Gracilaria verrucosa: (4,12,29?).

Griffithsia corallinoides: (32).

Heterosiphonia plumosa: (41,36,38,39,41).

Lomentaria articulata: (5,9).

Lomentaria clavellosa: (22?,41).

Membranoptera alata: (9,11,13,20,26,28,31,32,33,38,40). On rock and stipes.

Nitophyllum punctatum: (41). On cobble on sand in current.

Odonthalia dentata: (2-6,8,9,11,13,23,26,28,30,31,32,33,34,38). Widespread mostly on bedrock in middle and outer exposed parts of loch. No dense beds.

Palmaria palmata: (5,6,9,11,13,23,25,26,28-32).

Phycodrys rubens: (4-6,8-14,18,20,26,28-30,36,38-40). Widespread and scattered on rock and stipes.

Phyllophora crista: (14,16,18,26,28,32,34). Mostly on pebbles and shells on sediment.

Phyllophora sp.: (39,41).

Plocamium cartilagineum: (2-6,8-15,18-21,23,25-34,36-41). The most widespread and common red alga throughout the loch.

Polyides rotundus: (9,17,25).

Polysiphonia sp.: (2,32,37).

Porphyra sp.: (12).

Pterosiphonia parasitica: (12).

Ptilota plumosa: (4-6,9,11,13,30,31,32,38,40).

Rhodomela sp. : (4,9).

Rhodophyllis divaricata: (10).

Rhodymenia pseudopalmata: (32).

'Lithothamnia': (1,3-6,9-11,13-15,18-21,23,25-41). Widespread and often abundant on bedrock, boulders, cobble and pebbles to the deepest depths reached. Dominant at some grazed sites (6, 34). Probably present at all sites with rock but not always recorded by the divers.

'Maerl': (16,41). Occasional scattered pieces.

ANGIOSPERMS

Zostera marina: (12,23). Thick, healthy bed at site 12. Occasional pieces on sand below rock at 23.

ANIMALS

Axinella infundibuliformis: (10).

Amphilectus fucorum: (19,35). Occasional. Tassled form locally common on bridge piles in rapids at 35.

Cliona celata: (2,3,4,5,8,10,11,26,27,28,29,30,31,33,34,35,36,38,39,40,41). Massive form widespread and usually occasional especially on bedrock slopes and cliffs. Boring form also recorded.

Clathrina coriacea: (29,34,36,39,41). Mostly small patches. No massive quantities found since surge too great to investigate likely gulleys etc.

Dysidea fragilis: (35). Rare.

Hemimycale columella: (37).

Halichondria panicea: (3,4,6,7,8,9,13,19,20,23,26,28,29,30,31,32,33,35,36,38,39,40). Widespread usually patches on rock. Massive encrustations on kelp stipes in rapids at sites 20 and 35.

Haliclona sp.: (3,4,6,8,10,26,29,30,35,38,39,40). Fairly widespread mostly purple volcanoes type. Probably several species (see end of list).

Haliclona oculata: (11). On cliff at about 20m.

Halisarca dryadini: (28).

Hymedesmia paupertas: (26,38). Rare.

Hymedesmia stephensi: (23). Identified from collected specimen.

Leucosolenia botryoides: No site data.

Mycale rotalis: (2,29,30,35). Rare in deep water on cobble plain at 2 and on bedrock below 20m at 29 and 30.

Microciona sp.: (10).

Myxilla incrustans: (2,3,4,6,10,14,15,18,26,29,28,30,31,33,34,36,38,39,40,41). Widespread and common throughout the loch on bedrock and boulders.

Myxilla fimbriata: (10,11,26,27,30,33,34). Widespread.

Pachymatisma johnstonia: (2,3,5,14,27,29,30,31,33,34,38,39). Large patches present on cliffs in outer parts of loch (eg 29,39) but smaller pieces present even at sheltered sites (eg 14).

Polymastia mammillaris: (29,30,36,39,41). Occasional.

Polymastia boletiformis: (2,29,30,36,37,38,39). Occasional. At 37 in the form of a massive encrustation on Pecten valves.

Polymastia sp: (3).

Scypha ciliatum: (11,28,30,32,34,35,36,40,41). Fairly widespread but often overlooked because only a few individuals present. Common in rapids at 35 and 41.

Scypha compressa: (9,28,30,32,34,35,38,39,40,41). Comments as for S. ciliatum. Common at 41.

Suberites carnosus: (10,11,16,18,21,22,29,35,38). Occasional to frequent attached to rock.

Suberites domuncula: (15,18,19,20,21,22,31,35,37). Attached to shell fragments and stones on sediment and on hermit crab shells. Some appeared to be living completely unattached on the sediment. On Chlamys at 15,19,22.

Suberites sp.: (21). On Chlamys.

Stelligera stuposa: (11,30,36). On rock. One specimen on kelp stipe (36).

Stelligera rigida: (36). On cliff in area of high current.

Raspailia hispida: (30,36,39). On cliffs in area of high current (36) and wave exposure (39).

Raspailia ramosa: (36,39). As for R. hispida.

Haliclona spp -

1. Haliclona sp. 'A' : (3?,4,29,30,38).
2. Haliclona sp. 'P' : (26).
3. Haliclona sp. 'M' : (29).
4. Haliclona sp. 'J' : (39?).
5. Haliclona sp. 'F' : On shore in Little Loch Roag Narrows.

HYDROZOA

Aglaeophenia pluma: (41). On Halidrys in rapids.

Abietinaria abietina: (2,4,5,6,11,22,26,34,36,39,41). Occasional patches on rock in kelp forest. Common on cobble at site 2 and on boulders at site 36 where reasonable currents.

Abietinaria filicula: (2,19,20,30). Frequent on cobble and boulder in rapids at site 20.

Amphisbetia operculata: (20,21,36). Abundant on kelp stipes in rapids at site 20, and on stipes at site 36 (also current exposed).

Campanularia verticillata: (2,6,19,26,36).

Diphasia rosacea: (35). Identified from collected specimen.

Eudendrium arbuscula: (35,36). Rich growths on boulders.

Filellum serpens: (19).

Halecium halecinum: (6,10,11,14,15,18,20,22,26,30,35,36,39,41). Frequent on bedrock and boulders. Very large plants at 11,20,36 and 39.

Lafoea dumosa: (35,20). On other hydroids.

Lafoea fruticosa: (33).

Hydrallmania falcata: (36,39).

Hydractinia echinata: (4,5,15,21,22,28,37). On hermit crab shells. Probably under-recorded.

Kirchenpaueria pinnata: (1,4,11,34). Occasional.

Nemertesia ramosa: (1,2,5,10,11,15,19,20,21,26,27,30,32,33,36,38). Occasional scattered individuals at many sites. Common on cobble at site 2 and boulders at site 36.

Nemertesia antennina: (5,6,10,11,14,15,16,19,26,27,30,33,36,38,39,41). As for N. ramosa.

Obelia geniculata: (3-9,11-13,15,18-21,23,27-41). Common to abundant on kelp fronds and occasionally Zostera, Halidrys and bedrock.

Obelia plicata: (13,31,36).

Plumularia setacea: (10). On Nemertesia

Sertularia argentea: (19,20,26,29,30,31,36,39). Common on stipes and boulders at sites 20,26,36 and 39 where some water movement.

Sertularella polyzonias: (28,31,41). On kelp stipes and Halidrys.

Sertularella gayi: (39).

Tubularia indivisa: (4,6). Only occasional tatty pieces.

ANTHOZOA

Actinia equina: (36).

Actinothoe sphyrodeta: (7,9,10,20,29,31,39). Occasional; but frequent in rapids at site 20.

Adamsia carciniopados: (2,4,33).

Alcyonium digitatum: (2,3,4,5,6,7,8,10,11,13,14,15,19,20,26,27,28,29,30,31,33,34,35,36,38,39,41). Often common on small vertical cliffs in kelp forest. Occasional large pieces on grazed boulders in outer lochs and common on more extensive vertical faces.

Anemonia viridis: (12,25,26,28,36,37,40,41). One or two at each site on algae and Zostera.

Caryophyllia smithi: (2-8,10,11,13,14,18,19,26-34,36,38-41). Widespread. Often present on silty rock and on heavily grazed rock.

Cerianthus lloydi: (11,13,14,15,16,18,19,21,22,24,25,27,36,37,41). In muddy sand sediments. Generally not very many in each area.

Corynactis viridis: (2,10,15,30,39,40). Only on vertical cliffs and overhangs mainly in the clearer waters of the outer parts of the loch.

Cereus pedunculatus: (22).

Hormathia coronata: (39).

Metridium senile: (4,5,6,8,11,18,20,26,27,30,31,33,34,36,39,41). Widespread; large form on exposed boulders and bedrock cliffs and small form in current areas such as site 20.

Sagartia elegans var venusta: (3,5,7,8,9,10,11,27,35,36,38,39-41). Often on bedrock in kelp forest. Common on cliff at 39.

Sagartia elegans var miniata: (3,4,5,7,8,11,20,28,30,32,34,35,36,38,39,41). As above.

Sagartia elegans var nivea: (20,21,35).

Sagartia troglodytes: (4?,38).

Urticina (Tealia) felina: (2-11,13,15,19,20,23,25-30,34-41). Widespread; present at most sites where sediment and rock mixed.

Virgularia mirabilis: (27,36,37). On muddy sand in East Loch Roag. Not as widespread as might be expected.

SCYPHOZOA

Aurelia aurita: (13,31).

Haliclystus auricula: (3,25,13,32,40).

Lucernariopsis campanulata: (3,4,5,12,26,27,28,30,39,40,41). Found at many sites on red algae and kelp.

NEMERTEA

Tubulanus annulatus: (16).

SIPUNCULOIDEA

Golfingia sp.: (15).

Golfingia vulgaris: (16,18).

ANNELIDA

Arenicola sp.: (casts) (9,10,12,18,21,37,41). Probably under-recorded.

?Amphicteis sp.: (31). Identified from specimen.

Chaetopterus variopedatus: (1-3,4?,8,10,11,13-15,18,19,21,26-28,30,32,33,34,46,38-41). Widespread

Eupolymnia nebulosa: (16,26?). Identified from specimens.

Euphrosyne foliosa: (18). Bottlebrush worm; rarely recorded from Scotland.

Filograna implexa: (4,28,31-33,38=40). Often on kelp stipes and holdfasts.

Harmothoe imbricata: (4).

Harmothoe impar: (31).

Hydroides norvegica: (6,16).

Glycera sp: (18).

Lanice conchilega: (7,10,12,13,30,40).

Lepidonotus spp.: (15,21,26). Ubiquitous on hard irregular surfaces.

Lepidonotus clava: (2).

Lepidonotus squamatus: (16,25,26).

Myxicola infundibulum: (16?,18,21,22,40).

Nephtys sp.: (16,21,18,20?,31?)

Nereis pelagica: (8,25,31). Often in kelp holdfasts.

Nicomache sp.: (18).

Notomastus sp.: (15).

Ophelia sp.: (15).

Pomatoceros triqueter: (Recorded at all sites except 7,12 and 24).
Widespread and common especially on grazed rock.

Polynoe sp.: (21).

Polynoe scolependria: (6).

Pectinaria koreni: (16,31).

Potamilla reniformis: (21,25).

Phyllodoce maculata: (15).

Sabella pavonina: (18-20,33,36,37,41).

?Serpula vermicularis: (16).

Spirorbis sp.: (2,4,6,8,15,18,19,21,23,26,29,31,32,33,35-38,41). On kelp
and under stones and boulders.

Syllis sp.: (15).

Stylarioides plumosa: (15,16).

Scale worm: (8)

Terebellidae: (4,6,10,12,15,16,18,19,21,22,25,27,28,30-37,39,41)

PYCNOGONIDA

Achelia echinata: (20,36,39). In collected hydroid material.

Callipallene brevis: (39). In collected hydroid
material.

Endeis spinosa: (3,11,12,20,21,39)

Nymphon brevis: (20,35,36).

?Phoxichilidium sp.: (15)

OSTRACODA

Loxoconcha impressa: (20,36,39). In collected hydroid material.

ACARI

Thalassarachna basteri: (20,39). In collected hydroid material.

CRUSTACEA : CIRRIPIEDIA

Balanus balanus: (5,7,15,16,26,40), 19.

Balanus crenatus: (3,4,5,9,11,14,15,16,18,19,21,22,25,26,27,30,31,32,35,36,38,39,40). Widespread and common at some sites but was not found as a dominant species.

Balanus improvisus: (1). Identified from specimen (GAB; BM(NH)).

Balanus sp.: (6,8,10,13,23,28,29,31,33,34,35,40,41).

?Elminius modestus: (15). A doubtful record.

Verruca stroemia: (26,36,15,19,31).

CRUSTACEA : AMPHIPODA/ISOPODA

Amphithoe rubricata: (4).

Ampherusa jurinei: (20). Amongst collected material.

Caprellids: (4,5,6,15,20,28,35,36,41). Widespread and common on algae and hydroids. Probably present at most sites.

Dexamine spinosa: (4)

Gammarus locusta: (12)

Lysianassa ceratina: (20). Amongst collected material.

Janira maculosa: (20,39). In collected material.

Jassa falcata: (20). Many tubes present on kelp, stones etc in rapids.

Janiropsis breviremis: (20). In collected material.

Parajassa pelagica: (20). Amongst collected material.

Munna kroyeri: (20). In collected material

Idotea waltica: (1,3,12,25,32). On algae and Zostera.

CRUSTACEA : DECAPODA

Anapagurus hyndmani: (3). Identified from collected specimen.

Cancer pagurus: (Recorded at all sites except 1,6,9,11,16,17,21,23,26 and 37). Common and widespread throughout the area on bedrock and sediment.

Carcinus maenas: (4,7,9,12,13,15,16,18,19,21,22,25,28,31,32,35,36,37,48,41). Common and widespread throughout the loch.

Crangon crangon: (12). Amongst Zostera.

Achaeus cranchii: In collected hydroid and other material

Ebalia (tuberosa?): (15).

Eurynome spinosa: (3,26). Amongst algae. A new record for this area.

Galathea strigosa: (4,6,8,34,40,41). In crevices in bedrock; middle and outer parts of the loch only.

Galathea squamifera: (6).

Galathea sp.: (3,5,6,13,15,26,27,30,32,36,38,39,40,41). Between boulders, cobble etc.

Galathea dispersa: (13). Identified from specimen.

Homarus gammarus: (4,19,25,36,38,41). Occasional throughout the loch. Very large specimen at site 36.

Hyas araneus: (19,21,25,32,36).

Hyas coarctatus: (36)

Hippolyte longirostris: No site data. In collected material.

Inachus dorsettensis: (13,15,16,18,21,22,23,26,31,35,36,37,39,41). Both species of Inachus widespread in the loch on kelp and algae. This species often on shallow sediment near to rock.

Inachus phalangium: (3,4,7,8,12,13,18,21,31,36,37,41).

Inachus sp.: (2,6,13).

Liocarcinus puber: (3-6,8-11,13-15,17,18,21,23,25-32,34-41). Common and widespread at all sites with some rock.

Liocarcinus depurator: (3,4,12,13,15-18,21,22,24-27,31,32,35-38,40). Widespread; at most sites with sediment.

Liocarcinus marmoreus: (7,12). Found on clean sand; in Zostera bed at site 12.

Liocarcinus corrugatus: (25,36). Identified from specimens.

Liocarcinus pusillus: (28).

Liocarcinus sp.: (17,20,22,36).

Leander sp.: (2,3,23,24,33).

Macropodia rostrata: (8,16,21).

Macropodia tenuirostris: (16,25).

Macropodia sp.: (12,21,22,23,24,26,27,36,39,41).

Palinurus elephas: (2). One on steep cliff face in clear water in outer part of loch.

Pisidia longicornis: (3,4,6,15,16,19,26,28,30,32,36,39,41). Frequent and widespread under cobbles, pebbles and boulders.

Pagurus bernhardus: (3,5,7,12,15,16,22,37). Widespread and often very common at sediment sites. Probably most records of Pagurus sp. (below) were this species.

Pagurus prideauxi: (22). Identified from a collected specimen.

Pagurus sp.: (1-7,9,11,12,15,16,18,21-26,28,31,35-37,41). Widespread living in a variety of shells.

Porcellana platycheles: (13).

?Pirimela denticulata: (2).

BRACHIOPODA

Grania anomala: (26).

MOLLUSCA : POLYPLACOPHORA

Acanthochitona crinitus: (16).

Callochiton achatinus: (26).

Lepidopleurus asellus: (2,15,18,26).

Lepidochitona cinereus: (25).

Tonicella sp. : (8)

MOLLUSCA : OPISTHOBRANCHIA

Aplysia punctata: (3,30,31,38,2,29,34).

Archidoris pseudoargus: (67,38).

Aeolidiella glauca: (20,21).

Antiopella hyalina: (23,26) A rare species - see Section 5.2

Acanthodoris pilosa: (31,22).

Ancula gibbosa: (21,22,15).

Cadlina laevis: (5,29,33,34,37,38,4).

Colpodaspis pusilla: (26,27).

Coryphella pellucida: (20,35,36).

Coryphella lineata: (35).

Coryphella pedata: (35).

Cuthona concinna: (3).

Cuthona caerulea: (39,31).

Doto coronata: (20,36).

Doto eireana: (2)

Eubbranchus farrani: (4,7,10,18).

Eubbranchus tricolor: (4).

Elysia viridis: (3,16).

Facelina bostoniensis: (16,20,21).

Goniodoris nodosa: (6,31,22,2,4,15).

Jorunna tomentosa: (3).

Limacia clavigera: (3,5,6,10,16,26,29,33,38,39,41,27,34,40,4).

Limapontia capitata: (In littoral collections).

Limapontia senestra: (In littoral collections).

Lomanotus marmoratus: (15).

Onchidoris bilamellata: (31)

Onchidoris muricata: (14, 16, 20, 21, 26, 28, 35, 37, 18, 27, 12) Ubiquitous on
larger algae

Onchidoris luteocincta: (31)

Polycera quadrilineata: (7, 20, 29, 30, 33, 4, 21)

Polycera faeroensis : (34)

Tritonia hombergi: (4, 2)

Philine scabra: (16) In mud sample.

Retusa umbilicata (16) In mud sample.

MOLLUSCA : GASTROPODA : PROSOBRANCHIA

Acmaea virginea: (2,19,26,16).

Acmaea sp.: (2,8,36).

Alvania beanii: (15) from muddy shell gravel sample

Alvania [Alvinia] punctura: (19,26).

Bittium reticulatum: (18).

Buccinum undatum: (5,6,8,11,13,15,16,21,22,24-27,30,34-38,41).

Calliostoma ziziphinum: (2-6,8-11,13,14,18,19,21-23,25-34,36-41).

Diodora aperta: (2,3?).

Gibbula cineraria: (1-7, 8-16, 18-22,25,26,28,29,30,31,32,34-41).
Present at most sites on kelp.

Gibbula magus: (13,16,21s,22,25,28,32,37). Mostly on muds and muddy sands in sheltered areas. Very common on shallow muddy sand slope at site 22.

Gibbula tumida: (15,2).

Helcion pellucida [Patina]: (3-5,7-9,11,13,19,20,23,24,28,29,31,32,34-40). Widespread and very common at some sites on kelp.

Hinia incrassata [Nassarius]: (4,5,9,11,26,40,19,18,26).

Lacuna parva: (4,15,21,26).

Lacuna vincta: (2-6,8,9,11-13,15,18,19,21,26,28,30,32,34,36-41).
Ubiquitous on algae.

Littorina littorea: (16) Very shallow site.

Lamellaria latens: (3) Identified from specimen.

Lamellaria perspicua: (15) Identified from specimen.

Lunatia alderi [Natica]: (7)

Lunatica montagui [Natica]: (7). One collected.

Mangelia brachystoma: (18) from mud and shell gravel sample.

Mangelia coarctata: (15) from muddy shell gravel sample.

Nassarius reticulatus: (1,12).

Nucella lapillus: (4) Frequent on small cliff between 3-6m.

Ocenebra erinacea: (26,19,26). At its northern limit.

Onoba semicostata /Cingula: (15,18,19,26).

Odostomia eulimoides: (18). From mud and shell gravel sample.

Patella sp.: (23,29).

Philbertia linearis: (15). From muddy shell gravel sample.

Rissoa parva: (2,4,6,15,26,28,30). Under-recorded; ubiquitous on algae.

Rissoa parva interrupta: (2,4,15,26). Under-recorded; ubiquitous on algae.

Rissoa albella: (26,15). On algae.

Rissoa rufilabrum: (15,21). On algae.

Trivia arctica: (6,26,39,41).

Trivia monacha: (4,6,38,39).

Turitella communis: (5s,13s,14s,15,18,19s,21s,22,28,36s,37s). Dead shells very common especially at sheltered sites on muddy sand.

MOLLUSCA : BIVALVIA

Aequipecten opercularis /Chlamys: (14-16,19,21,36).

Abra alba: (16,19,22). In mud and muddy shell gravel samples.

Abra nitida: (16,18). In mud and shell gravel samples.

Abra prismatica: (18). In mud and shell gravel sample.

'Anomidae': (4-6,9,11,21,26,28,30,32,35-37,40,41). On bedrock and often under boulders and stones.

Anomia ehippium: (21,31,15).

Arctica islandica: (4s,12). In clean sand.

Chlamys distorta: (3,26,41).

Chlamys varia: (26,13).

Cochlodesma praetenuis: (11s).

Corbula gibba: (15,18). In muddy shell gravel samples.

Chamelea gallina /Venus striatula

Dosinia sp.: (12s, 35).

Dosinia lupinus: (15).

Ensis arcuatus: (7,12).

Ensis sp.: (4,5,7,12,13,15,22,25,26,28,35-37). Common in sand and muddy sand. Very many empty shells at some sites.

Hiatella arctica: (4,6,11,15,18,19,22,31,36). Ubiquitous on stones.

Kellia suborbicularis: (4).

Lucinoma borealis: (31).

Laevicardium crassum: (5).

Lutraria angustior: (3).

Lutraria lutraria: (19s,26,35). Only dead shells.

Modiolus modiolus: (5s,15,16,18,19,22,35,36). Occasional specimens in mud and muddy sand. Common forming a bed in the current swept channel of site 36.

Mya arenaria: (5,36). Probably more widespread but not seen.

Mya truncata: (15,18,22,25,26,33s,36s,37s). As above.

Myrella bidentata: (15,16,18,22,31). Under-recorded. Ubiquitous in muddy shell gravel.

Myrtea spinifera: (21). In muddy shell gravel sample.

Mytilus edulis: (5,20,35). One at site 5. Frequent in rapids at sites 20 and 35; on bridge piles at 35.

Musculus marmoratus: (3,4,10). In tests of ascidians.

Nucula nucleus: (15). In muddy shell gravel sample.

Ostrea edulis: (5s). Shell only.

Pecten maximus: (2,4-6,8,10,11,13-19,21,22,24-28,31,32,35-37). Widespread throughout the loch, but few in the outer parts. Most common in East Roag and some dense beds at some sites.

Parvicardium exiguum: (15,16). From sediment samples.

Parvicardium ovale: (15,31).

Parvicardium scabrum (15,16,18,26,31).

Pododesmus squamula /Heteranomia/: (15,19,26,31). Under-recorded. Ubiquitous on stones.

Pododesmus patelliformis /Monia/: (26).

Timoclea ovata /Venus/: (15,18,19).

Thyasira flexuosa: (16,18,22,31). Under-recorded. Ubiquitous in muddy

Thracia convexa: (18). In sediment sample.

Thracia villosiuscula: (30s).

Tellina tenuis: (11,2).

Venerupis senegalensis (pullastra): (22)

MOLLUSCA : CEPHALOPODA

Eledone cirrhosa: (8,33sp.,40).

Sepia officinalis: (3).

Sepietta oweniana: (21).

Sepiolo atlantica: (16).

Rossia macrosoma: (11) Eggs only.

ECHINODERMATA

Achroplida brachiata: (18). In sediment sample.

Asterias rubens: (Recorded at all sites except 12 and 17). Ubiquitous and common.

Antedon bifida: (3-8,10,11,13,15,17-23,26-41). Very widespread. Abundant in current swept areas and on cliff faces and stipes at wave exposed sites.

Astropecten irregularis: (10,27).

Anseropoda placenta: (6). On sand at 20m.

Amphipholis squamata: (16,15).

Amphiura filiformis: (21).

Amphiura chiaje: (20).

Crossaster papposus: (1-8,10,11,14,15,16,18-22,25,26,29,41). Widespread.

'Cucumaria' sp. (tentacles in rock crevices): (4-8,10,11,13,15,18,20,23, 25-30,32-36,38-40). In bedrock crevices and between boulders.

Echinus esculentus: (Recorded at all sites except 1,12,17,23,24). Very common at most sites resulting in heavy grazing pressure on the rock surfaces many of which were devoid of algae.

Echinocyamus pusillus: (40). In sand.

Echinocardium cordatum: (1,4,7,40). In clean sand.

Henricia sp.: (1-3,6-11,13,14,19,20,22,23,25-41). Widespread on bedrock and boulders.

Luidia ciliaris: (10,13,19,26,27,30,39).

Luidia sarsi: (33). One specimen seen.

Leptasterias mulleri: (6,10,11,13,26,29,33,34).

Marthasterias glacialis: (2-7,10,11,14,15,20,23,26,27,29-31,35,37,38, 40,41). Widespread.

Neopentadactyla mixta: (14?26?,32). In sand.

Ophiothrix fragilis: (2,4,6,8,10,13,15,16,18-20,26-28,30-33,36,38,39,41). No beds were found. Mostly occasional specimens between rocks and on sediment.

Ophiocomina nigra: (2,6,8,26,35,36,38,39). No beds were found. Mostly occasional specimens.

Ophiura albida: (4,6,7,11,15,16,20,22,26,27,30,32,36,39). Found in small numbers at most sites with sediment present.

Ophiura texturata: (27).

Ophiura sp.: (5,11,15,16,18,29,30,39).

Ophiopholis sp.: (3,22,30,39).

?Ophioderma longicanda: (20).

Psammechinus miliaris: (2,5,9,19,30,33,35,40,41).

Pawsonia (Cucumaria) saxicola: (6?,10,26-28,33-36,39,41). Mostly underneath boulders on boulder slopes.

Solaster endeca: (3,6,30,33,39,40).

Thyone sp.: (27).

Trisopterus luscus: (32)

Syngnathus sp.: (4,13,17,21,25,37).

Taurulus bubalis: (4,36,39,41).

Thorogobbius ephippiatus: (4,14,27,34).

Scomber scombrus: (11).

Clingfish (Diplecogaster or Apletodon): (23,36).

Flatfish (including '0' - group): (1,2,4,9,12,13,16,21,22,33,35).

Gurnard: (2,40).

Topknot sp.: (26,33,34,36). Some of these may be lemon sole with 'lithothammia' markings on them as identified from photos from a different area.

Unidentified gadoids: (2,6,36).

Sand eels: (22,30).

Nature Conservancy Council and Underwater Conservation Society

SUBLITTORAL HABITAT RECORDING SHEET

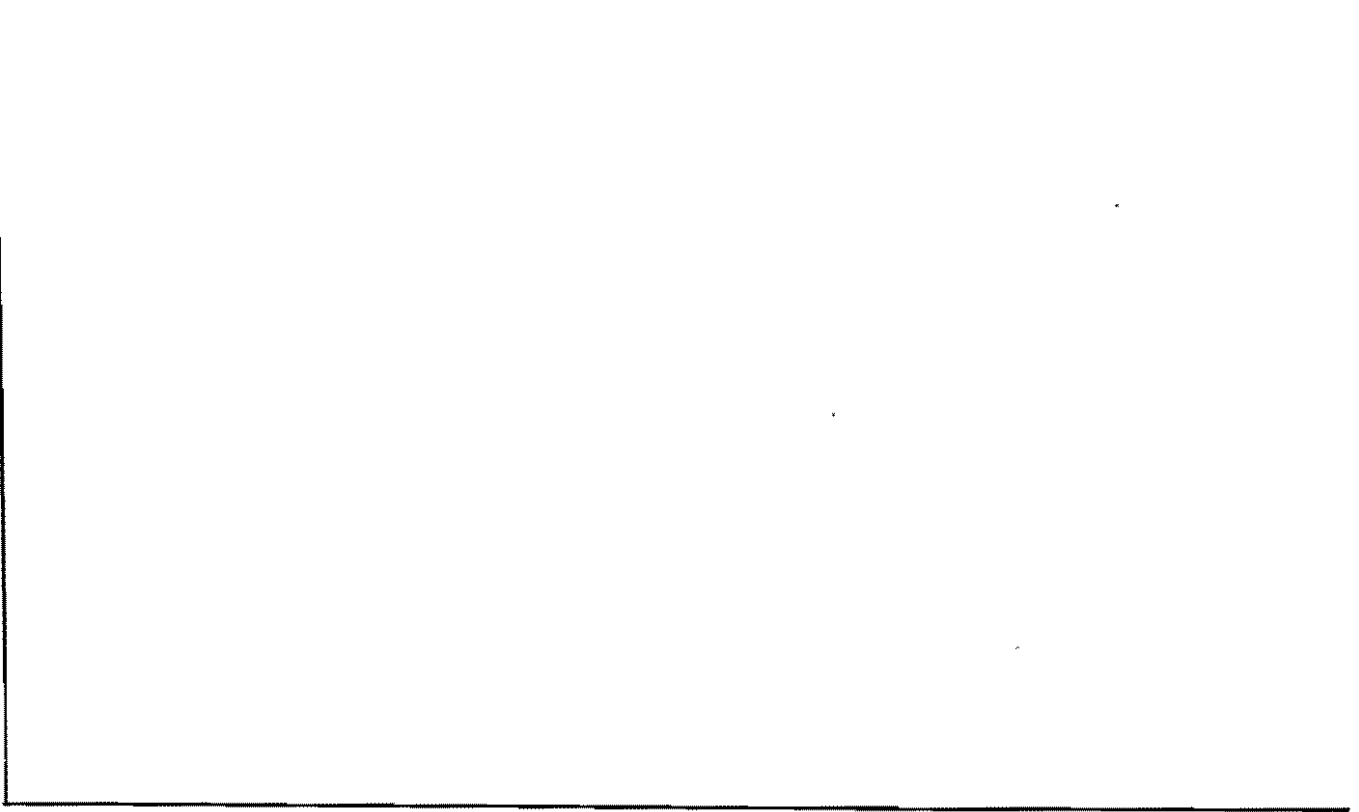
Recorders Name	Site Name
Address	Area/nearest town
Phone	Country
Date of observation	OS Grid Ref. Sheet number
	Lat/Long
	Duration of study

INSTRUCTIONS: Tick and score as appropriate using the following notations; 1 = <10%
 2 = 10% to 30%, 3 = 30%+

DEPTHS STUDIED corrected to Chart Datum:

		0-5m	5-10m	10-15m	15-20m	20-30m	30+m
AREA OF SURVEY	COMMENTS	FEATURES - ROCK				COMMENTS	
Extensive(site)		Gullies (size)					
Small(station)		Cliffs (size)					
Shore dive		Caves (size)					
Boat dive		Crevices (size)					
EXPOSURE TO WAVE ACTION		Wreck					
Very sheltered		Other					
Sheltered		Rock type (eg calcareous)					
Mod. exposed		FEATURES - SOFT SEDIMENT					
Exposed		Of one uniform type					
Very exposed		A mixture (eg sand & mud)					
EXPOSURE TO TIDAL CURRENTS		Burrows					
None		Mounds or worm casts					
Some, noticeable		Crab excavations					
Strong		Shell remains					
VISIBILITY(in metres)		'Worked' surface with obvious species					
SEA BED TYPE (score as indicated above)		Other comments					
Bedrock		Describe the site briefly. What features stand out in your mind about the site?					
Boulder (50 cm+)							
Boulder (15-50 cm)							
Cobble (5-15 cm)							
Pebble (2.5-5 cm)							
Gravel							
Coarse sand							
Medium fine sand							
Muddy sand							
Mud							
COVER - PLANT (score as indicated above)							
Kelp							
Foliaceous red							
Foliaceous green							
Foliaceous brown							
Calcareous encrusting reds							
Diatom							
COVER - ANIMAL (score as indicated above)							
Dominant species							
Hydroid 'turf'							
Bryozoan 'turf'							
Ascidian 'turf'							
Other							
Echinus - numbers seen in 10 minutes							
COVER - INANIMATE							
Mud on rock: None							
Some							
100%							
'Bare' rock							
'Bare' sediment plain							
Shell remains							
Human debris							

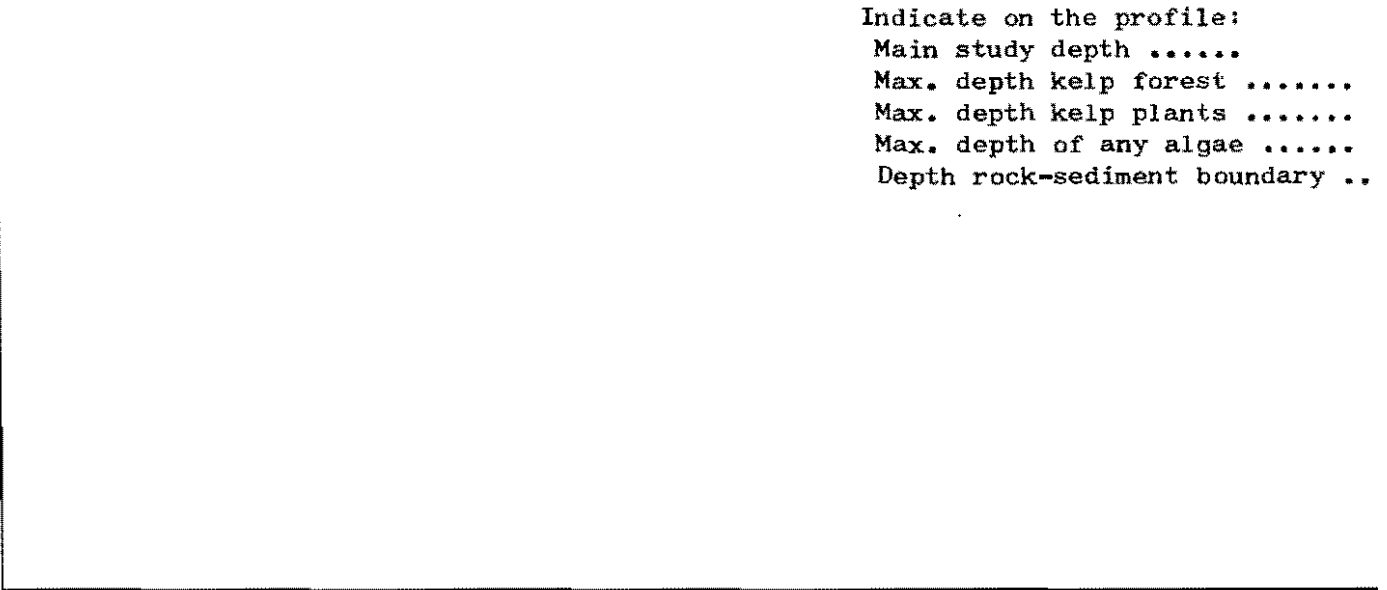
Draw an aerial view - map of the site. Give distances in metres & the direction of North



Draw a cross section (transect) of the site. Give distances in metres and depth in metres corrected to Chart Datum.

Indicate on the profile:
Main study depth
Max. depth kelp forest
Max. depth kelp plants
Max. depth of any algae
Depth rock-sediment boundary ..

Depth (Metres)



Distance (metres)

Other comments (on species, facilities etc.)

Does anything make this site like or unlike other sites you have visited in this or other areas?

THE UNIVERSITY OF NEWCASTLE UPON TYNE

DOVE MARINE LABORATORY
CULLERCOATS NORTH SHIELDS NE30 4PZ
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Dr. Roger Bamber,
Marine Biological Laboratory,
O.S.G.E.,
Fawley.

APPENDIX III. Material sent to Roger Bamber for pyncgonids - polychaetes found.

Dear Roger,

Apologies for the delay in producing the final list of the polychaetes from Loch Rong, Lewis, but here it is at last:

Family Polynoidae	<u>Ctenosyllis ctenostoma</u> (1)
* <u>Harmothoe impar</u> (3)	<u>Eusyllis blomstrandii</u> (numerous)
<u>Harmothoe extenuata</u> (1)	* <u>Autolytus alexandri</u> (2)
<u>Harmothoe</u> unidentified (13) (probably belong to one or other of the above spp.)	<u>Autolytus</u> sp. (<u>prolifer</u> group) (3)
<u>Laidocottus supracatus</u> (3)	* <u>Arceosrea cornuta</u> (1)
Family Sigalionidae	Family Nereididae
<u>Alvise minuta</u> (2)	<u>Nereis pelagica</u> (3)
Family Nyllodocidae	<u>Platynereis dumerilii</u> (1)
<u>Eulalia viridis</u> (2)	Family Teretellidae
Family Nereotidae	<u>Nicolea zostericola</u> (numerous)
<u>Heterosteinia cirrata</u> (3)	Family Sabellidae
<u>Nereis mucronata</u> (2)	<u>Branchioura bombyx</u> (1)
Family Syllidae	Family Spirorbidae
<u>Tyrosyllis</u> (<u>Tyrosyllis</u>) <u>aurillanisi</u> (1)	<u>Circeis spirillum</u>
<u>Tyrosyllis</u> (<u>Tyrosyllis</u>) <u>variegata</u> (1)	
<u>Tyrosyllis</u> (<u>Lanserhansia</u>) <u>cornuta</u> (1)	

The number of individuals of each species is given in brackets, and those species marked with an asterisk were not recorded by J.D. George in his paper on the polychaetes of Lewis and Harris (Proc. Roy. Soc. Ed., 77; 189-216 (1979)). May I keep the specimens, or would you like me to return them either to you or Frances Digger?

Best wishes, and send any more polychaetes you may come across,

