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LITTORAL SURVEYS AND  
MONITORING AT LUNDY  
APRIL 14TH TO 19TH, 1984

Edited by  
Keith Hiscock

July 1984

FIELD STUDIES  
COUNCIL



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A report to the  
Nature Conservancy Council  
from the  
Field Studies Council Oil Pollution Research Unit

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**APRIL 14TH TO 19TH, 1984**

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## LITTORAL SURVEYS AND MONITORING AT LUNDY

APRIL 14TH TO 19TH, 1984

Edited by

Keith Hiscock,

Field Studies Council Oil Pollution Research Unit.

### SYNOPSIS

Lundy shores have been studied over many years, providing a good descriptive basis for the assessment of the scientific interest of the area and for the location of sites and species of high conservation importance. The current status of Lundy as a voluntary marine nature reserve and the work being undertaken to obtain statutory designation make it important to understand the dynamics of littoral communities on Lundy and particularly of species of high scientific interest so that management is based on a good knowledge of the natural fluctuations and sensitivity of communities and species. The work undertaken in April 1984 was carried out to:

1. describe shore communities present at locations around Lundy, particularly in areas of high conservation interest or where little or no survey work had previously been carried out (Management Plan Project RL11);
2. photograph shore communities at locations around the island to provide a basis for future assessment of gross change and to provide illustrative material for lectures and displays (Management Plan Projects RL05, RL09, RL10);
3. record in an accurate and repeatable manner, communities and species of high conservation importance (Management Plan Project RF/RA);
4. photograph species present on shores to provide illustrations for lectures and displays (Management Plan Project RL10); and
5. assess the suitability of selected shores for interpretative purposes and collect information for leaflets (Management Plan Project MD01).

Shores were studied and described at the Devil's Kitchen, the Landing Bay from the northern seawall to Surf Point, north of Gannet's Rock and south of Lametry. A circumnavigation of the island provided a general assessment of the shores all around Lundy and photographs for illustrative and monitoring purposes. Detailed monitoring studies were started of rockpools at the Devil's Kitchen, of populations of cup corals at the Devil's Kitchen and north of Gannet's Rock, of the algae Bifurcaria bifurcata, and of a cave community at Rat Island. A general assessment was made of the suitability of Lundy shores for interpretative purposes. The work was designed so that a warden or liaison officer could undertake future monitoring. Other areas identified as worthy of monitoring include sandy rock areas below the jetty in the Landing Bay and the large pool between Rat Island and Surf Point.

## 1. INTRODUCTION

Lundy shores have been studied intermittently over the past 40 years. In the late 1940's and early 1950's, Professor L.A. Harvey described and sampled from many of the shores accessible from the land (Anon., 1948; Harvey, 1949, 1951). Irvine *et al.* (1973) describe algae sampled from the shore. Boyden (1971) carried out further survey work on some of the shores, giving particular attention to animal species. Hiscock and Hiscock (1979) describe the zonation of open-shore species at four sites, whilst the same two workers were mainly responsible for the descriptions of shores and caves included in Hiscock (1982). The distribution and habitats of littoral species are noted in the marine fauna lists published by various authors in the Report of the Lundy Field Society. Unpublished field notes are also held by K. Hiscock and the measurements of a Balanophyllia regia population made in 1970 were particularly useful in the present work.

The current status of the area of Lundy as a voluntary marine nature reserve and the work being undertaken to obtain statutory designation make it important to understand the dynamics of littoral communities on Lundy, and particularly of species of high conservation interest, so that management is based on a good knowledge of natural fluctuation and the dynamics/sensitivity of communities and species. Although some assessment of gross change can be made by comparison with past records, more detailed study is required for some habitats and species. Also, some habitats on particular parts of the coastline are poorly recorded and require further study. A field trip was therefore organised for the period of very low tides in mid-April 1984. The field trip had the following main aims:

1. To describe shore communities present at locations around Lundy, particularly in areas of high conservation interest or where little or no survey work had previously been carried out (Management Plan Project RL11).
2. To photograph shore communities at locations around the island to provide a basis for future assessment of gross change and to provide illustrative material for lectures and displays (Management Plan Projects RL05, RL09, RL10).
3. To record in an accurate and repeatable manner, communities and species of high conservation importance (Management Plan Project RF/RA).
4. To photograph species present on shores to provide illustrations for lectures and displays (Management Plan Project RL10).
5. To assess the suitability of selected shores for interpretative purposes and collect information for leaflets (Management Plan Project MD01).

Fig. 1.1 shows the location of coastal features around Lundy and includes the names of all of the sites visited during the work reported here. The different activities undertaken each day are noted in the log (Appendix 1). The photographs taken are listed in Appendix 2 and are held by the NCC Chief Scientist Team, the NCC Southwest Regional Office, and by K. Hiscock at the Field Studies Council Oil Pollution Research Unit. Sheets for the relocation of monitoring sites have been prepared and are held by the NCC Chief Scientist Team, the NCC Southwest Regional Office, and by K. Hiscock. The plates used in those location sheets are reproduced at the end of this report as photostat copies.

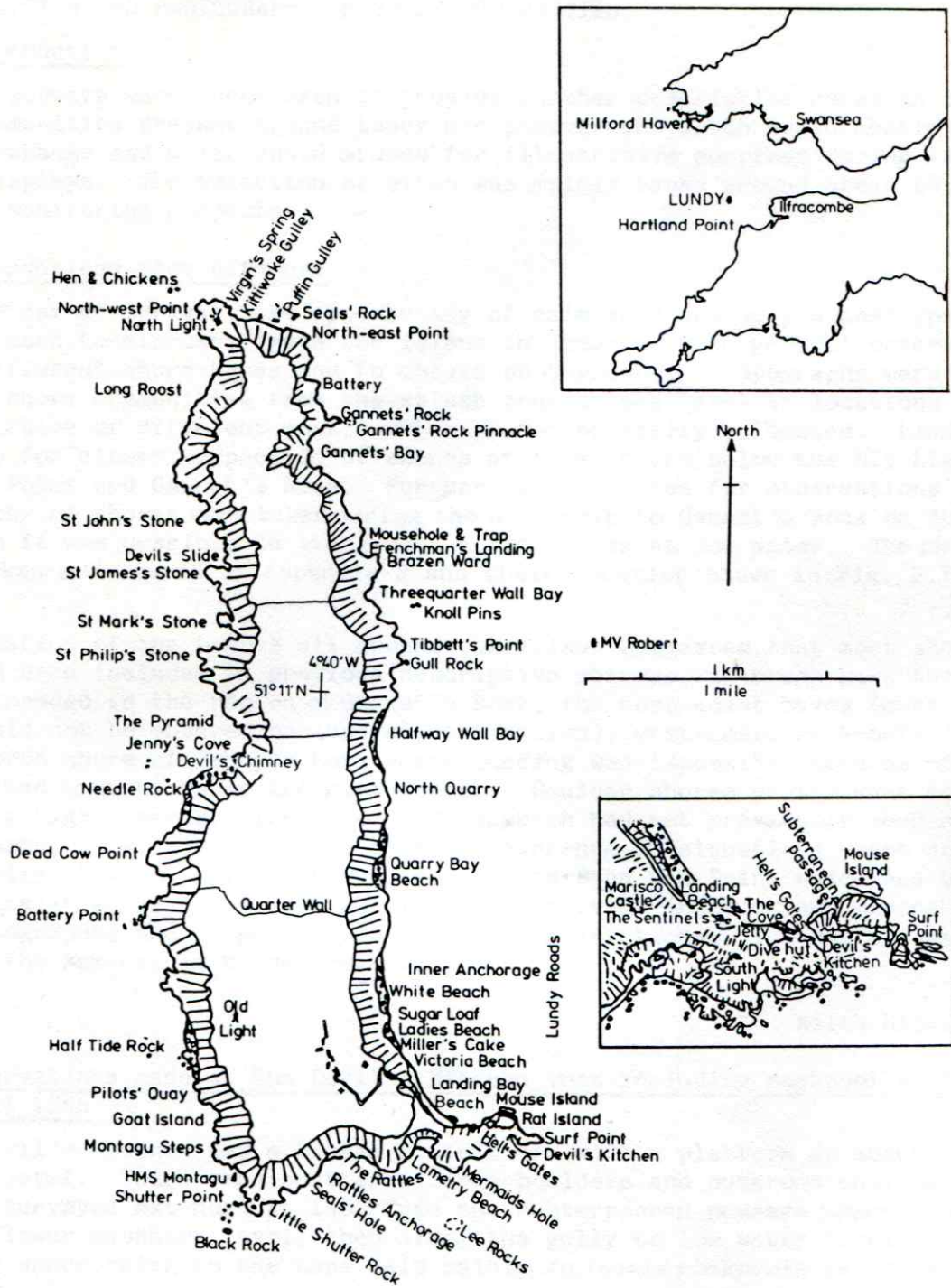


Fig. 1.1. Location of Lundy and of coastal features.

## 2. DESCRIPTION AND PHOTOGRAPHY OF SHORE COMMUNITIES

### 2.1. Introduction

These surveys were undertaken to provide further descriptive notes on the shore communities present around Lundy and photographs which would enable detection of gross change and which could be used for illustrative purposes during lectures and in displays. The selection of sites was mainly based around areas being used for monitoring projects.

### 2.2. Observations from offshore

On the day of arrival, the opportunity of calm seas and only a poor spring tide was used to circumnavigate the island in order to make general observations of the different shore types and to obtain photographs. Photographs were taken of whole shore communities from the splash zone to sea level at locations considered representative of different coasts and which can be easily relocated. Landings were made for closer inspection of shores at three caves below the Old Light, Dead Cow Point and Gannet's Rock. Further opportunities for observations and photography of shores were taken during the boat trip to Gannet's Rock on April 17th when it was possible to study east-coast shores at low water. The photographs taken are listed in Appendix 2 and their location shown in Fig. 2.1.

Observation of the shores all around the island suggested that most shore types had been included in previous descriptive surveys, although more thorough work was needed in the region of Gannet's Rock, the west-coast caves (most of which could not be entered because of wave action), west-coast rockpools (mainly on the north shore of Jenny's Cove where landing was impossible because of wave action), and open shores on the north coast. Boulder shores on the west coast included a high cover of diatomaceous film which had not previously been noted during summer surveys and was a seasonal occurrence in situations where rocks were heavily abraded. Sites at Brazen Ward and Dead Cow Point which had been systematically surveyed in 1976 and 1977 respectively (Hiscock and Hiscock, 1980) were photographed and compared with previous observations. The shore communities appeared the same as in those previous years.

Keith Hiscock

### 2.3. Observations made at the Devil's Kitchen (not including rockpool studies), April 15th

The Devil's Kitchen was a broken slate shore with a platform at about upper midshore level. There were scattered large boulders and numerous shallow rockpools. The area surveyed extended at 140° from the subterranean passage towards the gully at about lower midshore level, then along the gully to low water level. Distances along the shore refer to the tape laid mainly to locate rockpools described in Section 3.

Just inside the subterranean passage, the walls were dominated by Chthamalus montagui with a few Semibalanus balanoides (c. 70% cover at 1 m above pool level). There were scattered Patella sp., Littorina nigrolineata and L. neritoides.

On the very large boulders at the top of the transect there were scattered clumps of Pelvetia canaliculata with Fucus spiralis, F. vesiculosus and some Ascophyllum nodosum. Patches of generally broken or 'powdery' Verrucaria maura were present. There was a diatomaceous film in places with some very clear Patella grazing marks. Slightly lower on the shore, the tops of boulders and rock surfaces had a very sparse cover of organisms on horizontal surfaces, widely scattered

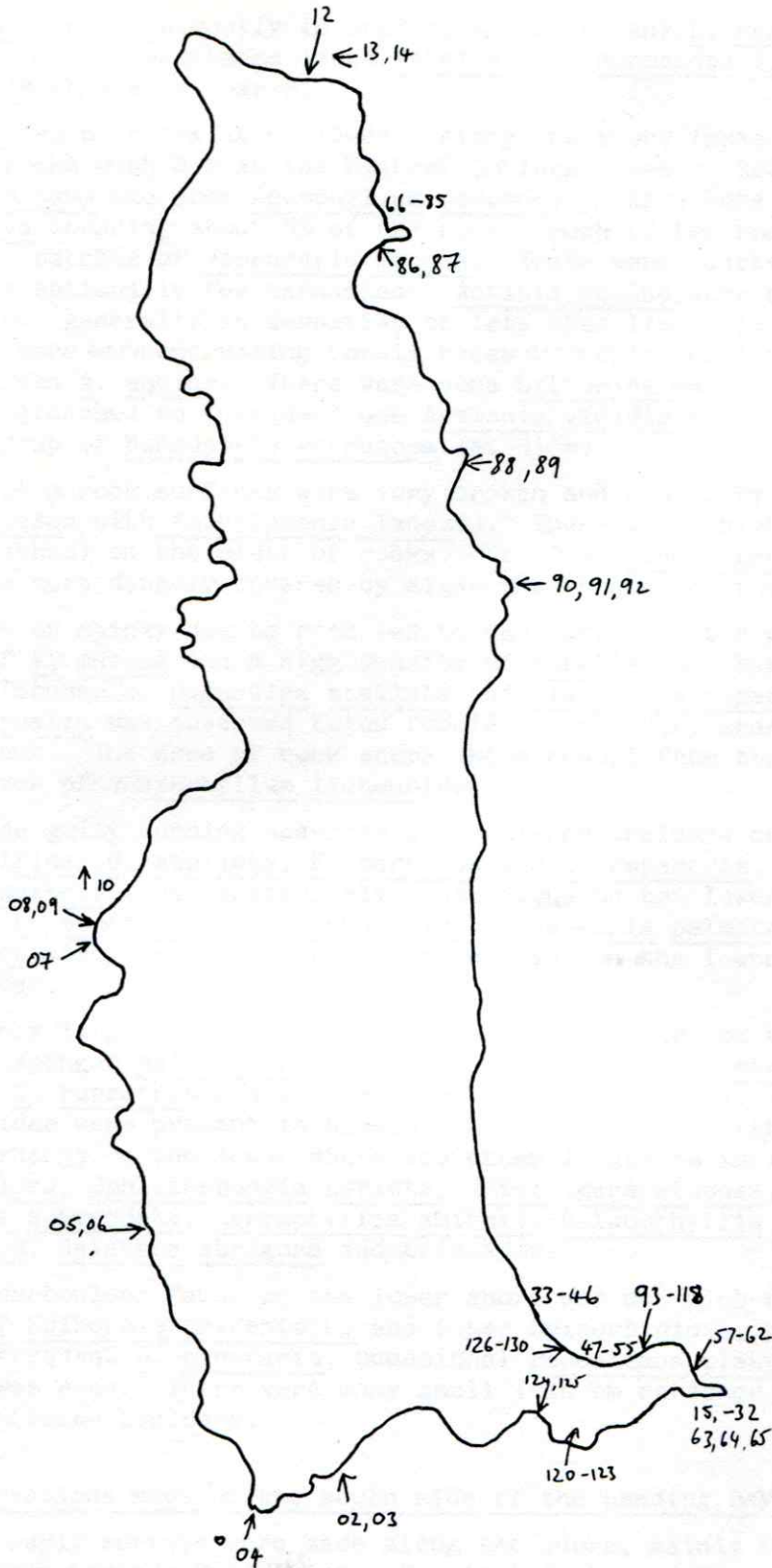


Fig. 2.1. Locations of shore photographs taken during the period April 14th to 19th, 1984.

Chthamalus stellatus mostly in cracks, and with many L. neglecta in dead shells. There were widely scattered large Patella sp., Monodonta lineata and Gibbula umbilicalis were very sparse.

The broken platform at c. 10-24 m along the shore (measured by a tape draped over the rocks with 0 m at the highest boulders) was c. 30% covered by fucoids (F. vesiculosus and some Ascophyllum nodosum). There were patches of Laurencia pinnatifida covering about 5% of the rock. Much of the rock surface was bare with small patches of Verrucaria mucosa. These were scattered large Patella sp. and exceptionally few barnacles. Actinia equina were present on open rock surfaces but generally in densities of less than 1/m<sup>2</sup>. In damp places under fucoids, there were encrusting Corallinacea with Spirorbinidae and clusters of red and green A. equina. There were some Littorina mariae and L. obtusata present with eggs attached to fucoids. One Anemonia viridis was present on open rock and one group of Bunodactis verrucosa (at 31 m).

At 24-34 m rock surfaces were very broken and capped by fucoids (F. vesiculosus and A. nodosum with Polysiphonia lanosa). There was a high cover of L. pinnatifida (some bleached) on the sides of rocks. At 33 m, Fucus serratus was present and rocks were more densely covered by algae than higher on the shore.

A slope of mainly quartz rock led to the bottom of the gully. There were patches of V. mucosa and a high density of Patella sp. Barnacles were extremely sparse. Patches of Gigartina stellata and Cladophora rupestris were present. Dynamena pumila was observed below furoid cover. Very sparse Nucella lapillus were present. The area of rock slope where runoff from the pools occurred had a high cover of Mesophyllum lichenoides.

The wide gully running seawards was of large boulders covered in places by L. pinnatifida, G. stellata, F. serratus and C. rupestris. Himanthalia elongata and C. rupestris were particularly conspicuous on the lower shore with Laminaria digitata, L. saccharina, Chondrus crispus, Palmaria palmata and Mesophyllum lichenoides also present. The main rock cover on the lower shore is of encrusting Corallinacea.

Some very large boulders formed extensive overhangs on the lower shore under which the sponges Halichondria panicea and Hymeniacidon perleve occurred amongst a turf of C. rupestris and stunted Corallina officinalis. Large numbers of Spirorbinidae were present in places. A fairly wide variety of species occurred under overhangs on the lower shore and other locations including Microciona atrasanguinea, Ophlitaspongia seriata, ?Stelligera stuposa, Sagartia elegans, Actinothoe sphyrodeta, Caryophyllia smithii, Balanophyllia regia, Archidoris pseudoargus, Galathea strigosa and Crisiidae.

The underboulder fauna on the lower shore was not rich but included large numbers of Spirorbis tridentatus and other Spirorbinidae, patches of encrusting Bryozoa, frequent G. cineraria, occasional Porcellana platycheles, and one Actinia fragacea was seen. There were many small (<10 cm carapace width) Cancer pagurus in the sand below boulders.

Keith Hiscock

#### 2.4. Observations made on the south side of the Landing Bay, April 16th

Fairly rapid surveys were made along the shore, mainly the lower shore, from the Sentinels towards Surf Point. Sentinel Rock, on the upper shore, was a large slate bedrock outcrop providing a good example of furoid zonation. Much of the rock was inaccessible although in parts species could be closely inspected. This part of the shore was considered useful for interpretation with monitoring undertaken to investigate effects of interpretative usage. Monitoring could be undertaken by viewpoint photography of the rock surfaces and of the boulders over which access would be obtained and which, at the time of survey, had a c. 50% cover of Ascophyllum nodosum and some Fucus vesiculosus.

The lower shore was a series of outcropping slate ridges and dykes running parallel to the shore and up to about 1.5 m high with gravel-filled gullies and shallow pools in between. There was a high algal coverage and a wide range of common species present plus some unusual species including Cladostephus spongiosus, Jania rubens, Laminaria ochroleuca and Cereus pedunculatus. The shale gravel occupying gullies makes the site less vulnerable to trampling and the site could be useful for interpretation at its northern portion, rather than to the south where the shores become richer and the scientific and conservation interests higher.

The 0.1 m tide enabled access to the lowest part of the shore where low sandy rock surfaces were present with many Cereus pedunculatus and Bunodactis verrucosa present, particularly near to the jetty. Anemonia viridis was also observed. Jania rubens was present. There were some extensive flat areas of this unusual community but all about 0.2 to 0.1 m above chart datum, so that any monitoring might be more appropriate using diving. To the north of the jetty, there were two open boilers at about +0.3 m. The upper one was colonised inside by Crisiidae, c. 17 Caryophyllia smithii, 3 Urticina felina, 1 Actinia fragacea, 1 A. equina and large patches of pink and green Corynactis. The lower boiler had a similar community, with 3 Sagartogetan undata in the middle and a few widely scattered Dendrodoa grossularia. Between Hell's Gates and Mouse Island, a high proportion of the kelp below Laminaria digitata was L. ochroleuca and Caryophyllia smithii, and Bugula sp. (apparently small, young colonies) were present under overhangs. Myxilla incrustans was the most conspicuous sponge. A large pool (part of a gully) between Rat Island and Surf Point held very rich communities which could not be properly inspected because of the sheer walls. There were many intact Tubularia indivisa, a group of Balanophyllia regia, Caryophyllia smithii, Urticina felina and extensive colonies of Corynactis viridis.

Keith Hiscock  
Christopher Lumb

#### 2.5. Observations made on the north side of the Landing Bay, April 16th

The Landing Bay area consisted of occasional low-lying outcrops of heavily abraded bedrock surrounded by large amounts of boulders and smaller material, all evidently mobile during heavy wave action. There was little growth of ephemeral algae and no Patella. An increase in sediment stability northwards was noted as the size of the boulders increased, although there was still considerable scouring around the bases of boulders due to cobbles etc. present. There was a considerable distance before Patella became evident. Enteromorpha and brown filamentous algae were Common.

Midshore at the site was not rich. Despite the large number of overhangs present, the species diversity was low (probably due to scouring). No rockpools were found on the midshore.

The large boulder area just to the north of the Landing Bay had good examples of zonation (Pelvetia to F. serratus) but access to the bottom might have given problems to some people, so the site was not considered ideal for interpretation.

Balanus perforatus was Common in the intertidal here. The lower shore was not investigated.

Christopher Lumb

## 2.6. Observations made to the north of Gannet's Rock, April 17th

The area of shore from just north of Gannet's Rock to the Battery was of steeply sloping rock to about low water neap tide level along most of the coast, with bedrock spurs extending seawards at two main locations. The northern spur was separated from the mainland by a steep-sided, narrow gully. Some gullies ran parallel to the shore with shallow pools present. Below LWN level, between the spurs, the shore was of large and small boulders with some cobbles. Many of the large boulders formed caves. Rocks were colonised by communities fairly typical of the east coast with bands of Verrucaria maura, Pelvetia canaliculata, Fucus spiralis, F. vesiculosus and F. serratus. The cover of fucoids on the midshore was about 30% (almost all F. vesiculosus with a few Ascophyllum nodosum). Large patches of A. nodosum were present in local shelter. Areas of rock had a sparse cover of barnacles and Patella. Lower-shore stable rock surfaces were dominated by Gigartina stellata and Laurencia pinnatifida with some Chondrus crispus, Himantalia elongata, F. serratus and Palmaria palmata present. Overhanging surfaces of boulders were dominated by P. palmata, Lomentaria orcadensis, Plumaria elegans and Membranoptera alata. Many pockets of boulders were obviously mobile with communities ranging from diatom films to Ceramium rubrum, P. palmata and Cladophora sp. Some small, very rounded boulders and cobbles were bare. Rocks exposed just above low water level were dominated by encrusting Corallinacea with Laminaria hyperborea present. There were several species of sublittoral foliose algae present on the lowest shores with Delesseria sanguinea, Myriogramme bonnemaisonia, Cryptopleura ramosa and species of Phyllophora particularly conspicuous. Corynactis viridis was also present. Many plants were bleached. Laminaria digitata was extensively bleached at its upper limits. There were many small overhangs and crevices with Myxilla incrustans, Hymeniacion perleve, Halichondria panicea, ?Stelligera stuposa, Dynamena pumila, Corynactis viridis, Caryophyllia smithii, Crisiidae, encrusting Bryozoa (Cryptosula pallasiana identified) and Balanus perforatus present. One overhang was dominated by Crisiidae and one had ?Diadumene cincta present. The most notable feature of this shore was the large numbers of Balanophyllia regia and Caryophyllia smithii present amongst boulders and particularly within and to the north of the large gully noted earlier. The gully was also colonised by Cereus pedunculatus, a high cover of Phyllophora pseudoceranoides, P. crispa, and a high algal diversity. There were also many Echinus esculentus present on the lower shore. Turnable boulders were obviously mobile and the underboulder fauna sparse with a high cover of Spirorbinidae present and large numbers of amphipods under some.

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## 2.7. Outline description of a cave southwest of Knoll Pins, April 17th

The southernmost of the three caves was briefly studied at mid-tide level and at extreme low water level. The cave had previously been investigated mainly for algae and noted as very rich in species when compared to other caves studied in 1980 (Hiscock, 1982).

The cave was at the base of a tall cleft in the rock, barely wide enough at the entrance for an inflatable boat and extending back approximately 15 m, only about 5m of which was navigable. A shelf allowed further penetration for about 5 m. The cave walls extended vertically into the sublittoral and, at the far end, a sloping boulder bottom could just be discerned through the water at extreme low water level. The presence of a low roof above water level and the sound of waves breaking beyond the visible part of the cave indicated that the cave extended further than could be seen and that a beach was present inside the further cave. The walls were largely of quartz rock.

The walls at mid-tide level were dominated by encrusting Corallinacea with Verrucaria mucosa present. Extensive patches of barnacles were present with Abundant red and green Actinia equina and Frequent Patella. Balanus perforatus was Abundant at just below mid-tide level and small separated patches of Halichondria panicea and Hymeniacion perleve were present. Algae noted were Lomentaria articulata, Plumaria elegans, Laurencia pinnatifida and Corallina officinalis. Near to low water level, the entrance to the cave was dominated in places by H. panicea and H. perleve. Inside the cave and visible mainly from the shelf, there were patches of Corynactis viridis, Metridium senile and ?Sagartia elegans mineata.

Keith Hiscock  
Christopher Lumb

## 2.8. Observations made on shores south of the South Light, April 18th

The shore here was reached by a rope fastened to the stakes permanently located in the cliff above the east side of Lametry Beach. The rope placed there in the past by Trinity House had been removed during winter and a climbing rope was attached to gain access to the shore.

### Lametry Beach

This was a slate, wave-cut platform covering most of the beach area. Dykes of more resistant basalts and 'dolerites' extend across the shore into the cliffs on either side.

On the lower shore the Laminaria-covered ridges were inaccessible because of the poor tide. Deeper gullies dissected the shore around the low water mark. Above low water mark, rocks were covered with Corallina and small amounts of Melobesia. Some Cladostephus was present with Jania rubens attached. Himanthalia was Frequent. Patella was present on bedrock and boulders. The large number of boulders present and some sand on rocks or at the base of gullies are most likely responsible for the scoured appearance of the platform and rock outcrops.

Midshore and above the rock was sparsely populated with Laurencia pinnatifida in crevices and with a lot of drift algae in pools. Brown filamentous algae, Sphacelaria sp. and diatoms were present. Some freshwater input from the top of the beach was apparent by the slight increase in Enteromorpha. Two large Littorina littorea were recorded here.

### Below South Light

The shore below the access point included a large elongated pool running along the base of the cliff. Beyond this pool was a raised bedrock platform topped by the large pool used for quantitative recording of Bifurcaria bifurcata populations (Section 6)5. The size of the pool was 16 m approximately WNW to ESE and 6 m, N to S. The pool was broken by many protuberant rocks. Most of the pool was less than 15 cm deep although some deeper parts extending to about 40 cm were present to the west. The pool was dominated by encrusting Corallinacea with a c. 25% cover of B. bifurcata. Other algae present were Corallina officinalis, Enteromorpha spp., Scytosiphon lomentaria, and a brown algal film on Patella and Ceramium rubrum. Patella vulgata was the most conspicuous animal species present in shallow areas and was Abundant. There were clumps of small Mytilus edulis in crevices in places, and some Littorina nigrolineata present. Many green and some grey Anemonia viridis were present in widely separated groups in crevices, though often obscured by algae. Small numbers of Actinia equina were present. Polydora sp. was most likely present in the encrusting Corallinacea, although only holes and no tentacles were seen. Two ?Limponia capitata were seen in the southwest corner of the pool.

Below the Bifurcaria pool, there was a large dead-ended gully. The gully had steep walls with many small caves and overhangs. Algae recorded were: Himanthalia elongata, Corallina officinalis, Mesophyllum lichenoides, Furcellaria lumbricalis, Gelidium latifolium, Chondrus crispus, Gigartina stellata, Laurencia pinnatifida, Cryptopleura ramosa, Heterosiphonia plumosa, Delesseria sanguinea, Melobesia membranacea, Griffithsia flosculosa, Bryopsis plumosa, Plumaria elegans, encrusting Corallinaceae, Halurus equisetifolius, Lomentaria articulata, Cladophora rupestris and Schottera nicaeensis. Animals present included about ten Balanophyllia regia in the western corner and one in the eastern corner. Caryophyllia smithii was also recorded. There was one large patch of Anemonia viridis and a small cave with one Cereus pedunculatus. Shaded vertical rock was colonised by encrusting Bryozoa (including Umbonula littoralis and Flustrellidra hispida), Myxilla sp., Hymeniacion perleve and Halichondria panicea. Scattered Corynactis viridis were present in one area. Widely separated barnacles (mainly Chthamalus stellatus) were present away from rock dominated by encrusting algae.

Further lower-shore areas including pools were searched to the east. Large gully pools held Dumontia incrassata, large Scytosiphon lomentaria, Laminaria saccharina, Polysiphonia urceolata, Codium sp. (two small plants seen), Himanthalia elongata, Cystoseira tamariscifolia (five plants in one pool and one in another smaller pool), Halidrys siliquosa, Halurus equisetifolius and Schottera nicaeensis. Some of the smaller lower-shore pools were considered potentially rich, although it was early in the year for some algae to be present. Animals present included one Trivia monacha, a few spots of Microciona atrasanguinea and one small patch of Ophlitaspongia seriata on open rock. Two small white Metridium senile were present on a shady overhang. Shady crevices and sandy pools held Urticina felina. Blennies were present on rocks.

Christopher Lumb  
Keith Hiscock

### 3. DESCRIPTION OF ROCKPOOL COMMUNITIES AT THE DEVIL'S KITCHEN

#### 3.1. Introduction

The Devil's Kitchen to the south of Rat Island is considered to be the richest intertidal area on Lundy. This is partly a result of the wide variety of habitats present there, including many rockpools on an extensive rock platform at about mid-tide level. The area is also reasonable accessible to visitors and a favourite location for exploration. The study described here was undertaken to provide a descriptive basis to monitoring of the communities present in some of those rockpools.

#### 3.2. Methods

A series of rockpools from the upper to the lower shore was selected along a line approximately southeast from the subterranean passage running through Rat Island. A tape was laid over the shore in a direction  $140^{\circ}$  from the cave entrance to provide a marker for the position of the pools. The tape position was photographed from the top of Rat Island and a sketch made of the line of the tape in relation to rock features from the top of the shore towards the open sea. A plan of the tape was drawn showing the position of boulders and outcrops under the tape and the location and shape of each pool surveyed. Photographs were taken of each pool. Each pool was assigned a letter and surveyed to record the species present and their abundance (according to the scale in Appendix 3).

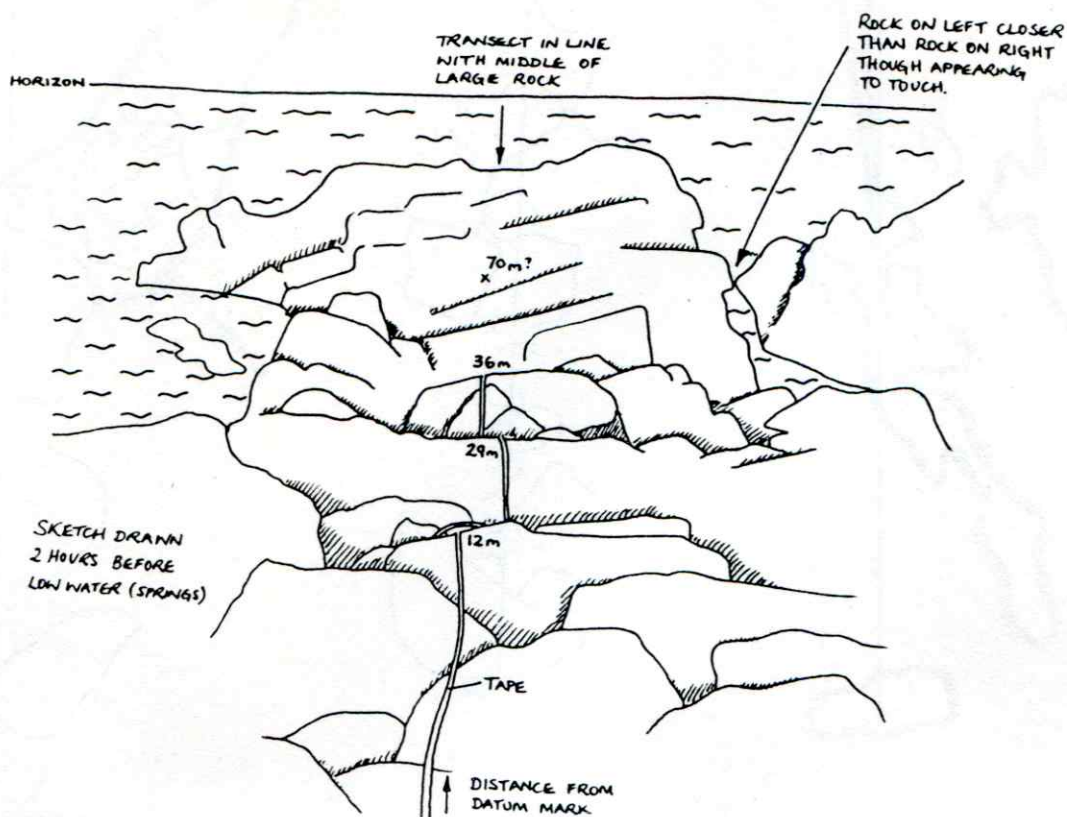


Fig. 3.1. Line of the tape drawn from the upper shore.

### 3.3. Results

Seven pools were surveyed at locations from about high water of neap tides to low water of neap tides level. Fig. 3.1 shows the line of the tape as drawn from the upper shore. Plate 1 shows the view from Rat Island. Fig. 3.2 shows the plan of the shore under the tape and the location of the pools. Photographs of the shore along the tape and of pools are shown in Plates 2-12. Pools were lettered A to G. Pools B and C were joined but had two sections. Descriptions of the species present in pools are given below.

#### Pool A

This was a large shallow pool (c. 10 m x 2.5 m, 0.3 m deep) present from 5 to 10-15 m inside the cave. There was considerable shading and some of the small slate boulders present in the bottom were probably mobile. Algae present were:

<u>Lithothamnion</u>	Ex	Particularly on boulders in the pool.
<u>Cladophora rupestris</u>	R	Fringe of pool at southern extremity.
<u>Plumaria elegans</u>	R	Fringe of pool at southern extremity.
<u>Corallina officinalis</u>	R	Fringe of pool at southern extremity.
<u>Ceramium rubrum</u>	R	Fringe of pool at southern extremity.

Animal species were extremely sparse with only four Actinia equina and widely scattered Spirorbinidae present.

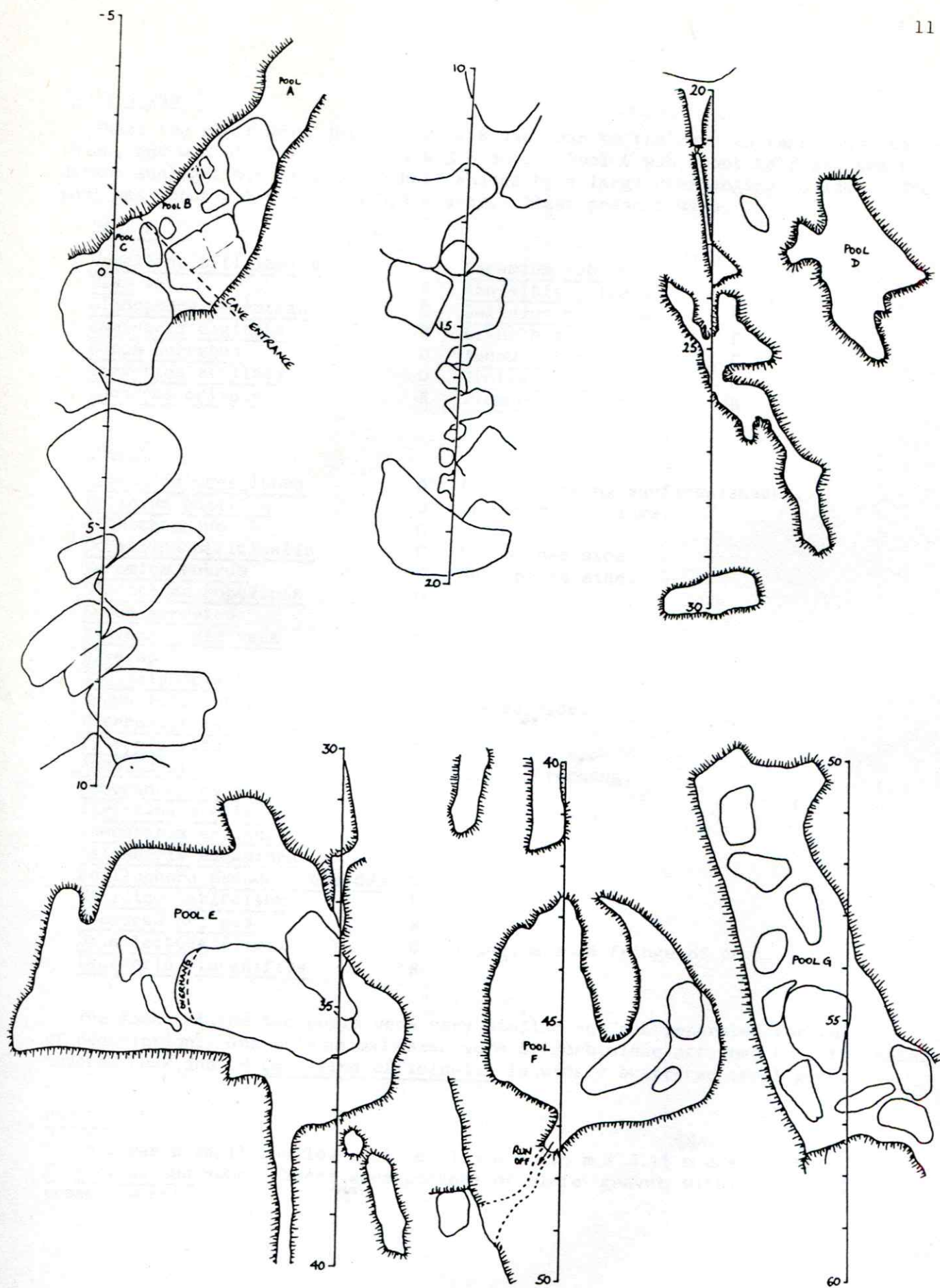


Fig. 3.2. Plan of the shore and Pools A to G, drawn as sections along the tape.

Pools B and C

These two pools were joined. Pool B was near to the cave entrance and its shade, and was about 2 m x 1 m x 0.3 m deep. Pool C was about half-exposed to direct sunlight with the outer half shaded by a large overhanging boulder. The pool was about 1.5 m x 1 m x 0.4 m deep. Algae present were:

Pool B

<u>Corallina officinalis</u>	A	<u>Ceramium rubrum</u>	C
<u>Ulva sp.</u>	C	<u>Ahnfeltia plicata</u>	R
<u>Cladophora rupestris</u>	C	<u>Gelidium pusillum</u>	O
<u>Laminaria digitata</u>	O	<u>Lithothamnium</u>	F
<u>Fucus serratus</u>	O	<u>Audouinella sp.</u>	O
<u>Gigartina stellata</u>	O	<u>?Polysiphonia sp.</u>	O
<u>Chondrus crispus</u>	R	<u>Plumaria elegans</u>	R

Pool C

<u>Catenella caespitosa</u>	O	On overhanging surfaces/shaded.
<u>Gelidium pusillum</u>	O	Around pool fringe.
<u>Lithothamnium</u>	O	
<u>Corallina officinalis</u>	C	Non-shaded side.
<u>Ceramium rubrum</u>	C	Non-shaded side.
<u>Cladophora rupestris</u>	O	
<u>Fucus serratus</u>	R	
<u>Laminaria digitata</u>	R	
<u>Ulva sp.</u>	O	
<u>?Polysiphonia sp.</u>	O	
Brown filamentous algae	F	Shaded side.
<u>Heterosiphonia plumosa</u>	R	
<u>Plumaria elegans</u>	O	
<u>Audouinella sp.</u>	F	Shaded/overhang.
<u>Membranoptera alata</u>	O	
<u>Gigartina stellata</u>	R	
<u>Lomentaria articulata</u>	R	
<u>Delesseria sanguinea</u>	R	
<u>Phyllophora pseudoceranoides</u>	O	
<u>Gelidium latifolium</u>	R	
<u>Chondrus crispus</u>	R	
<u>Ulva lactuca (juv.)</u>	O	Young, around fringe of pool.
<u>Laurencia pinnatifida</u>	R	

The fauna of the two pools were very similar and not separated for the purpose of description. The only animals seen were Spirorbiniidae attached to lithothamnia-covered rock and to Corallina officinalis in widely scattered small groups.

Pool D

This was a small shallow pool (c. 1.5 m x 1.5 m x 0.15 m deep) within the F. vesiculosus zone. There were pockets of slate gravel within the pool. Algae present were:

<u>Fucus serratus</u>	F)	Fronds overhanging pool.
<u>Fucus vesiculosus</u>	C)	
<u>Lithothamnion</u>	A	
<u>Corallina officinalis</u>	C	
<u>Laurencia pinnatifida</u>	F	Around fringe.
<u>Ceramium rubrum</u>	O	
<u>Ulva sp.</u>	O	
<u>Gastroclinium ovatum</u>	R	
<u>Lomentaria articulata</u>	R	
<u>Laminaria digitata</u>	R	
<u>Enteromorpha intestinalis</u>	O	On limpets.
Brown filamentous algae	F	On limpets and lithothamnion.
<u>Scytosiphon ?lomentaria</u>	R	
<u>Gelidium pusillum</u>	R	

Limpets were present on submerged rocks around the rim of the pool. There were about four Actinia equina and one small Anemonia viridis present. There were frequent Spirorbinidae on encrusting Corallinacea.

#### Pool E

This was a large, deep (c. 0.5 m), irregularly shaped pool. Algae recorded were:

<u>Corallina officinalis</u>	S	
? <u>Melobesia sp.</u>	S	On <u>Corallina</u> .
<u>Fucus serratus</u>	R	Fringe of pool.
<u>Bifurcaria bifurcata</u>	O	Six to eight clumps in central area.
<u>Gastroclinium ovatum</u>	C	
<u>Chondrus crispus</u>	F	
<u>Cystoseira nodicaulis</u>	R	One clump in central area.
<u>Schottera nicaeensis</u>	R	
<u>Polysiphonia sp.</u>	R	
<u>Ulva sp.</u>	O	Especially around fringe.
<u>Laminaria digitata</u>	O	
<u>Phyllophora pseudoceranooides</u>	R	
<u>Ceramium rubrum</u>	R	
<u>Lomentaria articulata</u>	O	Shaded overhangs.
<u>Ahnfeltia plicata</u>	R	
<u>Gelidium latifolium</u>	O	
<u>Calliblepharis jubata</u>	O	
<u>Furcellaria lumbricalis</u>	R	
<u>Halidrys siliquosa</u>	R	
<u>Gelidium pusillum</u>	O	

There were small 'groups of green and grey' A. viridis, mostly near the edges (c. 30 grey and 2 green individuals). A few Actinia equina were present just above pool level.

#### Pool F

This was a large (c. 3 m x 2 m x 0.2 m deep) pool with large boulders on bedrock and a cobble bottom. Algae present were:

<u>Corallina officinalis</u>	S	
<u>Melobesia</u> sp.	A	On <u>Corallina</u> .
<u>Fucus serratus</u>	C	Edge of pool/overhanging cover.
<u>Laminaria digitata</u>	F	
<u>Gelidium pusillum</u>	F	
<u>Ceramium rubrum</u>	O	
<u>Chondrus crispus</u>	O	
<u>Palmaria palmata</u>	O	
<u>Cladophora rupestris</u>	O	
<u>Lithothamnion</u>	O	
<u>Laminaria saccharina</u>	O	
<u>Ulva</u> sp.	O	
Red encrusting algae	O	
<u>Gastroclonium ovatum</u>	O	
<u>Furcellaria lumbricalis</u>	O	
<u>Polysiphonia ?spiralis</u>	R	
<u>Audouinella</u> sp.	R	
<u>Schottera nicaeensis</u>	O	Under overhang.
<u>Membranoptera alata</u>	R	

Spirorbinidae were conspicuous on C. officinalis where fucoids overhung the pool. There were about four A. viridis seen and two Gibbula cineraria in the bottom of the pool. A small area of Electra pilosa colonised one clump of Furcellaria fastigiata.

#### Pool G

This was a large (c. 8 m x 2 m x 0.1-0.2 m deep) pool on the lower shore. The pool had patches of sand and shingle in the bottom and rock outcrops emerging through the surface. Algae present were:

<u>Fucus serratus</u>	O	Overhanging pool.
<u>Cladophora rupestris</u>	F	
<u>Enteromorpha</u> sp.	F	
<u>Ulva</u> sp.	F	
<u>Corallina officinalis</u>	A	Larger cobbles and bedrock.
<u>Furcellaria lumbricalis</u>	C	
<u>Ceramium rubrum</u>	O	
<u>Chondrus crispus</u>	O	
<u>Laminaria saccharina</u>	O	
<u>Laminaria digitata</u>	O	
Brown filamentous algae	O	
<u>Palmaria palmata</u>	O	
<u>Porphyra</u> sp.	R	
<u>Gastroclonium ovatum</u>	F	
<u>Cladophora pellucida</u>	O	
<u>Calliblepharis jubata</u>	O	
<u>Gelidium latifolium</u>	O	
<u>Lithothamnion</u>	O	
<u>Melobesia</u> sp.	F	On <u>Corallina</u> .
<u>Laurencia pinnatifida</u>	O	At water's edge.
<u>Gelidium pusillum</u>	O	
<u>Ahnfeltia plicata</u>	O	
<u>Hildenbrandia</u> sp.	R	
<u>Audouinella</u> sp.	O	Periphery of pool.
<u>Phyllophora pseudoceranoides</u>	O	
<u>Gigartina stellata</u>	O	

The only conspicuous signs of animal species were large numbers of egg sacs of Eulalia viridis.

#### 4. MAPPING AND MEASUREMENT OF POPULATIONS OF CUP CORALS

##### 4.1. Introduction

In the assessment of the nature conservation value of marine sites, one factor considered is the presence of species considered to have a high nature conservation interest. One such species, which has a limited biogeographic distribution around the British Isles, is Balanophyllia regia. The northern limit of the species on the west coast is off Pembrokeshire, but in the littoral and shallow sublittoral of Lundy Balanophyllia is frequently found. Studies in aquaria undertaken by Mr. P. Tranter (Marine Biological Association of the U.K., Plymouth) revealed that B. regia readily produced planulae larvae between May and August. The larvae often settled immediately upon release or swam feebly for several days before settling. Individuals produced planulae from about two years of age. In the aquarium, individuals of B. regia have had a lifespan exceeding 14 years and appeared to die only if starved. However, little is known of the reproduction, growth and turnover of populations of B. regia on the shore. Lundy, as a voluntary and potential statutory MNR, provides an ideal site for the study of the population dynamics of this species, knowledge of which is important for management of the reserve. Caryophyllia smithii, a more common cup coral, is also found on the shore at Lundy and its presence provides further opportunity for study of the population dynamics of a species not often seen on the shore.

##### 4.2. Methods

Sites were established in two areas: at the Devil's Kitchen and N. of Gannet's Rock (Fig. 4.1). The Devil's Kitchen measurements were made at a location where, on 20th August 1979, K. Hiscock mapped and measured B. regia in a 50 x 60 cm area of steep rockface situated about 0.6 m above chart datum in a gully south of Rat Island. The position and dimensions (length x width x height of skeletal parts) of each individual B. regia was recorded (Fig. 4.2). The site was relocated on 15th April 1984 and a similar recording exercise undertaken for both B. regia and C. smithii. The distribution and size of cup corals were recorded by K. Hiscock (twice) and R. Irving (once) to compare intra- and inter-worker variation. Dimensions were measured using a pair of dividers and a ruler. Animals were easily visible although the presence of a 2-4 mm thick silt layer, trapped by an algal/faunal turf, suggested that smaller individuals might have been overlooked. As the silt cover was considered to be an ephemeral feature in the habitat occupied by the cup corals, the rock surface was gently rinsed with seawater to remove loose silt. No further animals were observed.

N. of Gannet's Rock, a much simpler exercise was undertaken. Sketches were made and photographs taken in two areas to show numbers and distribution of cup corals. Both distance and close-up photographs were taken. Close-up photographs were taken with a Nikonos camera equipped with Nikonos supplementary lens and frame, giving a picture area of 22 x 15 cm.

##### 4.3. Results

The location of the study site is illustrated in Plate 13.

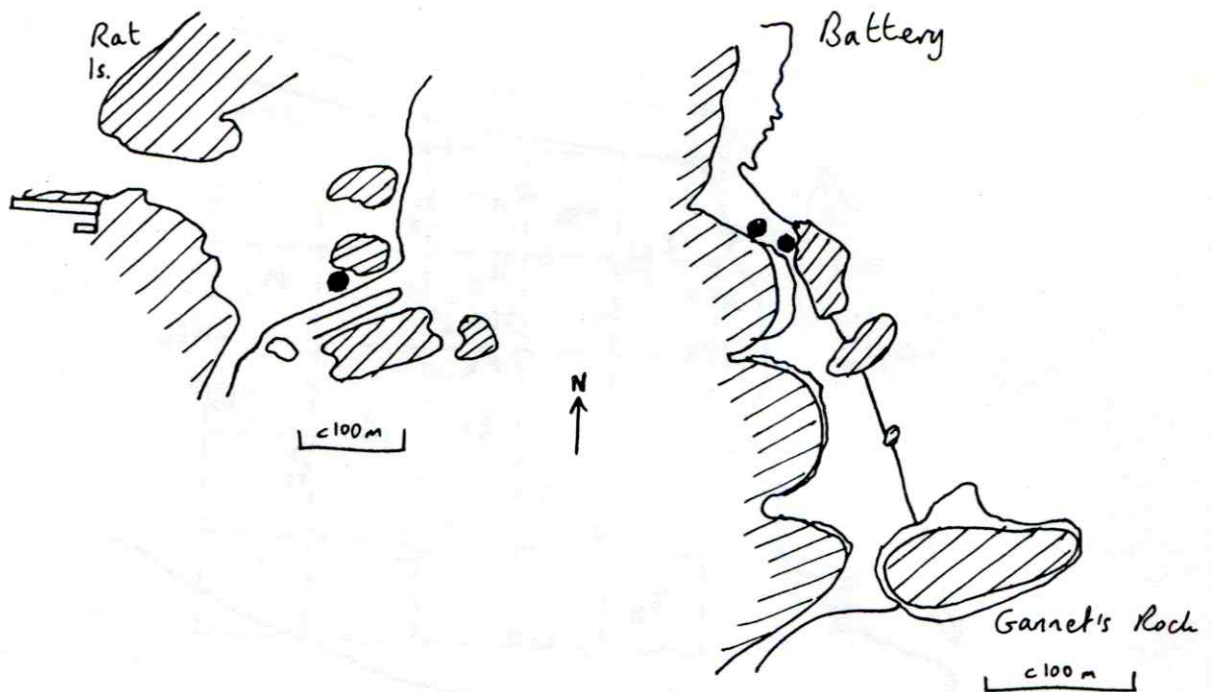


Fig. 4.1. Sketches showing the location (black spots) of monitoring sites for cup corals. Rock pinnacles and areas above high water level are shaded.

#### 4.3.1. Devil's Kitchen site

The distribution and size of individuals in 1984 are shown in Fig. 4.3. Seventeen *Balanophyllia* and five *Caryophyllia smithii* were recorded in the area, representing the entire population on that rockface. (Only one other *B. regia* was recorded in the immediate vicinity.) It was not possible to relate the positions of animals in 1984 to those in 1970; this may have been due to mapping inaccuracies or to changes in population composition.

The animals present in 1984 had maximum dimensions ranging from 5 to 9 mm. The small size of the cup corals reduced the accuracy of sampling. To check on the intra- and inter-worker variation, size measurements were repeated and are shown below.

	Worker 1, 1st	Worker 1, 2nd	Worker 2
Animal 1	5.0 x 4.6	6.2 x 5.2	4.5 x 4
2	5.0 x 5.0	missed	6 x 5
3	7.0 x 6.4	missed	7 x 6.5
4	6.0 x 5.0	5.5 x 5.0	6 x 5
5	6.5 x 5.5	5.2 x 5.0	6 x 4.5
6	6.0 x 5	5.8 x 5.2	5.5 x 5.5
7	8.0 x 7.6	8.2 x 8.0	6.5 x 6

Considerable variation was present, both intra- and inter-worker, with individual measurements varying by up to 25%.

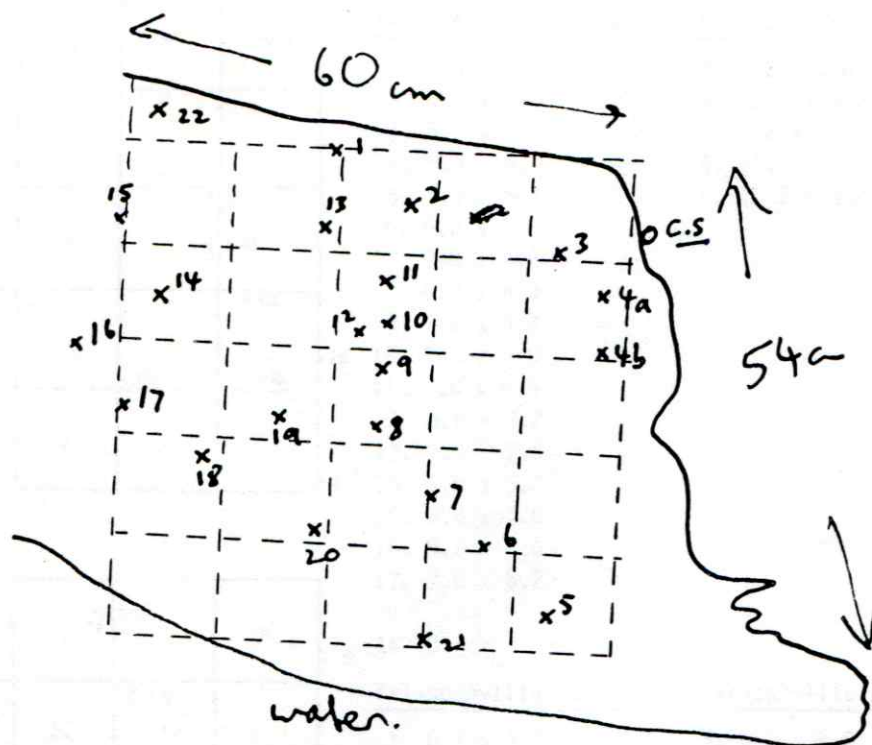


Fig. 4.2. Photocopy of location sketch made of *B. regia* at the Devil's Kitchen site on August 8th 1970. A 50 x 50 cm grid divided into 10 x 10 cm squares has been sketched on to help comparison with April 1984 records. The dimensions of corals in 1970 are given. Records in brackets are approximate.

Dimensions in mm (height last)

- |                                 |  |
|---------------------------------|--|
| 1. 6.5 x 7.3 x 3.0              | 12. 6.8 x 7.2 x 4.0                        |
| 2. 6.0 x 6.8 x 3.0              | 13. in crevice about 3.5 mm (not measured) |
| 3. 2 x extremely small          | 14. (?6.6 - faint) x 6.9 x 4.0             |
| 4a. 6.3 x (6.5) x 4.6           | 15. 5.8 x 6.2 x 4.0                        |
| 4b. 3.5 x 3.3                   | 16. 5.6 x 5.8 x 7.0                        |
| 5. 7.3 x 6.9 x varies (crevice) | 17. 5.4 x 6.2 x 3.0                        |
| 6. 6.8 x 6.4 x 3.0              | 18. ( <i>C. smithii</i> in this position)  |
| 7. 7.3 x 7.6 x 5.0              | 19. 2.6 x 2.4 x 1.5                        |
| 8. (4.8) x 3.7 x 2.0            | 20. 6.4 x (5.8) x 4.0                      |
| 9. 6.2 x 7.2 x 5.0              | 21. 6.1 x 6.4 x 4                          |
| 10. 8.1 x 8.0 x 5.0             | 22. 4.3 x 4.6 x 1.5                        |
| 11. 6.0 x 6.6 x 2.0             |  |

The measurements were sufficiently accurate to allow comparison of the 1984 population size structure with that of 1970 (Fig. 4.4) using 1 mm size corals.

No small *Balanophyllia* (<5 mm) were recorded in 1984 although several were in the previous survey. Animals were more evenly distributed in the larger size classes in 1984 than in 1970, when there was a peak in the 6-6.9 mm size class. The size structure in 1984 is likely to approach that of the 1970 population as recruitment of individuals into larger size classes is likely to be more rapid in the small animals. This would result in an increase in the relative numbers of animals in the 6-7 mm size class.

.1		.7	.C	X	X	.E
.2	.A					
.3	X		.8	.9	X	
				.10		
.4	.6	X			.11	.13
						.14
X		.B	X			.15
				.12		.16
X	X	X	X	X		.17

KH (1)

Balanophyllia regia

1. 5.0 x 4.6
2. 5.0 x 5.0
3. 6.4 x 7.0
4. 5.0 x 6.0
5. 6.5 x 5.5
6. 6.0 x 5
7. 8.0 x 7.6
8. 6.0 x 6.0
9. 7.0 x 8.2
10. 8.9 x 8.0
11. 7.0 x 6.4
12. 6.8 x 7.2
13. 7.0 x 7.0
14. 5.0 x 5.2
15. 8.0 x 7.0
16. 5.2 x 5.0
17. 7.0 x 6.2

Caryophyllia smithii

- A. 6.2 x 6.0
- B. 11.2 x 9.0
- C. 7.2 x 6.0
- D. 10.2 x 9.0
- E. 10.8 x 9.0

.1	.A	.7	.C	X	.E
	X	X	.8	.9	
.3				.10	
.4	.6	X			.11
					.13
X		.B	X		.14
				.12	.15
X	X	X	X	X	.16
					.17

KH (2)

Balanophyllia regia

1. 6.2 x 5.2
2. not recorded
3. not recorded
4. 5.5 x 5.0
5. 5.2 x 5.0
6. 5.8 x 5.2
7. 8.2 x 8.0
8. 5.5 x 5.3
9. 7.0 x 6.2
10. 8.0 x 7.2
11. 6.0 x 6.0
12. 6.2 x 6.0
13. 7.2 x 6.5
14. 4.8 x 4.2
15. 7.5 x 6.0
16. 6.0 x 5.0
17. 7.2 x 6.8

Caryophyllia smithii

- A. 6.0 x 6.0
- B. 11.2 x 8.8
- C. 7 x 6
- D. 11 x 9.0
- E. 8.8 x 8.0

.1		.7	.C	?
.2	.A			
.3	X	X	?	?
.4	.6	?	?	?
		.B		
X	X	X	?	?
X	X	X	?	?

RI

Balanophyllia regia

1. 4 x 4.5
2. 5.6 x 6
3. 7 x 6.5
4. 5 x 6
5. 4.5 x 6
6. 5.5 x 5.5
7. 6.5 x 6

Caryophyllia smithii

- A. 6.5 x 5.5
- B. 11 x 7.5
- C. 7 x 7

Fig. 4.3. Mapping and measurement of B. regia in April 1984. Three separate sets of records were made, although the last set was incomplete because of incoming tide. The positions are shown in relation to a 50 x 50 cm quadrat.

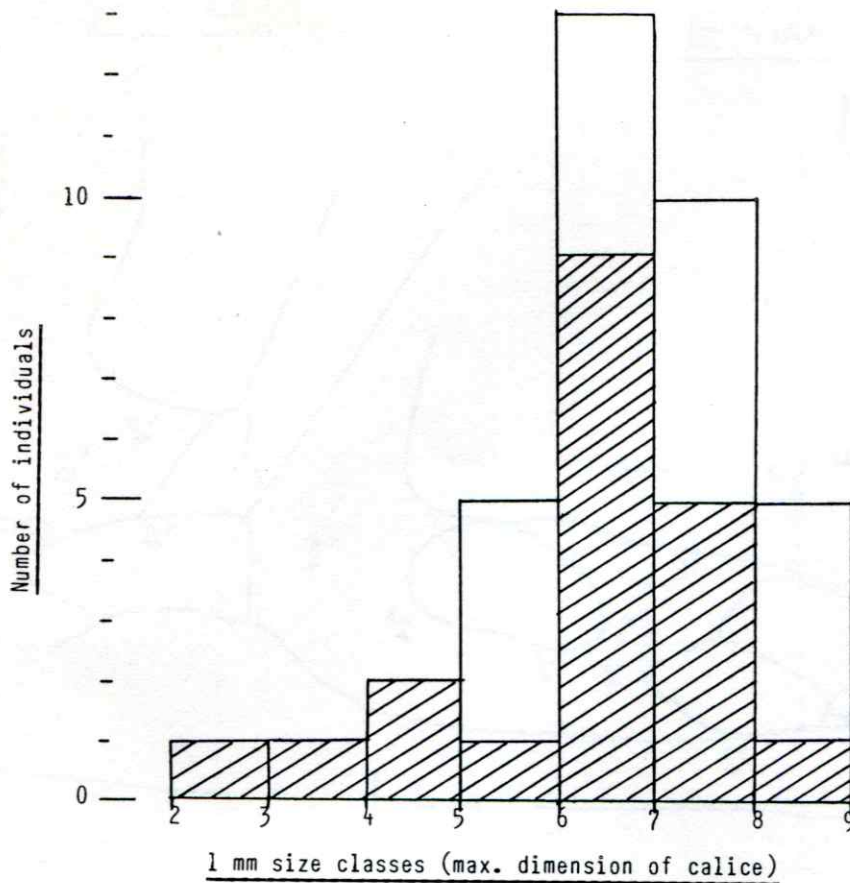


Fig. 4.4. Size distribution of B. regia at Devil's Kitchen site in August 1970 (shaded, 20 individuals) and April 1984 (unshaded, 17 individuals).

Recruitment of juveniles, via a creeping planula larval stage, occurs in summer and the juveniles found in 1970 may represent that year's settlement. A further study of the site later in 1984 may reveal details of the settlement and establishment of the species.

The mechanism of loss of Balanophyllia is unclear. No dead specimens were observed at this or other sites. In Caryophyllia smithii loss is caused by boring of the calcareous exoskeleton by marine worms leading to fracture. Balanophyllia has a much broader base and would be less susceptible to this. In the habitat in which it occurs, mainly surge gullies, dislodgement may be induced by wave action or scouring by mobile stones. The maximum size attained by Balanophyllia would appear to be about 10 mm.

No information was collected on the size distribution of Caryophyllia smithii in 1970, but it is intended to monitor this species similarly in future.

#### 4.3.2. N. of Gannet's Rock site

Fig. 4.5 shows the sketches made and the position and reference numbers of close-up photographs. Plates 14-18 show the location of the gully site and each of the 22 x 15 cm photographs at the headwall site.

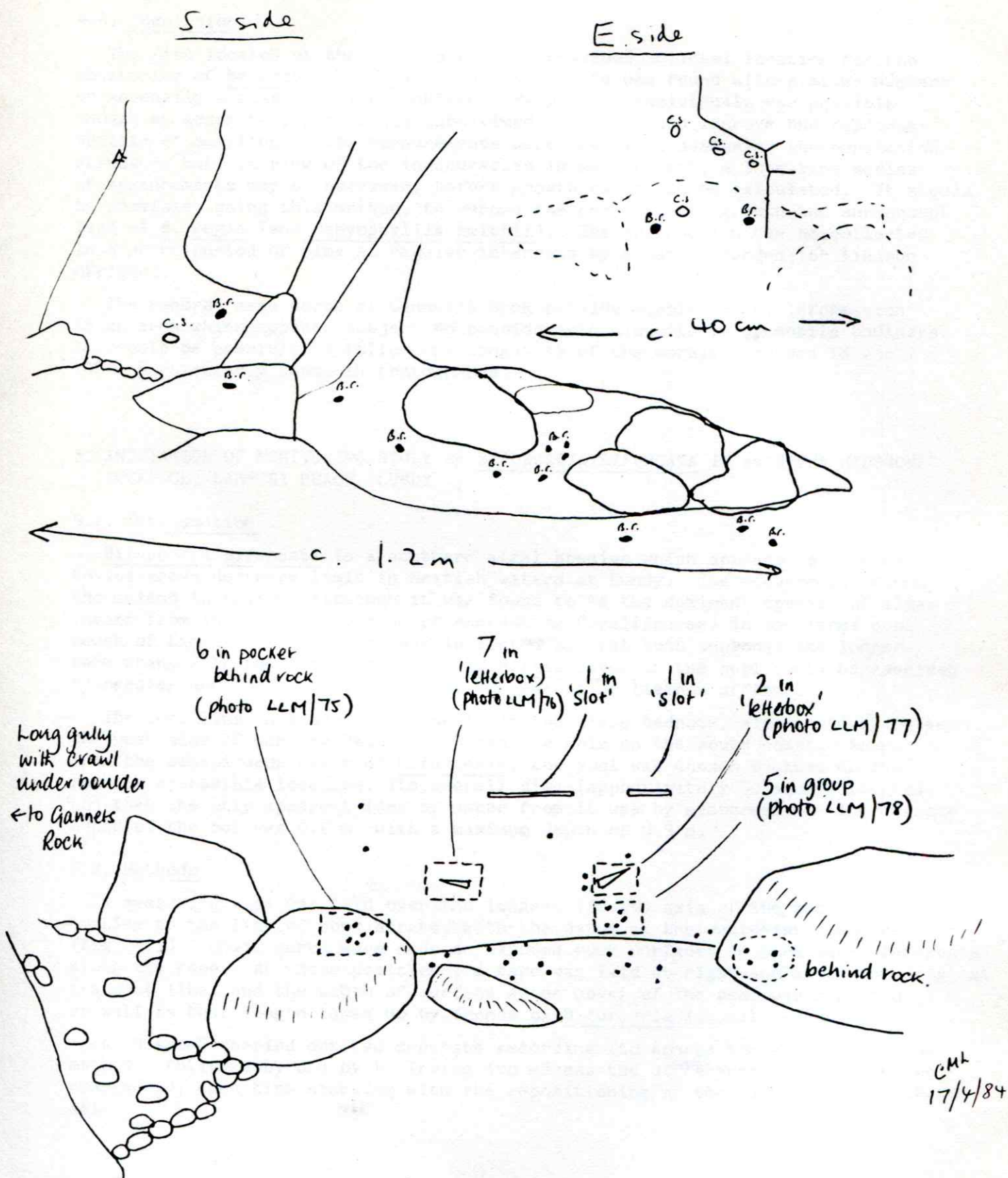


Fig. 4.5. Photocopies of sketches made to show positions of B. regia and C. smithii below the very large boulder blocking the end of a gully at c. 150 m north of Gannet's Rock (upper sketches) and of B. regia on the headwall of the third bay north of Gannet's Rock (lower sketch). Broken rectangles show positions of 22 x 15 cm photographs.

#### 4.4. Conclusions

The site located at the Devil's Kitchen provided an ideal location for the monitoring of Balanophyllia regia. No other site was found with similar numbers or an easily accessible flat rockface. Mapping of individuals was possible, though an accurately positioned subdivided quadrat would improve the reproducibility of sampling. Size measurements were useful in assessing the population structure but, in view of the inaccuracies in measurement, a long-time series of measurements may be necessary before growth rates can be calculated. It should be possible, using this method, to record the recruitment, growth and subsequent loss of B. regia (and Caryophyllia smithii). The information can be collected in a short period of time at regular intervals by a marine warden (or liaison officer).

The records made north of Gannet's Rock provide supplementary information in an area which appears subject to considerable disturbance by mobile boulders. It should be possible to follow the longevity of the corals recorded in April 1984, particularly those in photographs.

### 5. INITIATION OF MONITORING STUDY OF BIFURCARIA BIFURCATA IN AN UPPER MIDSHORE ROCKPOOL, LAMETRY BEACH, LUNDY

#### 5.1. Introduction

Bifurcaria bifurcata is a southern algal species which appears to be close to its known northern limit in British waters at Lundy. Its occurrence around the island is sparse, although it was found to be the dominant species of algae (apart from an overall covering of encrusting Corallinacea) in one large pool south of Lametry. This study was initiated so that both seasonal and longer-term changes in the extent of the Bifurcaria cover in the pool could be assessed by regular monitoring of the site by the warden or liaison officer.

The pool lies on a horizontal shelf in the slate bedrock, almost midway between the west side of Lametry Beach and Mermaid's Hole on the south coast. Apart from the conspicuous cover of Bifurcaria, the pool was chosen because of its readily accessible location, its overall size (approximately 50 square metres), and that the only apparent loss of water from it was by evaporation. The average depth of the pool was 0.2 m, with a maximum depth of 0.5 m.

#### 5.2. Methods

A measuring tape was laid over the longest (SE-NW) axis of the pool, approximating to the line of rock strata, with the datum at the southeast corner (Fig. 5.1). Chalk marks were made on exposed rock surfaces to mark metre intervals along the tape. At these positions, a tape was laid at right angles to the original transect line, and the width of surface water cover of the pool was recorded as well as that length taken up by fronds of Bifurcaria (at all depths).

K. Hiscock carried out two separate recordings (to assess the accuracy of the method), followed by one by R. Irving (to assess the difference between the two observers), each time starting with the repositioning of the tape along the SE-NW axis.

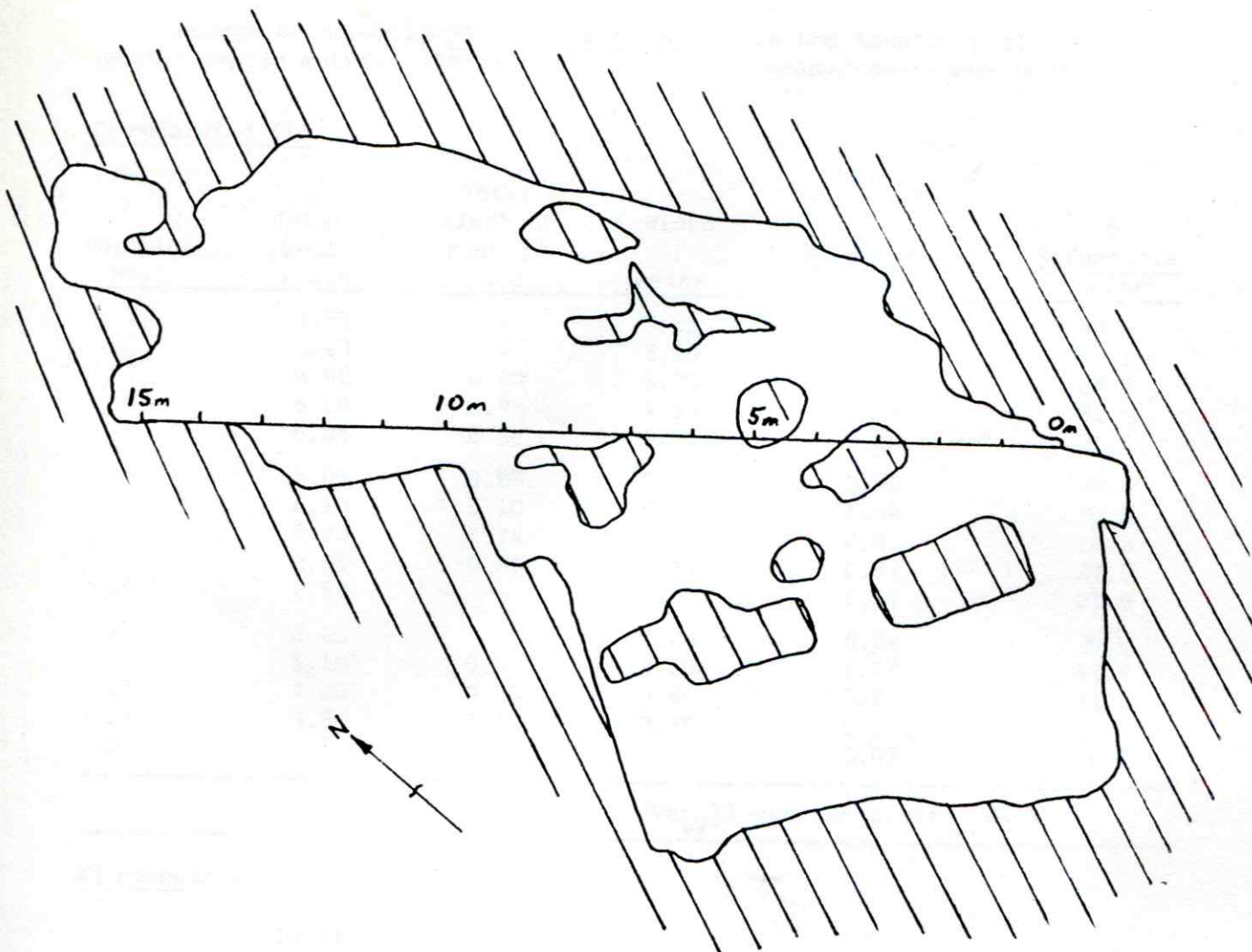


Fig. 5.1. Plan of the Bifurcaria pool showing location of tape. Rock surfaces above pool level are shaded.

### 5.3. Results

These are set out in Table 6.1. At the start of the exercise, the three observers (K. Hiscock, R. Irving and C. Lumb) gave independent estimates of the approximate percentage cover of Bifurcaria in the pool as being 30%, 25-30% and 25% respectively. The result of the measurements, with an overall average Bifurcaria cover of 27% (from the three recordings) agrees with these estimates, which shows that an objective estimate of this sort can be made reasonably accurately.

Robert Irving

TABLE 5.1

Records of cover by *Bifurcaria bifurcata* in the Lametry pool. Widths are in metres. Three separate sets of measurements were made.

KH recording (1)

Position No.	Total pool width	Total width of rock in pool	Width of water	<u>Bifurcaria cover</u>	% <u>Bifurcaria cover</u>
1	3.55	-	3.55	1.66	46.8
2	3.90	-	3.90	0.59	15.1
3	3.90	0.60	3.30	0.93	28.2
4	5.00	0.45	4.55	2.34	51.4
5	6.05	0.55	5.50	1.19	21.6
6	6.05	0.65	5.40	2.40	44.4
7	6.10	1.10	5.00	1.54	30.8
8	6.20	1.74	4.46	0.81	18.2
9	3.55	0.20	3.35	0.91	27.2
10	2.60	-	2.60	0.57	21.9
11	2.25	-	2.25	0.89	39.5
12	5.10	0.50	4.60	2.18	47.4
13	4.20	0.60	3.60	0.85	23.6
14	3.85	1.10	2.75	0.22	8.0
15	1.65	0.60	1.05	0.07	6.6

Overall average cover: 28.7%

KH recording (2)

Position No.	Total Pool width	Total width of rock in pool	Width of water	<u>Bifurcaria cover</u>	% <u>Bifurcaria cover</u>
1	3.55	-	3.55	1.33	37.5
2	3.80	0.20	3.60	0.47	13.1
3	3.90	0.55	3.35	1.27	37.9
4	5.20	0.38	4.82	1.80	37.3
5	5.55	1.42	4.13	0.74	17.9
6	6.00	1.10	4.90	2.15	43.9
7	6.00	1.32	4.68	0.94	20.1
8	5.90	1.78	4.12	0.81	19.7
9	3.45	0.20	3.25	0.81	24.9
10	2.65	-	2.65	0.43	16.2
11	2.30	-	2.30	0.93	40.4
12	5.20	0.44	4.76	2.13	44.7
13	4.10	0.56	3.54	0.53	15.0
14	3.75	0.12	3.63	0.14	3.8
15	1.80	0.55	1.25	0.16	12.8

Overall average cover: 25.7%

Table 5.1 (continued)

RI recording

Position No.	Total pool width	Total width of rock in pool	Width of water	<u>Bifurcaria cover</u>	% <u>Bifurcaria cover</u>
1	3.75	-	3.75	1.31	34.9
2	3.80	0.19	3.61	0.37	10.2
3	4.00	0.68	3.32	1.05	31.6
4	5.23	0.44	4.79	2.22	46.3
5	5.56	1.53	4.03	0.89	22.1
6	6.02	0.97	5.05	2.03	40.2
7	6.02	1.17	4.85	0.98	20.2
8	5.60	1.73	3.87	0.96	24.8
9	3.42	0.19	3.23	0.91	28.2
10	2.60	-	2.60	0.71	27.3
11	2.30	-	2.30	0.91	39.6
12	5.15	0.50	4.65	2.41	51.8
13	4.13	0.77	3.36	0.57	17.0
14	4.38	1.26	3.12	0.13	4.2
15	2.00	0.62	1.38	-	0.0

Overall average cover: 26.6%

## 6. PHOTOGRAPHIC MONITORING OF A CAVE COMMUNITY AT RAT ISLAND

6.1. Introduction

There are a large number of intertidal caves present around Lundy and these are colonised by a small variety of species not often encountered elsewhere on the shore. One such cave is situated in a very accessible position adjacent to Hell's Gates on the northwest side of Rat Island at about low water of neap tides level (Fig. 6.1).

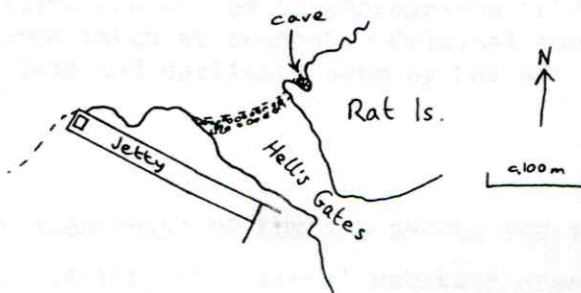


Fig. 6.1. Location of the study cave.

The cave surveyed was the larger of a pair of adjacent caves. There was a sloping floor of slate shingle extending towards the back of the cave at a distance of about 5 m from the entrance. The wall surveyed was of overhanging slate. The communities present were considered typical of darker, small caves at Lundy with large numbers of white dwarf Metridium senile present, together with Sagartia elegans ?mineata, widely scattered Corynactis viridis, one ?Sagartiogetan undatus, Hymeniacion perleve, Halichondria panicea, encrusting Bryozoa (mostly Flustrellidra hispida), Dynamena pumila, Spirorbinidae and Balanus perforatus.

The presence of some of these species on the shore is of scientific interest. Collections of anemones for marine aquaria have been made from this and other caves in the past, and a better understanding of the dynamics of the cave community is required for proper management of the area. A technique was therefore adopted to obtain a quantitative record of the species present along one part of the cave.

### 6.2. Methods

A transect was established on the overhanging wall of the cave. The transect was 2.5 m long and extended through the most dense area of sea anemones. The ends of the transect were marked by two nails and a guideline stretched between them. Sequential photographs 22 x 15 cm in area were taken along the string from left to right along the top followed by right to left along the bottom. (Fig. 6.2 shows the sequence of photographs and their numbering in the set of photographs.) Photographs were taken with a Nikonos IVA camera with a 35 mm lens, supplementary close-up lens, picture area frame and Oceanics 2000 flashgun. Filmstock was Ektachrome 200 and aperture f16. The string was removed after the photographs were taken. The nails could not be considered as permanent and their locations were photographed so that the transect can be re-established (Plates 19-20).

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Q22	Q21	Q20	Q19	Q18	Q17	Q16	Q15	Q14	Q13	Q12

Fig. 6.2. Sequence and numbers of photographs along the transect.

### 6.3. Results

The results are stored as photographs LLM/96-117 and no analysis of them has been undertaken at present. Original photographs are held by the NCC Chief Scientist Team and duplicate sets by the NCC Southwest Regional Office and by K. Hiscock.

## 7. A BRIEF ASSESSMENT OF LUNDY'S SHORES FOR INTERPRETATIVE AND EDUCATIONAL PURPOSES

The wide variety of littoral habitats present around Lundy, including the occurrence of very exposed and very sheltered shores (though with the notable exception of any sandy shores) and intertidal caves, leads to the island in theory being well-suited to comparative studies for interpretative and educational purposes. However, as many of these areas are inaccessible from the land and may also be hazardous to approach from the sea, limitations are imposed upon their use for such purposes.

Those sites which can be approached without too much difficulty are set out in Fig. 8.1. Of these, the Landing Beach is most easily accessible and likely to be the most familiar to visitors, as it is here that those who have arrived on the island by boat will step ashore, and the beachroad provides relatively easy, if steep, access from the top of the island for those who have arrived by helicopter. The other sites around the island provide useful comparisons to this beach, especially when considering the degree of exposure to wave action, the difference between slate and granite bedrock, the slope of the shore/vertical zonation, and boulder and bedrock habitats.

The central part of the Landing Beach consists of slate bedrock covered by small, smooth slate pebbles which are highly mobile. As a consequence, this area has a very sparse fauna and flora. However, larger boulders to the north (Fig. 7.2 (1)) and raised bedrock to the south (Fig. 7.2(2)) provide suitably stable habitats for colonisation by species characteristic of rocky shores in southwest Britain. Zonation of the shore algae is clearly apparent on the larger boulders, with the conspicuous animals being barnacles, dogwhelks, limpets, periwinkles, encrusting sponges and beadlet anemones. These areas remain accessible from approximately two hours after high water to two hours before. One large rock in particular, one of the Sentinels (3), was singled out as being most suitable for explaining the concept of shore algal zonation, with distinct bands of lichens, channelled wrack, spiral wrack and knotted wrack being present. Its base was worn smooth by the movement of loose slates around it. Further down the shore, there were small rock pools, with the edge of the kelp becoming apparent at low water. There were a sufficient variety of rocky habitats within that area to provide examples of many common shore species, which can be found without too much difficulty and without disturbing the habitats to any great extent.

At low water it is possible to clamber over the rocks to Hell's Gates and beyond into Devil's Kitchen (at other times, access is via the hazardous cliff path beyond South Light). Much of Devil's Kitchen consists of gullies between slate ridges which run in a NW/SE direction, providing suitable habitats for a large number of plant and animal species. There are also many rockpools to be found here, some of which, together with the lower-shore Balanophyllia site, are the subject of monitoring studies. By encouraging shore field parties to explore those areas to the north of the Gates, it is hoped that disturbance to these sites will be kept to a minimum.

Leaflets are in preparation which are aimed at the visitor to the shore, explaining the various physical factors which influence the distribution of shore plants and animals, and identifying the more conspicuous of these (especially those present around the North Landing Beach.

Robert Irving

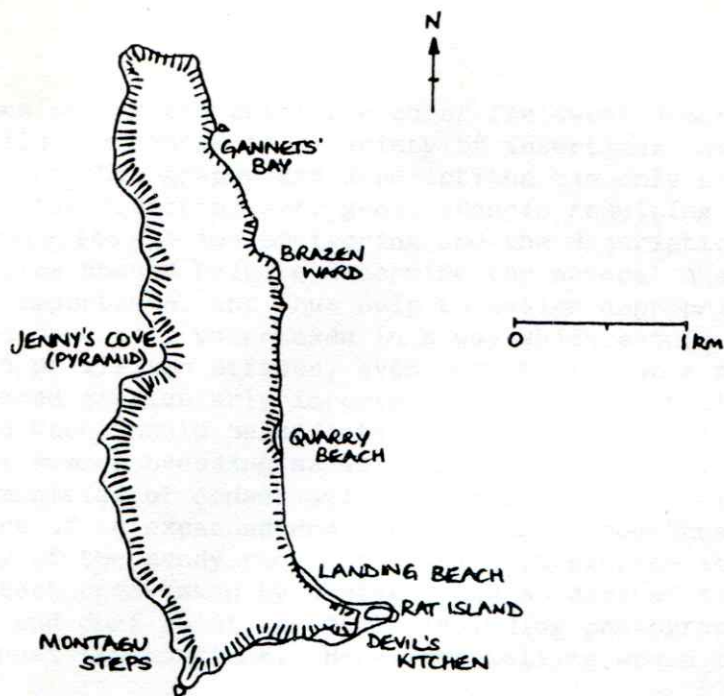


Fig. 7.1. Intertidal sites with land access.

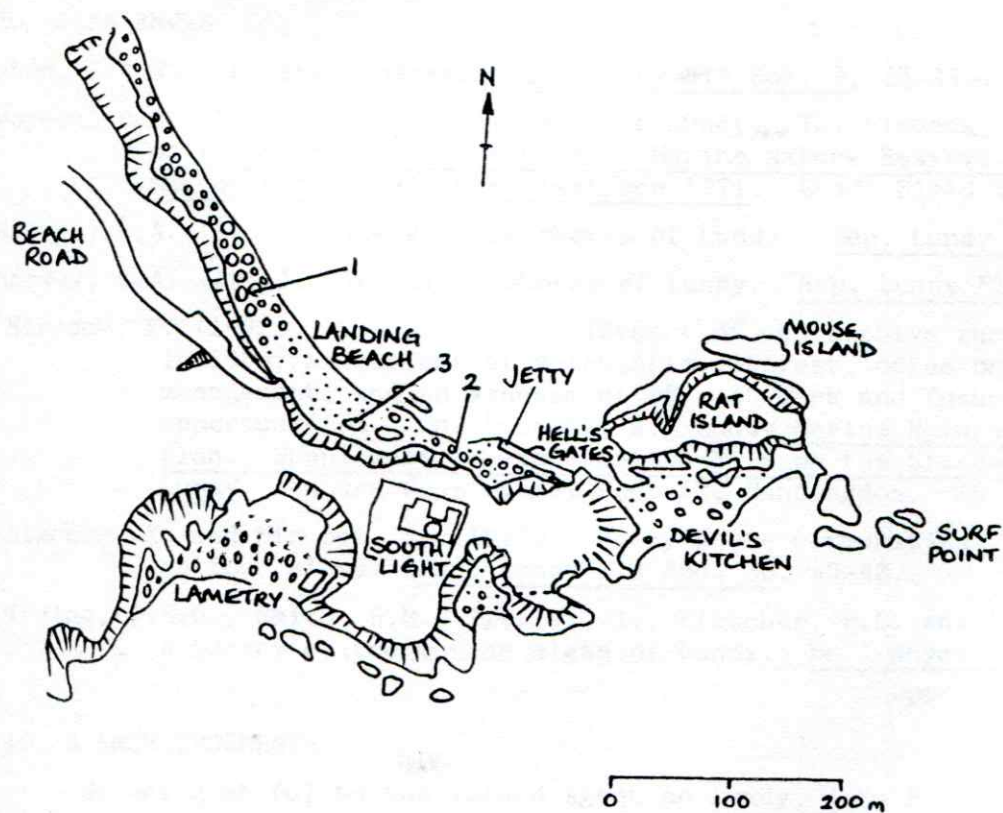


Fig. 7.2. The southeast part of Lundy.

## 8. DISCUSSION OF WORK

The studies undertaken during the brief period of fieldwork described here have provided a basis for following change in a variety of intertidal communities and populations. The shore photography and descriptions can only be considered a useful monitoring tool for detecting very gross changes resulting from disasterous impacts. The more detailed species monitoring and the description of localised and relocatable communities should help to determine the natural change in populations of conservation importance, and thus help to design appropriate management strategies. The studies have been undertaken in a way which should make follow-up recording by a warden or liaison officer, even one who is not a marine biologist, possible. It is considered particularly important to continue studies of Balanophyllia regia, and work should be undertaken during low spring tides in September 1984 after the summer breeding as well as in subsequent years. There are some intertidal communities of conservation interest which we did not study but which could form part of an expanded monitoring programme. These include recording by photography of the sandy rock communities at extreme low water level below the jetty (best undertaken by diving), and studies of the large pool between Rat Island and Surf Point, probably including photography and recording of seasonal and annual fluctuations. Here, snorkelling would be necessary.

The work at Lundy forms some of the first marine biological monitoring undertaken to aid in the management of sites of marine conservation importance. As such, there is a degree of experiment and development in the approaches adopted and a future assessment of the value of the type of work carried out at Lundy.

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## 10. ACKNOWLEDGEMENTS

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## APPENDIX 1

Lundy littoral surveys and monitoring.  
Log. April 14th to 19th 1984.

(Times and heights of low water are correct for Lundy.)

April 13th

KH and SD drive to Ilfracombe, stopping at Swansea, meeting CL at Taunton and collecting boat equipment from Exeter.

April 14th

(Low water 11.52 BST, +0.6 m.) SD and most of equipment depart for Lundy at 06.30 on the 'Polar Bear'. KH, CL and RI depart for Lundy on 09.30 helicopter. Boat assembled on landing slip and general survey all around island commenced at 11.15. Photographs taken from the sea to provide illustrations of different shore communities on different coastal aspects. Landings were made a three caves below the Old Light, Dead Cow Point and Gannet's Rock. Arrived back at Landing Beach 15.15. Weather: clear skies, light southerly breeze, very slight swell on west coast.

April 15th

(Low water 12.37 BST, +0.2 m.) Work was undertaken entirely on the south side of Rat Island (Devil's Kitchen). An area of shore extending at 140° from the entrance to the subterranean passage was considered to provide good examples of the main shore types and rockpool habitats, and was marked with a tape guideline. RI surveyed and drew the main shore features for future relocation, KH carried out a descriptive survey of the shore extending all along the taped area and to low water down the lower-shore gully, KH and CL described the abundance of species in several rockpools along the shore. The rockface on which Balanophyllia regia were mapped and measured in August 1970 by KH was relocated and the corals were remeasured. CL and RI did five-minute searches on the upper shore to record the abundance of Monodonta lineata. Photographs were taken to record general shore communities, rockpools, species, and location of survey sites. SD surveyed sponge populations. Weather: clear skies, strong northwest wind.

April 16th

(Low water 13.19 BST, +0.1 m.) The area to the north of the Landing Bay was explored for potential interpretive sites. A location near the northern end of the concrete seawall was selected and RI was briefed on the features and species present by KH and CL. Photographs were taken of some of the main species and of the whole shore from different positions. The area to the south of the Landing Bay was similarly searched for potential sites by CL and RI and notes on a site at Sentinel Rock made. The lower shore around from Sentinel Rock to Mouse Island was studied and notes on species of conservation interest made. The transect surveyed in 1978 at Rat Island was rephotographed. Photographs were taken of the rich communities in a large rockpool/gully between Rat Island and Surf Point by SD. Weather: some sunshine, some cloud, strong northwest wind.

## Appendix 1 (continued)

April 17th

(Low water 13.58 BST, +0.2 m.) Used boat to get to north of Gannet's Rock. Explored upper and midshore areas whilst tide was falling to obtain a general description of the communities present. Near to low water KH, CL and RI started searching lower shore for Balanophyllia regia; SD went in search of sponges. The locations of some of the B. regia found were sketched to enable assessment of future change. Lower-shore areas, overhangs etc. were searched to provide lists of the species present and to assess the richness of the area. Immediately following low water, a cruise around Gannet's Rock and along the shore back towards the Landing Bay was made. The Brazen Ward rocky shore transect site was rephotographed (the downshore photographs from the datum mark). The main caves to the southwest of the Knoll Pins was explored and the species present noted. On return to the Landing Bay, marking of a photographic quadrat within the richest Hell's Gates caves was attempted but the large galvanised nails were in danger of fracturing the slates. Weather: cloudy, light southwesterly wind.

April 18th

(Low water 14.36 BST, +0.6 m.) KH established photographic transect in the Rat Island cave. CL photographed Lametry Beach from viewpoint on South Light bridge. KH, CL and RI carried out a general survey along shores to the east of Lametry Bay and a detailed survey of the large pool colonised by Bifurcaria on the upper shore. The cover of Bifurcaria was recorded by placing a tape across the pool at 1 m distances and measuring the length of tape covering Bifurcaria and the total length of tape over water. Weather: cloudy, light southwesterly wind, some swell.

## APPENDIX 2

## List of photographs.

The details included here are copied from the labels on each slide. All photographs are taken by K. Hiscock except LLM/15 and 124 to 126 by C. Lumb and LLM/61 and 62 by S. Davies. All photograph numbers are preceded by the letters LLM (Lundy Littoral Monitoring). Other abbreviations are: Splash = splash zone above EHWS; EDWS = extreme high water of spring tides level; US = upper shore; UMS = upper midshore; MS = midshore; LMS = lower midshore; LS = lower shore; ELWS = extreme low water of spring tides level; LWS = low water of spring tides level.

Slide no.	Subject	Site	Height on shore	Date	Picture width
LLM/01	Aerial view of Lundy from south.	-	-	14/4/84	-
LLM/02	South coast zonation.	W. of Seals Hole.	-	14/4/84	c. 20 m
LLM/03	South coast zonation	W. of Seals Hole.	-	14/4/84	c. 8 m
LLM/04	Shore at Great Shutter Rock.	-	-	14/4/84	c. 5 m
LLM/05	Diatom-covered boulders.	Below Quarter Wall.	-	14/4/84	c. 10 m
LLM/06	Shore and cave.	Below Quarter Wall.	-	14/4/84	c. 15 m
LLM/07	Shore.	Dead Cow Point	-	14/4/84	c. 8 m
LLM/08	1977 transect - whole shore.	Dead Cow Point	-	14/4/84	c. 6 m
LLM/09	<u>Fucus vesiculosus v. linearis.</u>	Dead Cow Point	UMS	14/4/84	c. 40 cm
LLM/10	Lower shore community.	Dead Cow Point.	LWS	14/4/84	c. 50 cm
LLM/11	View of west coast.	From Dead Cow Point.	-	14/4/84	-
LLM/12	Shore.	North coast.	-	14/4/84	c. 4 m
LLM/13	Shore to North Light.	North coast.	-	14/4/84	c. 10 m
LLM/14	View of north coast.	From Seals Rock.	-	14/4/84	-
LLM/15	Shore from top of Rat Island.	Devils Kitchen.	-	15/4/84	-
LLM/16	Transect - upper shore.	Devils Kitchen.	US	15/4/84	c. 5 m
LLM/17	Transect - upper midshore platform.	Devils Kitchen.	UMS	15/4/84	c. 5 m
LLM/18	Transect - midshore.	Devils Kitchen.	MS	15/4/84	c. 5 m
LLM/19	Transect - lower midshore.	Devils Kitchen.	LMS	15/4/84	c. 5 m
LLM/20	Pool B.	Devils Kitchen.	US	15/4/84	c. 50 cm
LLM/21	Pool C.	Devils Kitchen.	US	15/4/84	c. 50 cm
LLM/22	Pool D.	Devils Kitchen.	UMS	15/4/84	c. 1 m
LLM/23	Pool E.	Devils Kitchen.	MS	15/4/84	c. 1.5 m
LLM/24	Pool F.	Devils Kitchen.	LMS	15/4/84	c. 1.5 m
LLM/25	East side of Pool G.	Devils Kitchen	LS	15/4/84	c. 1.5 m
LLM/26	West side of Pool G.	Devils Kitchen.	LS	15/4/84	c. 1.5 m
LLM/27	View towards Hells Gates.	Devils Kitchen.	-	15/4/84	c. 15 m
LLM/28	Site location for <u>Balanophyllia</u> site.	Devils Kitchen	LWS	15/4/84	c. 5 m
LLM/29	Measuring <u>Balanophyllia</u> .	Devils Kitchen	LWS	15/4/84	-
LLM/30	<u>Actinia fragacea</u> .	Devils Kitchen	LS	15/4/84	c. 10 cm
LLM/31	<u>Cancer pagurus</u> and <u>Gibbula cineraria</u> under boulder.	Devils Kitchen	LS	15/4/84	c. 20 cm
LLM/32	Encrusting Bryozoa, <u>Verruca stroemia</u> , spirorbids under boulder.	Devils Kitchen	LS	15/4/84	c. 5 cm
LLM/33	Shore above MTL.	N. of Landing Bay.	-	16/4/84	-
LLM/34	Shore below MTL.	N. of Landing Bay.	-	16/4/84	-
LLM/35	View down shore, below end of concrete wall.	N. of Landing Bay.	-	16/4/84	-
LLM/36	View northwards.	N. of Landing Bay.	-	16/4/84	-
LLM/37	Large barnacle-dominated boulder.	N. of Landing Bay.	US	16/4/84	-

Slide no.	Subject	Site	Height on shore	Date	Picture width
LLM/38	<u>Ascophyllum nodosum.</u>	N. of Landing Bay.	US	16/4/84	c. 40 cm
LLM/39	<u>Fucus vesiculosus.</u>	N. of Landing Bay.	UMS	16/4/84	c. 40 cm
LLM/40	<u>Fucus vesiculosus, Verrucaria mucosa.</u>	N. of Landing Bay.	US	16/4/84	c. 50 cm
LLM/41	<u>Laminaria digitata etc.</u>	N. of Landing Bay.	LWS	16/4/84	c. 1 m
LLM/42	<u>Lecanora atra, Caloplaca marina, Verrucaria maura.</u>	N. of Landing Bay.	Splash	16/4/84	5 cm
LLM/43	<u>Caloplaca marina, Ramalina siliquosa.</u>	N. of Landing Beach.	Splash	16/4/84	10 cm
LLM/44	<u>Halichondria panicea.</u>	N. of Landing Bay.	LWS	16/4/84	8 cm
LLM/45	<u>Chthamalus stellatus, C. montagui.</u>	N. of Landing Bay.	UMS	16/4/84	4 cm
LLM/46	<u>Littorina rudis/saxatilis.</u>	N. of Landing Bay.	Splash	16/4/84	7 cm.
LLM/47	Behind Sentinel Rock.	S. of Landing Bay.	US	16/4/84	8 cm
LLM/48	S. of Sentinel Rock.	S. of Landing Bay.	US	16/4/84	-
LLM/49	E. of Sentinel Rock.	S. of Landing Bay.	US	16/4/84	-
LLM/50	N.E. of Sentinel Rock.	The Cove.	LWS	16/4/84	-
LLM/51	<u>Furcellaria fastigiata and Jania rubens.</u>	The Cove.	ELWS	16/4/84	10 cm
LLM/52	<u>Laminaria ochroleuca.</u>	The Cove.	ELWS	16/4/84	c. 4 m
LLM/53	Overhang/cave community.	The Cove.	ELWS	16/4/84	20 cm
LLM/54	<u>Sagartia elegans</u> in wreckage.	The Cove.	LWS	16/4/84	20 cm
LLM/55	<u>C. smithii, A. fragacea, C. viridis etc.</u>	The Cove (wreckage)	LWS	16/4/84	20 cm
LLM/56	Rockpool.	Between Rat Island and Surf Point.	LMS	16/4/84	-
LLM/57	<u>Balanus perforatus, Hymeniacidon perleve etc.</u>	Between Rat Island and Surf Point.	LMS	16/4/84	c. 10 cm
LLM/58	<u>Bunodactis verrucosa, Cereus pedunculatus.</u>	Between Rat Island and Surf Point.	LMS	16/4/84	c. 7 cm
LLM/59	<u>Tubularia indivisa, Corynactis viridis</u> in pool.	Between Rat Island and Surf Point.	LMS	16/4/84	c. 20 cm
LLM/60	<u>Tubularia indivisa</u> in pool.	Between Rat Island and Surf Point.	LMS	16/4/84	c. 12 cm
LLM/61	Rockpool/gully community.	Between Rat Island and Surf Point.	LMS	16/4/84	20 cm
LLM/62	Rockpool/gully community.	Between Rat Island and Surf Point.	LMS	16/4/84	20 cm
LLM/63	<u>Balanophyllia regia, Caryophyllia smithii.</u>	Devils Kitchen (monitoring site).	LWS	15/4/84	20 cm
LLM/64	Overhang community.	Devils Kitchen (monitoring site).	LWS	15/4/84	20 cm
LLM/65	Overhang community.	Devils Kitchen.	LWS	15/4/84	20 cm
LLM/66	N. side of Gannets Rock.	N. of Gannets Rock.	LWS	17/4/84	-
LLM/67	Third bay to N. of Gannets Rock (view S.).	N. of Gannets Rock.	LWS	17/4/84	-
LLM/68	Third bay to N. of Gannets Rock (view N.).	N. of Gannets Rock.	LWS	17/4/84	-
LLM/69	Part of boulder shore.	N. of Gannets Rock.	LS	17/4/84	c. 1 m
LLM/70	Scoured boulders.	N. of Gannets Rock.	LS	17/4/84	c. 3 m
LLM/71	<u>Laminaria hyperborea.</u>	N. of Gannets Rock.	LS	17/4/84	c. 1.5 m

Slide no.	Subject	Site	Height on shore	Date	Picture width
LLM/72	Beached <u>Laminaria digitata</u> .	N. of Gannets Rock.	LS	17/4/84	c. 1 m
LLM/73	Cobble-scoured rock with <u>Balanophyllia regia</u> .	N. of Gannets Rock.	LS	17/4/84	c. 1 m
LLM/74	<u>Balanophyllia</u> location shot at site 1.	N. of Gannets Rock.	LS	17/4/84	c. 1 m
LLM/75	<u>Balanophyllia</u> location site 2, photo 1.	N. of Gannets Rock.	LS	17/4/84	20 cm
LLM/76	<u>Balanophyllia</u> location site 2, photo 2.	N. of Gannets Rock.	LS	17/4/84	20 cm
LLM/77	<u>Balanophyllia</u> location site 2, photo 3.	N. of Gannets Rock.	LS	17/4/84	20 cm
LLM/78	<u>Balanophyllia</u> location site 2, photo 4.	N. of Gannets Rock.	LS	17/4/84	20 cm
LLM/79	<u>Cereus pedunculatus</u> .	N. of Gannets Rock.	LS	17/4/84	20 cm
LLM/80	<u>Caryophyllia smithii</u> , <u>Balanophyllia regia</u> .	N. of Gannets Rock.	LS	17/4/84	20 cm
LLM/81	<u>Balanophyllia regia</u> .	N. of Gannets Rock.	LS	17/4/84	20 cm
LLM/82	<u>Balanophyllia regia</u> .	N. of Gannets Rock.	LS	17/4/84	7 cm
LLM/83	<u>Hymeniacion perleve</u> .	N. of Gannets Rock	LS	17/4/84	10 cm
LLM/84	<u>Echinus esculentus</u> .	N. of Gannets Rock.	LWS	17/4/84	c. 25 cm
LLM/85	<u>Delesseria sanguinea</u> .	N. of Gannets Rock.	ELWS	17/4/84	c. 20 cm
LLM/86	Zonation at N. Gannets Bay.	Gannets Bay.	-	17/4/84	-
LLM/87	Zonation at S. Gannets Bay.	Gannets Bay.	-	17/4/84	-
LLM/88	Zonation at Brazen Ward.	Brazen Ward.	-	17/4/84	-
LLM/89	View down the shore (1977 transect).	Brazen Ward.	-	17/4/84	-
LLM/90	<u>Metridium senile</u> , <u>Sagartia elegans</u> .	Tibbetts Cave	LMS	17/4/84	20 cm
LLM/91	<u>Halichondria panicea</u> , <u>Hymeniacion perleve</u> .	Tibbetts Cave.	LMS	17/4/84	20 cm
LLM/92	<u>Balanus perforatus</u> .	Tibbetts Cave.	LMS	17/4/84	20 cm
LLM/93	Start of Transect.	Rat Island Cave.	LMS	18/4/84	-
LLM/94	Position of outer nail.	Rat Island Cave.	LMS	18/4/84	-
LLM/95	Position of inner nail.	Rat Island Cave.	LMS	18/4/84	-
LLM/96	0.1.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/97	0.2.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/98	0.3.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/99	0.4.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/100	0.5.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/101	0.6.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/102	0.7.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/103	0.8.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/104	0.9.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/105	0.10.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/106	0.11.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/107	0.12.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/108	0.13.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/109	0.14.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/110	0.15.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/111	0.16.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/112	0.17.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/113	0.18.	Rat Island Cave.	LMS	18/4/84	20 cm

Slide no.	Subject	Site	Height on shore	Date	Picture width
LLM/114	Q.19.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/115	Q.20.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/116	Q.21.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/117	Q.22.	Rat Island Cave.	LMS	18/4/84	20 cm
LLM/118	Cave wall community.	Rat Island Cave.	LMS	17/4/84	c. 40 cm
LLM/119	<u>Bifurcaria</u> pool etc. from cliff-top.	E. Lametry.	-	18/4/84	-
LLM/120	<u>Bifurcaria</u> pool - marker transect.	E. Lametry.	MS	18/4/84	-
LLM/121	Recording below <u>Bifurcaria</u> pool.	E. Lametry.	MS	18/4/84	-
LLM/122	<u>Runcina coronata</u> in <u>Burfurcaria</u> pool.	E. Lametry.	MS	18/4/84	4 cm
LLM/123	<u>Bifurcaria birfurcata</u>	E. Lametry.	MS	18/4/84	4 cm
LLM/124	E. Lametry Beach.	Lametry.	-	18/4/84	-
LLM/125	W. Lametry Beach.	Lametry.	-	18/4/84	-
LLM/126	Landing Beach from castle walls.	Landing Beach.	-	19/4/84	-
LLM/127	Landing Beach, The Cove and Rat Island.	S.E. Lundy.	-	19/4/84	-
LLM/128	N. of Landing Beach from old road.	Landing Beach.	-	19/4/84	-
LLM/129	Landing Bay at high tide.	Landing Bay.	-	4/84	-
LLM/130	Landing Bay at low tide.	Landing Bay.	-	4/84	-

APPENDIX 3  
 ABUNDANCE SCALE

1. Live barnacles (excluding B. perforatus)  
 (record adults, spat, cyprids separately)  
Littorina neritoides  
Littorina neglecta  
 7 Ex 500 or more per  $0.1 \text{ m}^2$  - 5+ per  $\text{cm}^2$   
 6 S 300-499 per  $0.01 \text{ m}^2$  - 3-4 per  $\text{cm}^2$   
 5 A 100-299 per  $0.01 \text{ m}^2$  - 1-2 per  $\text{cm}^2$   
 4 C 10-99 per  $0.01 \text{ m}^2$   
 3 F 1-9 per  $0.01 \text{ m}^2$   
 2 O 1-99 per  $\text{m}^2$   
 1 R Less than 1 per  $\text{m}^2$
  2. Balanus perforatus  
 7 Ex 300 or more per  $0.01 \text{ m}^2$   
 6 S 100-299 per  $0.01 \text{ m}^2$   
 5 A 10-99 per  $0.01 \text{ m}^2$   
 4 C 1-9 per  $0.01 \text{ m}^2$   
 3 F 1-9 per  $0.1 \text{ m}^2$   
 2 O 1-9 per  $\text{m}^2$   
 1 R Less than 1 per  $\text{m}^2$
  3. Patella spp. 10 mm+  
Littorina littorea (juv. & adults)  
Littorina littoralis (adults)  
Nucella lapillus (juv. <3 mm)  
 7 Ex 20 or more per  $0.1 \text{ m}^2$   
 6 S 10-19 per  $0.1 \text{ m}^2$   
 5 A 5-9 per  $0.1 \text{ m}^2$   
 4 C 1-4 per  $0.1 \text{ m}^2$   
 3 F 5-9 per  $\text{m}^2$   
 2 O 1-4 per  $\text{m}^2$   
 1 R Less than 1 per  $\text{m}^2$
  4. Littorina 'saxatilis'  
Patella <10 mm  
Anurida maritima  
Hyale nilssoni & other amphipods  
Littorina littoralis (juv.)  
 7 Ex 50 or more per  $0.1 \text{ m}^2$   
 6 S 20-49 per  $0.1 \text{ m}^2$   
 5 A 10-19 per  $0.1 \text{ m}^2$   
 4 C 5-9 per  $0.1 \text{ m}^2$   
 3 F 1-4 per  $0.1 \text{ m}^2$   
 2 O 1-9 per  $\text{m}^2$   
 1 R Less than 1 per  $\text{m}^2$
  5. Nucella lapillus >3 mm  
Gibbula spp., Monodonta lineata  
Actinea equina, Idotea granulosa,  
Carcinus (juv. & recent sett.),  
Ligea oceanica  
 7 Ex 10 or more per  $0.1 \text{ m}^2$   
 6 S 5-9 per  $0.1 \text{ m}^2$   
 5 A 1-4 per  $0.1 \text{ m}^2$   
 4 C 5-9 per  $\text{m}^2$ , locally sometimes more  
 3 F 1-4 per  $\text{m}^2$ , locally sometimes more  
 2 O Less than 1 per  $\text{m}^2$ , loc. 2's times more  
 1 R Always less than 1 per  $\text{m}^2$
  6. Mytilus edulis, Dendrodoa grossularia  
 7 Ex 80% or more cover  
 6 S 50-79% cover  
 5 A 20-49% cover  
 4 C 5-19% cover  
 3 F Small patches (5%, 10+ small individuals per  $0.1 \text{ m}^2$ , 1 or more large per  $0.1 \text{ m}^2$ .  
 2 O 1-9 small per  $0.1 \text{ m}^2$ . 1-9 large per  $\text{m}^2$ . No patches exc. small in crevices  
 1 R Less than 1 per  $\text{m}^2$
  7. Pomatoceros triqueter  
 5 A 50 or more tubes per  $0.01 \text{ m}^2$   
 4 C 1-49 tubes per  $0.01 \text{ m}^2$   
 3 F 1-9 tubes per  $0.1 \text{ m}^2$   
 2 O 1-9 tubes per  $\text{m}^2$   
 1 R Less than 1 tube per  $\text{m}^2$
  8. Spirorbis spp.  
 5 A 5 or more per  $\text{cm}^2$  on appropriate substrata. More than 100 per  $0.01 \text{ m}^2$  generally.  
 4 C Patches of 5 or more per  $\text{cm}^2$ , 1-100 per  $0.01 \text{ m}^2$  generally.  
 3 F Widely scattered small groups, 1-9 per  $0.1 \text{ m}^2$  generally  
 2 O Widely scattered small groups, less than 10 per  $0.01 \text{ m}^2$  generally  
 1 R Less than 1 per  $\text{m}^2$
  9. Sponges, Hydroida, Bryozoa  
 5 A Present on 20% or more of suitable surfaces  
 4 C Present on 5-19% of suitable surfaces  
 3 F Scattered patches, <5% cover  
 2 O Small patch or single sprig in  $0.1 \text{ m}^2$   
 1 R Less than 1 patch over strip, 1 small patch or sprig per  $0.1 \text{ m}^2$
  10. Flowering plants, lichens, lithothamnia  
 7 Ex More than 80% cover  
 6 S 50-79% cover  
 5 A 20-49% cover  
 4 C 1-19% cover  
 3 F Large scattered patches  
 2 O Widely scattered patches, all small  
 1 R Only 1 or 2 patches
  11. Algae  
 7 Ex More than 90% cover  
 6 S 60-89% cover  
 5 A 30-59% cover  
 4 C 5-29% cover  
 3 F Less than 5% cover, zone still apparent  
 2 O Scattered plants, zone indistinct  
 1 R Only 1 or 2 scattered plants
- Other animal species.**  
 Record as percentage cover or approximate average numbers within  $0.01$ ,  $0.1$  or  $1 \text{ m}^2$ .