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Lundy Marine Nature Reserve littoral monitoring report 5 - 9 October 1991

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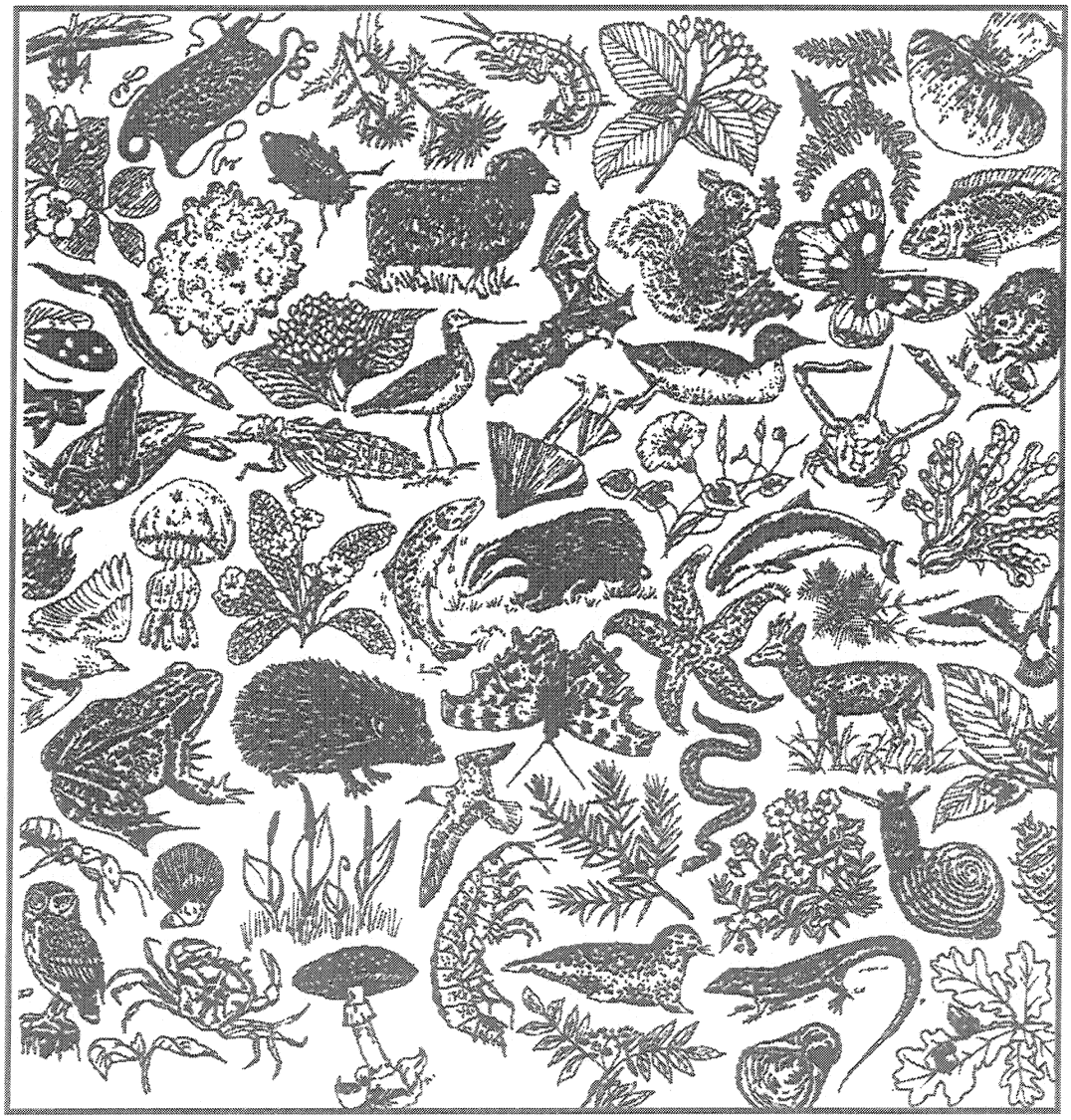

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LUNDY MARINE NATURE RESERVE
LITTORAL MONITORING REPORT
5th - 9th October 1991

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English Nature
March 1992

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CONTENTS

Synopsis

1. An intertidal monitoring programme was established at Lundy by Hiscock in 1984. This was designed to provide a basis for following change in a variety of intertidal communities. The sites studied in October 1991 included the rockpools on Devil's Kitchen, an intertidal cave on Rat Island and intertidal cup corals, species considered to have high nature conservation interest, on Devil's Kitchen and north of Gannet's Rock. Other than monitoring of the Devil's Kitchen cup coral site in 1989, no intertidal monitoring has been performed since 1986. In the interim period a road between Landing Beach and The Cove on the southeast part of the island has been developed.

2. On Devil's Kitchen shore in October 1991, an investigation of the chosen rockpools revealed that more green algae was recorded than in the spring of 1984 and 1986, although less than in the summer of 1985. The abundance and diversity of species in three out of the seven rockpools was greater in 1991 than previously recorded.

3. At the Rat Island cave site photographs were taken along a transect line of 2.5 metres length stretched between two screws in the cave wall. Analysis of these photographs showed there were far fewer Sagartia elegans and Metridium senile although Actinia equina numbers had increased substantially and it was noticeable that many of these were very small individuals. Those anemones that were present were concentrated in similar positions to the ones occupied in previous years.

4. The community present in the cave at Rat Island is characteristic of one present in areas subject to occasional scour. However, many of the anemones appear to have disappeared and there was more bare rock towards the back of the cave and fewer, less expansive sponges. If scour were the explanation for changes in the community structure, then the bryozoan/hydroid mat has returned subsequent to any such intense scouring, but not the sponges or the anemones Sagartia or Metridium although Actinia seem to have recruited successfully.

5. An attempt was made to locate, map and measure the cup corals at a site 0.6 metres above chart datum at the bottom of the shore at Devil's Kitchen. Unfortunately, due to insufficiently low tides and poor weather conditions it was only possible to give a rough indication of the position of cup corals at this site in 1991. The monitoring was, however, carried out in 1989 and details of the position and maximum calice diameter of cup corals at this site are included.

6. A visit was made to the site north of Gannet's Rock on a good low tide and the cup corals were mapped extensively. Despite difficulties experienced in relocating specified groups of cup corals, it was found that at least seven Balanophyllia regia identified in 1984 had disappeared, others were noted for the first time, and Caryophyllia smithii were found in positions previously occupied by Balanophyllia regia.

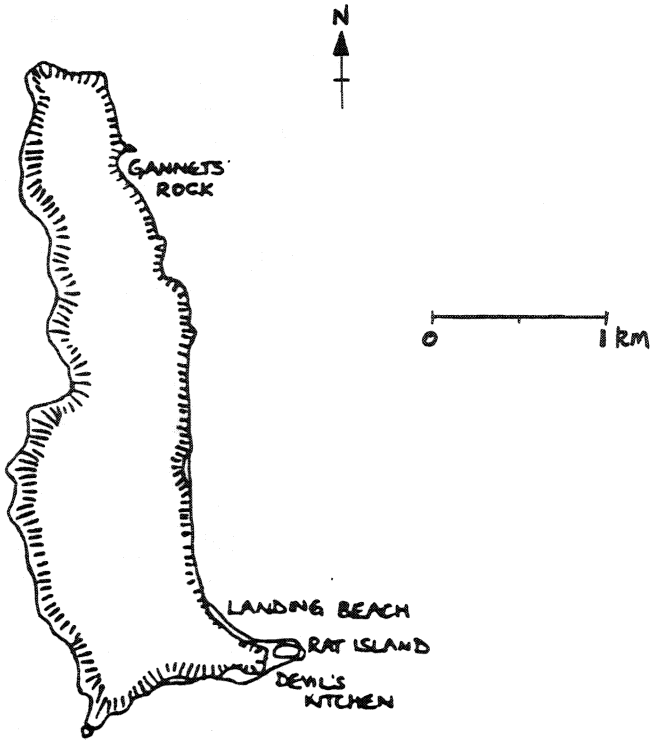


Figure 1: Map of Lundy Island showing intertidal monitoring sites (adapted from Hiscock 1984).

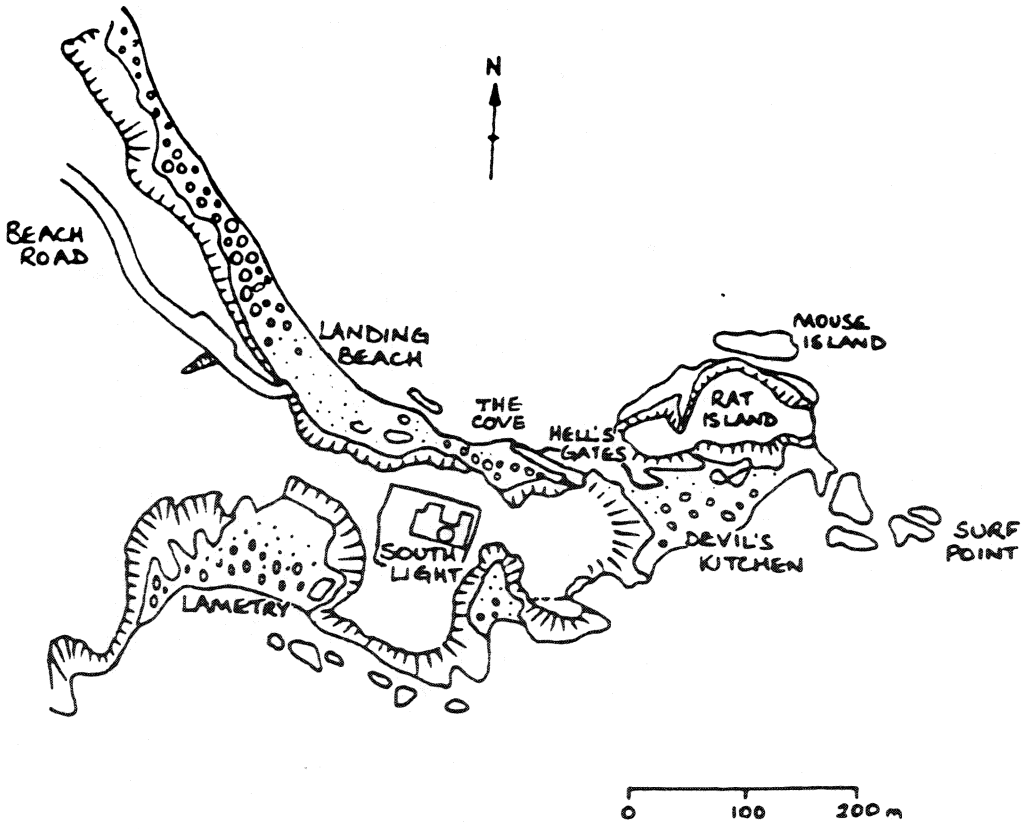


Figure 2: The southeast part of Lundy (adapted from Hiscock 1984).

1. General introduction

The monitoring programme established in April 1984 was designed to provide a basis for following change in a variety of intertidal communities. Subsequent intertidal monitoring was carried out under contract to the Nature Conservancy Council in August 1985 and March 1986. The Devil's Kitchen cup coral site was monitored in September 1989 and the results of that work are contained herein. Otherwise, no intertidal monitoring has been undertaken since 1986. In the interim period, the development of a road between Landing Beach and The Cove on the southeast part of the island has been in progress. Most of the intertidal monitoring sites are concentrated around this part of the island.

The sites and communities investigated this year were selected as they had been previously monitored in 1984,1985 and 1986. They were: the cave community at Rat Island; the rockpool fauna and flora of Devil's Kitchen; cup corals north of Gannet's Rock and at Devil's Kitchen (also monitored in 1989); and construction of the road between landing beach and diver's beach. The nomenclature used was according to Howson (1987). See Figures 1 and 2 (adapted from Hiscock 1984) showing intertidal monitoring sites on Lundy. The site location sheets, prepared by Keith Hiscock and held by English Nature, were used to locate the rock pools on Devil's Kitchen and the cup coral sites North of Gannet's Rock and Devil's Kitchen. A record of daily activities is contained in Appendix 1.

2. Devil's Kitchen rockpool communities

2.1 Introduction

Hiscock (1984) carried out a detailed survey of rockpool communities on Devil's Kitchen shore and seven rockpools were selected. The slate shore at Devil's Kitchen is an exceptionally rich site, with particularly interesting rock pool flora. Brief surveys of the shore were made in 1985 and 1986 and comparisons of photographs taken each year from the same angle were made (Hiscock 1986).

2.2 Methods

The rockpool communities on Devil's Kitchen rocky shore were surveyed in detail. The abundances of individual species were estimated using the MNCR abundance scale (Appendix 2), a more advanced form of that used by Hiscock in 1984. The majority of specimens were identified in situ (as the 1984 survey) but a few specimens were taken back to the laboratory at English Nature.

2.3 Results

Appendix 3 contains lists of species present and their abundance in rockpools at Devil's Kitchen.

2.3.1 Comparison with rockpool communities present previously

As it was dull weather on the days that Devil's Kitchen shore was visited in 1991, the photographs taken did not reveal the contents of the pools. However, as detailed notes were taken, these photographs were not crucial for comparing the communities present in the rockpools over the years. The following lists indicate which species had appeared in or disappeared from the rockpools, particularly between 1984 and 1991.

Rockpool A - the following species had not been recorded in 1984: Hildenbrandia, Ulva, Membranoptera alata, Ahnfeltia plicata, Griffithsia flosculosa, juvenile Laminaria, Gelidium latifolium, unbranched filamentous brown Audouinella (although it was recorded in rockpool B), Urticina felina, Pomatoceros triqueter, Hymeniacidon perleve, Halichondria panicea and a prawn.

Rockpools B and C - listed in 1984 but not found in 1991 were: Ahnfeltia plicata, Gelidium pusillum, Polysiphonia, Plumaria elegans, Laurencia pinnatifida, Delesseria sanguinea, Heterosiphonia plumosa and Audouinella (although found in rockpool A in 1991).

- the following species had not been recorded in 1984: Catenella caespitosa, Chondrus crispus, Enteromorpha, Lomentaria clavellosa, L.articulata, Palmaria palmata, Hypoglossum hypoglossoides, Cystoclonium purpureum, Gibbula umbilicalis, a prawn and Asterina gibbosa (although it had been found in pool A in 1986).

Rockpool D - listed in 1984 but not found in 1991 were: Ceramium rubrum, Laminaria digitata, Scytosiphon lomentaria, Gelidium pusillum, Gastroclinium ovatum, Lomentaria articulata, brown filamentous and Laurencia pinnatifida (although found in rockpool E) and Anemonia viridis.

- the following species had not been recorded in 1984: Gigartina acicularis, Phycodrys rubens, Cladophora rupestris, Chondrus crispus, Palmaria palmata, Polysiphonia and a goby.

Rockpool E - listed in 1984 but not found in 1991 were: Schottera nicaeensis, Phyllophora pseudoceranoides, Ahnfeltia plicata (although found in F and G), Calliblepharis jubata.

- the following species had not been recorded in 1984: Palmaria palmata, Mastocarpus stellatus,

Heterosiphonia plumosa, Membranoptera alata, Lithothamnium, Hildenbrandia, Griffithsia flosculosa, Fucus vesiculosus, Nemalion helminthoides, Chondria dasphylla, Pterocladia cappillacea, Rhodomela confervoides, Laurencia pinnatifida (although found in D in 1984), spirorbids, Asterina gibbosa, Monodonta lineata and Littorina obtusata.

Rockpool F - listed in 1984 but not found in 1991 were: Colpomenia, Ceramium rubrum, Laminaria saccharina, Furcellaria lumbricalis (with Electra pilosa growing epiphytically), Polysiphonia spiralis, Audouinella, Schottera nicaeensis, Membranoptera alata.

- the following species had not been recorded in 1984: Fucus vesiculosus, Mastocarpus stellatus, Laurencia pinnatifida, Lomentaria articulata, Delesseria sanguinea, Ahnfeltia plicata, Ectocarpus agg., Asterina gibbosa and Patella vulgata.

Rockpool G - listed in 1984 but not found in 1991 were: Laminaria digitata, Porphyra, Calliblepharis jubata, Audouinella and Phyllophora pseudoceranoides.

- the following species had not been recorded in 1984: Pterocladia capillacea, Polyides rotundus, Gelidium pusillum, Gymnogongrus griffithsiae, Arthrocladia villosa and Gigartina acicularis. Spirobinidae, Anemonia sulcata, Gibbula umbilicalis, Dynamena pumila, Patella depressa, Gammaridae (under boulders), Carcinus maenus, Gobiidae, a hermit, crab, and tube building amphipods on Pterocladia capillacea

Comparison of rockpool communities in April 1984, August 1985 and March 1986 had shown seasonal variation in the form of more green algae and Ceramium rubrum present in the summer (1985) and also the appearance of Himanthalia elongata at this time but not recorded previously or since. This year's survey, conducted in October, recorded more green algae than in the spring of 1984 and 1986, although less than in the summer of 1985. These differences were particularly noticeable from comparison of photographs, as no specific species abundances were recorded in 1985. Ceramium rubrum was recorded as present in rockpools A, B, D, E and G in 1991. Its abundance in these pools was not estimated although it appeared rare except where present epiphytically. If so, this compares with greater abundances recorded in previous years, probably highlighting seasonal variation. Eulalia egg cases were found in rockpool G in April 1984 but not subsequently, suggesting that this may also have been a seasonal occurrence.

Gigartina acicularis was found in rockpools D and G where it had not previously been recorded. Plumaria elegans was not found in 1991.

2.4 Discussion

Over the years that this site has been monitored, considerable seasonal variation has been evident, particularly in relation to the abundance of green algae but also Ceramium rubrum, and possibly Eulalia egg masses.

The abundance and diversity of species in rockpool A, E and G was greater in 1991 than previously. Otherwise the community structure remained similar to that described in 1984. It is interesting to note that rockpool A showed a considerable increase in species diversity and no loss of species, since this was not only the most sheltered and shaded site but also located at the top of the shore in a subterranean passage where it has less influence from the sea and a greater influence from climatic conditions.

There was no evidence of shale accumulation at this site as a result of the road works being carried out at the landing beach.

3. Rat Island cave community

3.1 Introduction

In 1984 a cave on Rat Island was chosen for monitoring purposes on the grounds of its interesting fauna and accessibility. Two stainless steel screws were screwed into plastic plugs inserted in drilled holes in the wall of the cave 2.5 metres apart, such that a string transect line could be stretched between them to bisect the densest colonies of anemones. In 1984, 1985 and 1986 photographs were taken along the transect line and numbers of anemones counted and other flora noted from the photographs.

3.2 Methods

The cave was rapidly surveyed to identify the species that were present. The screws in the cave were located and a piece of string stretched between them to form a reference line for taking photographs. Sequential photographs of 22 x 15 cm were taken along the line as indicated in Figure 3. Two sets of photographs were taken, the first set on slide film and the second set on print film. A Nikonos IVA camera with a 35 mm lens, supplementary close-up lens, picture framer and Oceanics 2000 flashgun was used. The slides were later analyzed to count the number of anemones and to compare each frame with photographs taken in 1985 and 1986. This was done using two projectors to project images from the same positions next to each other.

Figure 3: Sequence of photographs taken at Rat Island Cave.

1	2	3	4	5	6	7	8	9	10	11
22	21	20	19	18	17	16	15	14	13	12

3.3 Results

The community present included the anemones Metridium senile, Sagartia elegans, Actinia equina; the sponges Halichondria panicea, Hymeniacidon perleve; the polychaetes Pomatoceros triqueter and Spirorbinidae; individual molluscs including a saddle oyster Anomia ephippium, a mussel Mytilus edulis and a dog whelk Nucella lapillus; three distinct bryozoan mats including Flustrellidra hispida, and the bryozoan turf Bowerbankia spp. and Scruparia spp.; the hydroid Dynamena pumila and barnacle shells of Balanus perforatus (although most of these appeared to be empty). There were very few algae present: these included Ulva spp. near the entrance, a film of green alga and two red algae Pterosiphonia parasitica and Membranoptera alata. Neither Corynactis viridis or Sagartiogeton spp.,which had been recorded in 1984, were found despite specifically searching for these species.

The numbers of anemones recorded in each frame taken along the transect line are listed in Table 1.

Table 1: The number of anemones in each frame along the transect line in the cave at Rat Island.

Frame no.	Sagartia elegans	Metridium senile	Actinia equina
Frame 1	21	0	3
Frame 2	9	2	0
Frame 3	14	2	2
Frame 4	5	3	2
Frame 5	1	0	1
Frame 6	2	1	0
Frame 7	8	0	6
Frame 8	4	0	2
Frame 9	2	1	3
Frame 10	4	0	2
Frame 11	0	0	1
Frame 12	1	0	0
Frame 13	1	0	4
Frame 14	2	0	3
Frame 15	1	0	1
Frame 16	5	0	0
Frame 17	12	0	0
Frame 18	3	2	1
Frame 19	5	3	2
Frame 20	9	0	3
Frame 21	12	0	1
Frame 22	2	0	1
Total	**123**	**14**	**38**

Table 2: Comparison of total numbers of anemones along the transect line in the cave at Rat Island, 1984-1991.

	Sagartia elegans	Metridium senile	Actinia equina
1984	205	37	8
1985	507	75	4
1986	298	48	5
1991	123	14	38

There were far fewer Sagartia elegans and Metridium senile in 1991 compared to previous years (Table 2), although Actinia equina numbers had increased substantially to 38 in 1991, and it was noticeable that many of these were very small individuals. Those anemones that were present were concentrated in similar positions to the ones occupied in previous years and some individuals could apparently be identified from previous years. Alternatively they could be different individuals but in the same favourable attachment sites (see Plates 1, 2, 3 and 4).

Other than the above changes in the number of anemones, there was generally less green algal film covering the walls of the cave, particularly compared with the summer of 1985; slightly less extensive bryozoan mats (with some Flustrellidra mats appearing white as opposed to brown and therefore possibly dead); more extensive hydroid coverage; fewer sponges each covering a smaller area; and more bare rock towards the back of the cave.

3.4 Discussion

The community present in the cave is characteristic of one subject to occasional scour. However, many of the anemones appear to have disappeared, suggesting there may have been a very intense scouring in the past, between 1986 and 1991. If this were the explanation, the bryozoan/hydroid mat has returned subsequent to any such intense scouring, but not the sponges or the anemones Sagartia or Metridium, although Actinia seem to have recruited successfully.

The lower coverage of the cave walls with a green algal film this year may be a seasonal phenomenon, as there is less available light in the autumn. Indeed, the most extensive coverage was recorded in the summer of 1985, which would support this view.

4. Mapping of populations of cup corals

4.1 North of Gannet's Rock

4.1.1 Introduction

Two sites approximately 150 metres north of Gannet's Rock, where mapping of cup corals could be relatively easily performed, were identified by Hiscock in 1984. On the south and east sides of site 1 the positions of all cup corals were recorded and on the headwall at site 2 the positions of Balanophyllia regia were recorded and photographs taken of cup corals in specified areas.

4.1.2 Methods

The sites were approached from the north side, which proved to be a much easier route than that shown on the site location sheets. Both sites were easily located, and general photographs were taken using a Nikormat camera with 50 mm lens and flash gun. A Nikonos IVA camera with a 35 mm lens, supplementary close-up lens, picture framer and Oceanics 2000 flashgun was also used, particularly for close-up photography of cup corals at site 2; some of these were below water level so the camera was immersed to photograph submerged groups (Plate 5). Sketches were made to indicate the positions of cup corals so that comparisons could be made with records collected in former years. The positions of other cup corals in the vicinity of sites 1 and 2 and of Caryophyllia smithii at site 2 were recorded for the first time this year.

4.1.3 Results

The sketches in Figures 4,5,6 and 7 show the positions of cup corals present at sites 1 and 2 in October 1991. Plate 6 shows the south side of site 1 and is approximately equivalent to Figure 4. At site 1 on the east side all the cup corals noted in 1984 were present, however the top C.smithii was dead. There were two additional C.smithii not previously recorded to the south. At site 1 on the south side all the cup corals recorded in 1986 were present with the exception of one Balanophyllia regia to the left of centre on Figure 4, which was replaced by another one slightly further to the left. This could be a new recruit or alternatively a result of misdrawing in previous surveys. In addition there were a further five B.regia (two of which were in a position on the edge of site 1 drawn in 1984 and 1985) and one more C.smithii as indicated. These are thought to be new recruits although there is always the possibility that they were previously unrecorded if very small at that time.

At site 2 the 'letterboxes' indicated by Hiscock (1984) were relocated easily, however the exact locations of the other groups of B.regia were less obvious.

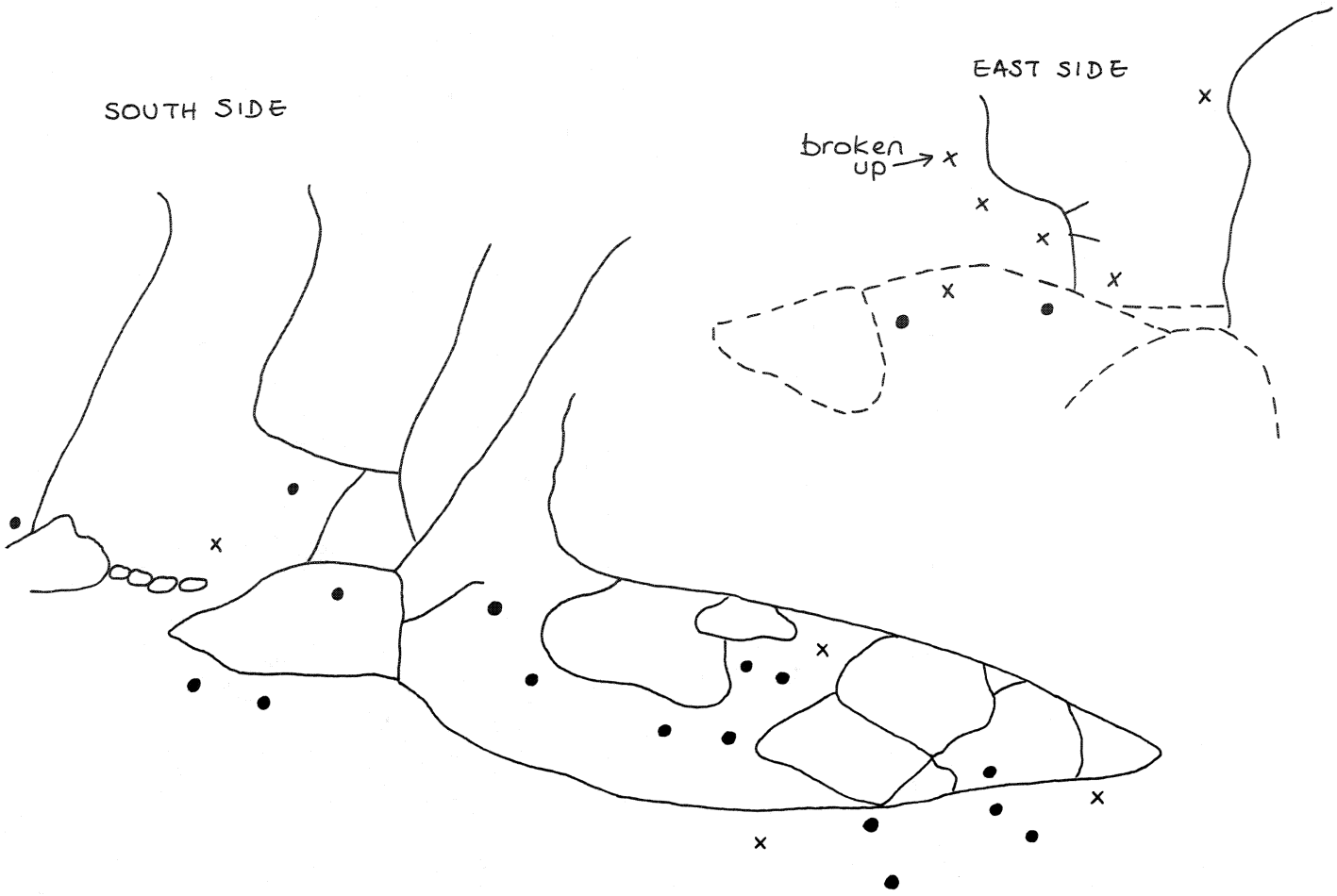


Figure 4: Cupcorals north of Gannet's Rock - Site 1, 8 October, 1991 (x = Caryophyllia smithii; ● = Balanophylllia regia)

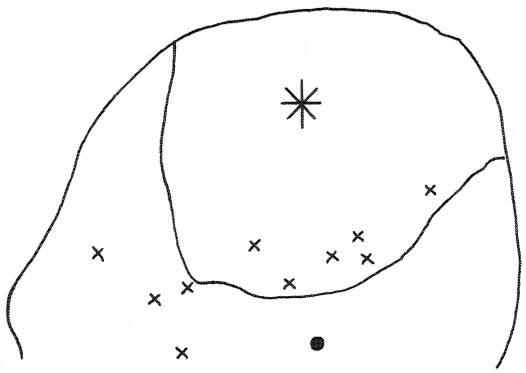


Figure 5: Cupcorals north of Gannet's Rock on boulder in front of site 2 (see figure 6 for location), 8 October, 1991.

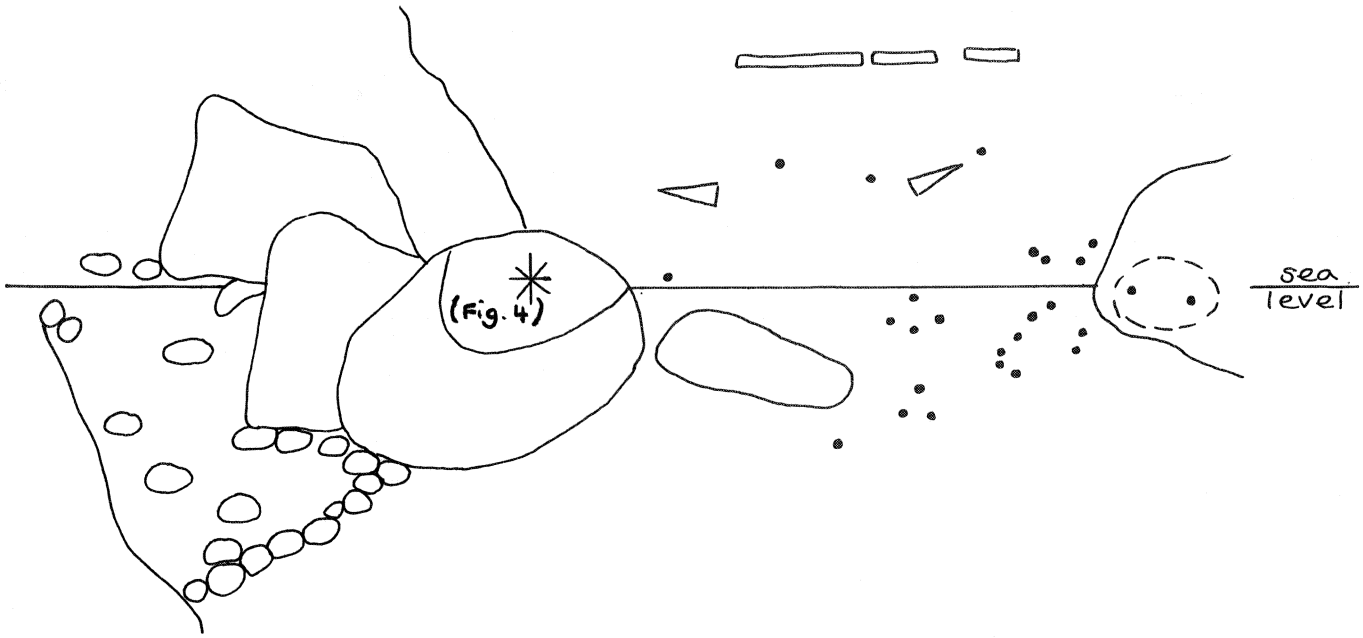


Figure 6: Balanophyllia regia at Site 2, North of Gannet's Rock, 8 October, 1991.

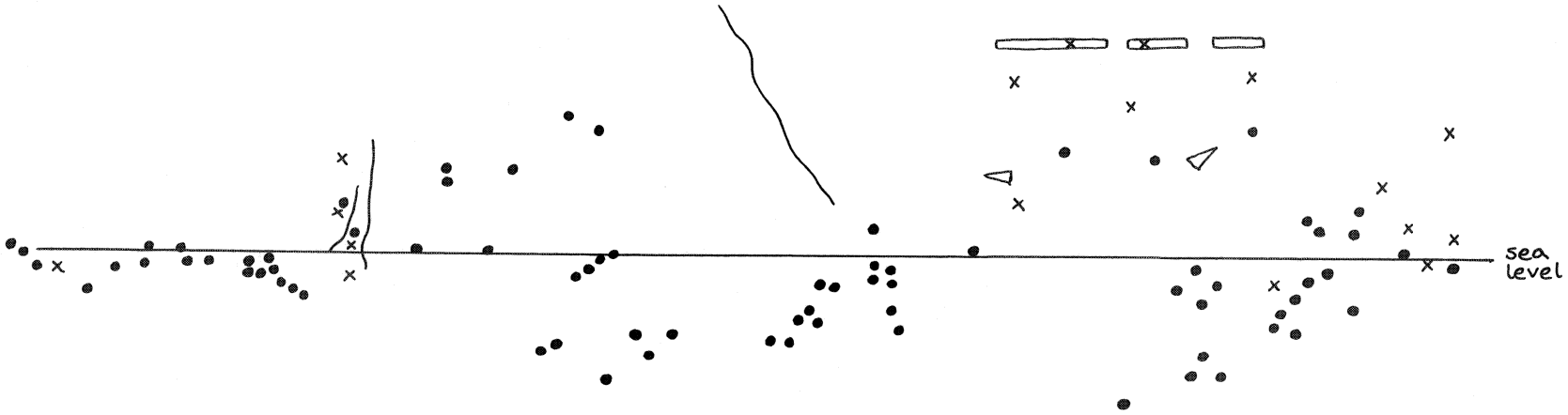


Figure 7: Site 2 headwall only, showing positions of cup corals behind boulders, 8 October, 1991 - corresponds with Fig. 6 (x = Caryophyllia smithii, ● = Balanophyllia regia)

Photographs LLM/75, taken in 1984, and LLM/26/86, taken in 1986 (Plate 7),were compared to Plate 8 which was taken in a equivalent place this year. Records indicate there were as many, if not more, B.regia in this general vicinity although not in exactly the same position. Confusion arises here as the mapping carried out in 1984 did not indicate the existence or position of B.regia further south of this point along the headwall. Furthermore, the cluster of B.regia indicated below the 'letterbox' in the 1984 sketches were not present in that position in 1991, but there was a similar cluster behind the rock. If these do correspond, the next group of four south of that crack might be equivalent to the '6 in a pocket behind rock' recorded in 1984, therefore two B.regia would have been lost.

The photographs of the left hand 'letterbox' did not come out particularly well because of the depth of the letterbox and the poor light. However, it was noted that there were seven B.regia contained within it. This compares with the seven recorded in 1984 and 1986 (although one was thought to be dead in 1986). There is no way of telling whether the B.regia present were the same individuals as those recorded in 1984.

The right hand 'letterbox' contained one B.regia as it did in 1986 (Plates 9 and 10), which is one less than in 1984 (Past photograph LLM/77).

The group of B.regia below the right hand 'letterbox' were difficult to relocate exactly, although photograph LLM/78 (taken in 1984) contained in the site location sheets shows a limpet. A limpet was also present this year. If this was in the same position, then three of the five B.regia recorded in 1984 remained in the same position (Plate 11). Slightly to the left and above these three is one very large B.regia (Plate 12). It would be surprising if this individual had not been present in 1986 however, photographs of this area were not taken in 1986 due to relocation problems. As indicated in the sketch there were a lot of B.regia in this general locality, although how many of them corresponded with those recorded previously is hard to say.

Inspection of 'the slots' at the top of the headwall revealed one C.smithii in each as compared with one C.smithii in the left hand "slot" and one B.regia in the right hand "slot" in 1986 and one B.regia in each slot in 1984.

Behind the rock to the northern end of the headwall there were only two B.regia in 1991, compared to the four indicated in 1984. There were not, however, any dead B.regia, only C.smithii.

4.1.4 Discussion

There appears to be little change from 1984 in the boulder formations. Records from site 1 showed that there is a turn over of cup coral populations, highlighted by damage to one Caryophyllia smithii and recruitment of three more. In addition there were a further five Balanophyllia regia on the edge of site

1 not recorded in previous surveys. At site 2, despite the difficulties experienced in relocating specified groups of cup corals, it was found that at least seven Balanophyllia regia identified in 1984 had disappeared, others were noted for the first time, and C.smithii was found in positions previously occupied by B.regia. Since it had been five years since the last survey it is not possible to assess whether they are new recruits or had been established for several years.The B.regia identified for the first time this year could have been present previously but were unrecorded because of their very small size.

4.2 Devil's Kitchen

4.2.1 Introduction

The cup corals which have been monitored at Devil's Kitchen are located under an overhang at 0.6 metres above chart datum. Their proximity to chart datum restricts access and has caused problems in the past, particularly on poor spring tides and in rough weather. The maximum diameter of the calice of each individual present was measured in 1970 and since then in 1984, 1986 and 1989. Height was measured in 1970. The position of all cup corals found under the overhang has also been recorded in relation to a grid 50 x 50 cm divided into 10 x 10 cm squares.

4.2.2 Methods

The site was located with some difficulty (see Appendix 1) and remained below water. It was therefore only possible to roughly map the positions of the cup corals; no measurements were made.

4.2.3 Results

On 17 September 1989, Stephen Warman (ARO Cornwall) and Andrew Gibson (Lundy Warden) resurveyed this site. These records are included in Figure 8 and appendix 4 for the purpose of comparison.The numbers of cup corals found each year are given in Table 3.

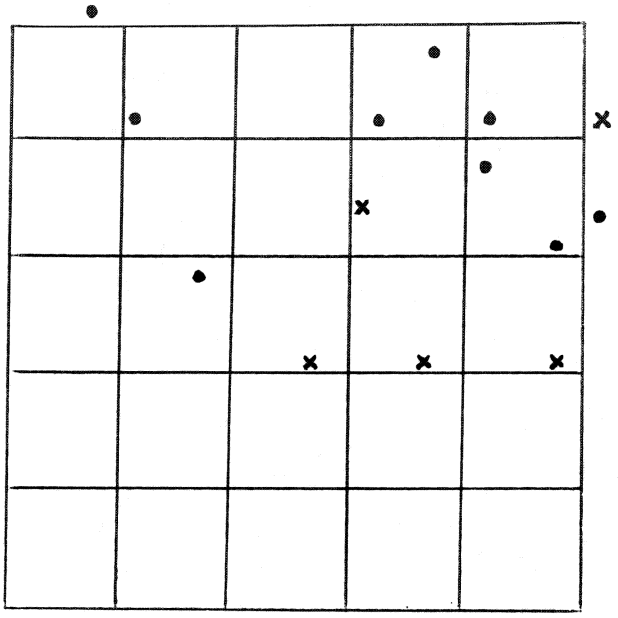
Table 3: Number of cupcorals present at Devil's Kitchen site, 1970-1991.

	Caryophyllia smithii	Balanophyllia regia
1970	1 (outside grid)	21 (plus 2 outside grid)
1984	5	17 (plus 1 outside grid)
1986	4	13
1989	4	8
1991	4 (plus 1 outside grid)	7 (plus 2 outside grid)

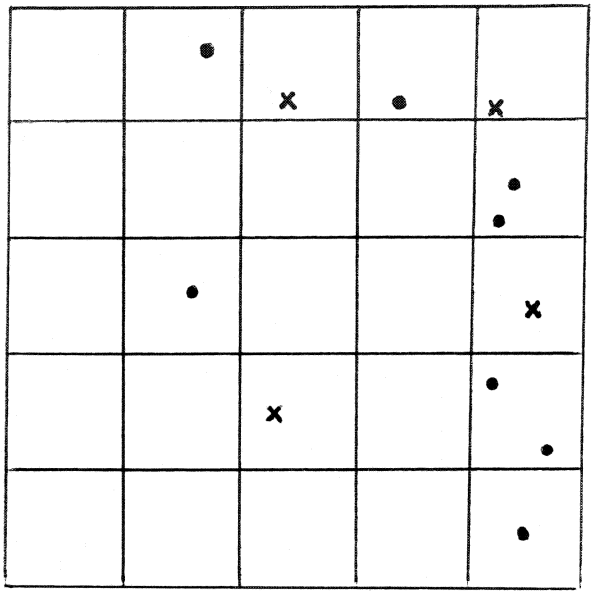
Figure 8 shows the positions of cup corals in 1989 and 1991. The four C.smithii and eight B.regia found in 1989 can be traced back to the 1984 records. Between 1984 and 1986 four B.regia were lost and five more between 1986 and 1989. There does not, however, appear to be any correspondence between the 1991 results and any of the previous surveys. This was probably as a result of difficulty in firstly relocating the quadrat and secondly in mapping the cup coral populations when the quadrat was largely underwater. The calice diameters for 1989 are recorded in Appendix 4.

Figure 8: Position of cup corals Balanophyllia regia and Caryophyllia smithii at Devil's Kitchen in 1984-1991. (x = C.smithii; ● = B.regia)

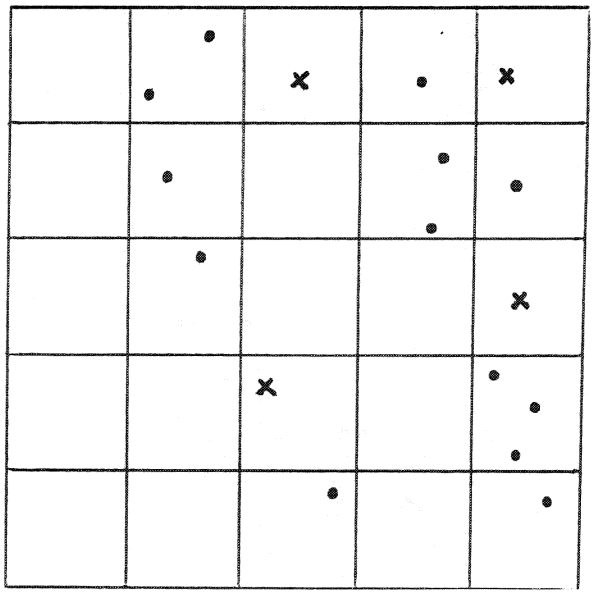
6 October 1991



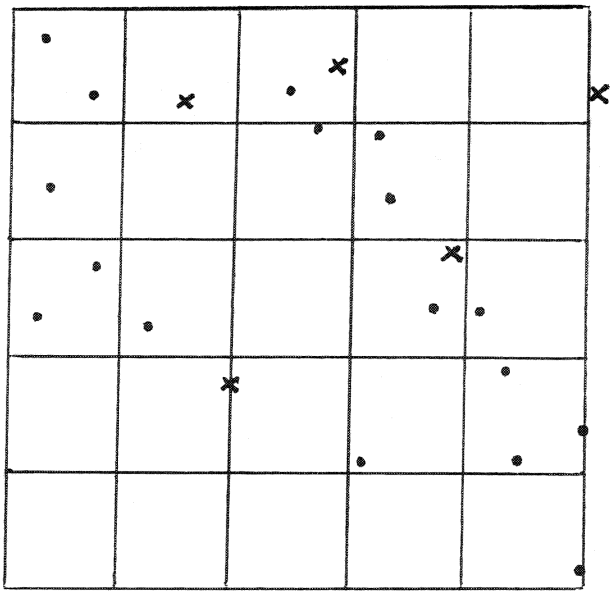
17 September 1989



29 March 1986



15 April 1984



4.2.4 Discussion

On the whole the number of cup corals found at this site has declined over the two decades that they have been studied reaching a minimum in 1989. Their maximum calice diameter has, however, increased. This suggests that older members of the population are being lost and recruitment has not taken place recently. Very small individuals were only found in 1970 (Hiscock 1984) and since then the maximum calice diameters have tended to be greater. There has been no change in the numbers of *C.smithii* but *B.regia* numbers have halved.

5. Construction of road at Landing Bay

Photographs of the construction of a road at Landing Bay were examined whilst on Lundy. Details of these are contained in Appendix 5 and some are reproduced in Plates 13 and 14. The general impression formed is that the construction of the road has caused land slides and slippages of slate into the sea. Rock blasted from the cliff face had accumulated as shale on the upper shore. In turn, this material had moved seaward towards a rock platform and gulleys (Plate 14) previously known to be rich in a variety of marine life (K. Hiscock, personal communication). It appears that slate rock pools have been lost and the quantity of slate fragments on the shore at Landing Beach and The Cove increased until about 1989, but has decreased subsequently, although not to pre-construction levels. Photographs taken from the view points identified by Hiscock (1986b) can be compared from year to year. Unfortunately, photographs were not taken from these exact points this year; it is hoped that this can be rectified soon. These photographs must be taken at low water so that the intertidal is exposed.

6. General discussion and recommendations for future work

6.1 General discussion

The results of the intertidal monitoring of Lundy Marine Nature Reserve carried out this year are best interpreted through comparison with data collected in previous years. The monitoring carried out at Lundy has been at different times of the year so that seasonal variation has become evident and may have overshadowed any year to year changes in rockpool communities on Devil's Kitchen and also in the occurrence of green algae in Rat Island cave.

Within the cave there had been a substantial decrease in the

number of the anemones Metridium senile and Sagartia elegans present. This may have been connected with the construction of a road between Landing Beach and The Cove, which caused much jagged slate to slip into the bay, especially in 1989. In times of rough weather, this could have caused a great deal of scouring within the cave. The otherwise normal appearance of the cave community and recent recruitment of Actinia equina may indicate that the other anemones and sponges had been lost some time ago, but the lack of monitoring between 1986 and 1991 means that it is impossible to confirm this hypothesis.

The number of cup corals recorded at the Devil's Kitchen site reached an all time low in 1989. A turnover in the cup coral populations was evident, with some recruitment of Caryophyllia smithii and possibly B.regia. The monitoring of cup corals over several years has shown that a turnover in population as well as longevity of individuals accounts for persistence of cup coral populations in particular locations on Lundy. Unfortunately insufficient evidence exists to resolve the question of which mechanism is the more important in maintaining communities posed by Hiscock (in press) for intertidal cup corals at least. This would seem to be particularly true for C.smithii, however the existence of very small B.regia in 1970 and not since suggests that they are a longer living population. The recruitment of C.smithii reviewed in Hiscock (1986a) adjacent to existing individuals appears to have been borne out from results gathered. The production of viviparous young by Actinia equina upon collection (Manuel 1981) suggests they are able to recruit rapidly in their immediate vicinity, which may account for their apparently recent success in Rat Island cave.

It is interesting to note in Fowler (1991) that probable recruitment of a subtidal population of Leptosammia pruvoti on the Isles of Scilly has been observed for the first time this year. She suggests that this might possibly be attributable to raised sea temperatures during recent warm summers. There were many cup corals observed at the site north of Gannet's Rock which had not previously been recorded. However in previous years cup coral populations were only studied in the designated sites and no description was made of their distribution outside the site.

6.2 Recommendations for future work

At the Devil's Kitchen cup coral site the bottom of the quadrat is at 0.6 metres above chart datum and therefore it is essential to work at this site on a really good spring tide in calm weather. The appropriate quadrat and callipers are held by the Warden on Lundy and it is recommended that he should undertake the work when suitable conditions occur.

Bearing in mind that there was only about a half hour stand at low water at the cup coral site north of Gannet's rock, with regard to site 2 it would have been better to:

a) only map the B.regia on the headwall and not C.smithii.
b) only photograph the 'letterboxes', 'slots' and groups

mentioned in 1984 and to take multiple shots
c) have recorded the positions of photographs on the sketch

Photographs should be taken from the viewpoint of landing beach from below the castle walls, as pictured in Hiscock (1986b).

7. Acknowledgements

Thanks are extended to the following persons:

John Alford, Lundy, for boat handling
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APPENDIX 1 - Record of daily activity

Marine Biological Studies at Lundy 5-9 October 1991

Record of daily activities

Saturday 5 October - RAT ISLAND CAVE SITE

Oldenburg depart Bideford 0600

Weather: wind northerly force 5
overcast
sea state - rough

Oldenburg disembarked passengers off Devil's Kitchen onto landing craft as sea state in landing bay was too rough to disembark. Arrived at landing beach at 0945 am.

Low water Lundy 1055 am 1.4 metres height

Took monitoring equipment to Dive lock-up. Went over the Rat Island to search for cave. Once located cave, searched within and found screws. Attached 2.5m transect line. Sue identified species within cave while Clare returned to Dive lock-up to prepare camera with close-up lens. Returned to cave and took slide photographs along line.

1	2	3	4	5	6	7	8	9	10	11
22	21	20	19	18	17	16	15	14	13	12

Took repeat photographs where flash unit indicated underexposure. Finished off slide film by taking pictures of fauna and flora within cave. Repeated photographic sequence along line with print film.

Sunday 6 October - DEVIL'S KITCHEN CUP CORALS

Weather: calm in morning
wind: southerly in afternoon gusting up to force 5

Arrived dive lock-up 0915 am. Kitted up. Fixed up quadrat and camera.

Low water at 1135 am 1 metre height

Located subterranean passage through Rat Island and noted positions of rock pools A, B and C.

Paced down beach to search for further rock pools. Were unable to locate rock pools D and E but finally found rock pools F and G. Decided that a tape measure was required to establish position of rock pools D and E.

Spent considerable time looking for cup coral overhang. Overhang turned out to be further away from large rock than indicated on site location map.

Removed thong weed which was obscuring overhang. Tried to determine quadrat location. Majority of quadrat remained underwater throughout the low water period (1 metre). Counted 9 Balanophyllia and 4 or 5 Caryophyllia, indicated positions of these, but were unable to obtain measurements as they remained underwater.

(Intend to return to site on better tide.)

Returned to village to rendezvous with Lundy foreman to arrange boat trip to Gannet's rock cup coral site.

Monday 7 October - DEVIL'S KITCHEN ROCK POOLS

Weather: very windy, overcast, showers, rain later
southerly wind force 6 gusting 7 in morning
south westerly wind force 7 gusting 8 in afternoon

Had planned to visit site north of Gannet's Rock today with foreman, John Alford. However, the wind was too strong, so decided to look at Devil's Kitchen rock pools instead.

Commenced work on shore about 1045 am.

Low water at 1220 pm, 0.7 metres height.

Located subterranean passage with rock pools A, B and C in entrance. Set out tape in line with left hand high part of big rock at bearing 140° magnetic from west side of rock pool C. Managed to locate rock pools D and E (in contrast to our attempts on Sunday).

[NB. After rock pool D ie (E, F & G): line of transect closer to 135° magnetic.]

Surveyed rock pools starting with pool G.

Photographed each one and identified fauna and flora as far as possible, estimated abundances and took samples for later identification where necessary. Completed monitoring of all rock pools except A, as wind was whistling through the subterranean passage, rippling the surface of the water, thus making it very difficult to see into the pool. Furthermore, the tide was rising and there was a gale force on-shore wind.

Completed work on shore at 1445 pm.

NB. Necessary to work with tide down and up shore to complete this piece of monitoring work.

Tuesday 8 October - NORTH OF GANNET'S ROCK CUP CORALS

Weather: sunny, warm, gentle breeze from west turning to easterly by afternoon

Identified seaweed in morning.

Arrived at landing bay by 1045 am.

Low water at 1300 0.6 metres height

Re-photographed rock pools on Devil's Kitchen site - all except G (from angle Keith Hiscock had taken them from before).

Met John Alford on shore at 1120 am in preparation to leave for cup coral site north of Gannet's Rock. Left landing beach at 1135 am.

Landed at site north of Gannet's Rock mid-day. Entered site from north side (much easier than climbing along gulley and squeezing through the gap under boulder: landed only about 10m from sites as opposed to 150m as indicated in site location sheets).

Took land, general photos of sites 1 and 2 then mapped cup corals of site 2, taking close up photos with Nikonos, 35mm lens, large frame to give 22 x 15 cm, and used flash. Some of the cup corals were underwater so immersed camera to take photos. Also mapped site 1 and took some photos.

Hard to distinguish live from dead Caryophyllia; also no time to permit closer examination to determine which species. Low water 1300, water started to rise noticeably about 1330. Left site at 1345. Returned to landing beach.

Surveyed rock pool A on Devil's Kitchen.

Returned to base to look at photographs of construction of road between landing beach and divers beach.

Wednesday 8 October

Weather: south easterly force 3 turning easterly force 5

Low water 1339 pm 0.7 metres height

Oldenburg due to depart Lundy 1530 pm.

Due to imminence of easterly wind we had to leave Lundy at 1100 am. Consequently we were unable to work the low tide, when we had intended to rendez-vous with the Warden, Andrew Gibson, to show him the rock pool and cave monitoring sites and to measure the cup corals at Devil's Kitchen. Instead, we could only pass over the plastic callipers necessary to perform the cup coral measurements to Andrew Gibson.

Arrived in Bideford at 1800.

APPENDIX 2

MARINE NATURE CONSERVATION REVIEW - ABUNDANCE SCALES

S=Superabundant, A=Abundant, C=Common, F=Frequent, O=Occasional, R=Rare

	GROWTH FORM		SIZE OF INDIVIDUALS / COLONIES				
% COVER	A	B	<1cm	1-3cm	3-15cm	>15cm	DENSITY
			S				>1 / 0.0001 m^2 (1x1cm) >10,000 m^2
>80%		S	A	S			1-9 / 0.001 m^2 1000-9999 m^2
40-79%	S	A	C	A	S		1-9 / 0.01 m^2 (10x10cm) 100-999 m^2
20-39%	A	C	F	C	A	S	1-9 / 0.1 m^2 10-99 m^2
5-19%	C	F	O	F	C	A	1-9 / m^2
1-5% (or density)	F	O	R	O	F	C	1-9 / 10 m^2 (3.16x3.16m)
<1% (or density)	O	R		R	O	F	1-9 / 100 m^2 (10x10m)
(use density)	R				R	O	1-9 / 1000 m^2 (31.6x31.6m)
						R	>1 / 10,000 m^2 (100x100m) <1/1000m^2

EXAMPLES OF SPECIES/GROUPS INCLUDED

PORIFERA	Crusts Massive spp.			Sml solitary Grantia	Lge solitary Stelligera	
HYDROZOA	Turf species Tubularia Abietinaria			Small clumps Sarsia Agleophenia	Solitary Corymorpha Nemertesia	
ANTHOZOA	Corynactis Alcyonium			Sml solitary Epizoanthus Caryophyllia	Med solitary Virgularia Cerianthus Urticina	Large solitary Eunicella Funiculina Pachycerianthus
ANNELIDA	Sabellaria		Spirorbis	Scale worms Nephtys Pomatoceros	Chaetopterus Arenicola Sabella	
CRUSTACEA	Tubiculous amphipods	Barnacles	Semibalanus Amphipods	B. balanus Anapagurus Pisidia	Pagurus Galathea Small crabs	Homerus Nephrops Hyas araneus
MOLLUSCA			Sml gastropod L. neritoides Sml bivalves Nucula	Chitons Med gastropod L. littorea Turritella Med bivalves Mytilus Pododesmus	Lge gastropod Patella Buccinum Lge bivalves Mya Pecten Arctica	
		Mytilus Modiolus				
BRACHIOPODA				Neocrania		
BRYOZOA	Crusts, turf & erect spp.				Alcyonidium Porella	
ECHINODERMATA				Echinocyamus Ocnus	Antedon Sml starfish Brittlestars Echinocardium Asiia Thyone	Large starfish Echinus Holothuria
ASCIDIACEA	Colonial Dendrodoa			Sml solitary Dendrodoa	Lge solitary Ascidia Ciona	Diazona
PISCES					Gobies Blennies	Dog fish Wrasse
ALGAE, PLANTS	Foliose Filamentous	Crusts Maerl Fucoids Kelp Lichens			Zostera	Kelp Chorda Halidrys Himanthalia

November 1990

MARINE NATURE CONSERVATION REVIEW

USE OF COVER/DENSITY ABUNDANCE SCALES

The cover/density scales adopted from 1990 provide a unified system for recording the abundance of organisms in biological surveys. The following notes should be read before use:

1 Whenever an attached species covers the substratum and percentage cover can be estimated, that scale is preferred to using the density scales.

2 Use percentage cover scale A for all species excepting those given in scale B.

3 Where two or more layers exist, for instance foliose algae overgrowing crustose algae, total percentage cover can be over 100% and abundance grades will reflect this.

4 Percentage cover of littoral species, particularly the fucoids, must be estimated when the tide is out.

5 Use quadrats as reference frames for counting, particularly when density is borderline between two of the scale.

6 Some extrapolation of the scales may be necessary to estimate abundance for restricted habitats such as kelp fronds.

7 The species (as listed) take precedence over their actual size in deciding which scale to use.

APPENDIX 3 - species presence and abundance in rockpools at Devil's Kitchen

Species present and their abundance: Rockpool A

Flora:

A Lithothamnium spp.
O Hildenbrandia spp.
O Cladophora rupestris
O Corallina officinalis
R Ulva spp.
R Membranoptera alata
P Ahnfeltia plicata
P Griffithsia flosculosa
P Laminaria spp. (juvenile)
P Ceramium rubrum agg.
P Gelidium latifolium
P Audouinella spp.
P Unbranched filamentous brown

Fauna:

C Spirobinidae
P Urticina felina
P Actinia equina
P Pomatoceros triqueter
P Hymeniacidon perleve
P Halichondria panicea
P Prawn

Species present and their abundance: Rockpool B

Flora:

S Corallina officinalis
C Ulva spp.
C Catenella caespitosa
C Cladophora rupestris
F Lithothamnium spp.
P Laminaria digitata
P Mastocarpus stellatus
P Chondrus crispus
P Palmaria palmata
P Enteromorpha spp.
P Lomentaria clavellosa
P Fucus serratus
P Ceramium rubrum agg. on Palmaria palmata and Chondrus crispus
P Hypoglossum hypoglossoides
P Phyllophora crispa

Fauna:

P Spirobinidae
P Asterina gibbosa

P Gibbula umbilicalis

Species present and their abundance: Rockpool C

Flora:

S Corallina officinalis
C Catenella caespitosa
C Cladophora rupestris
F Ulva spp.
F Mastocarpus stellata
F Enteromorpha spp.
O Hildenbrandia spp.
O Lithothamnium spp.
O Laminaria digitata
R Membranoptera alata
P Ascophyllum nodosum
P Lomentaria articulata
P Phyllophora crispa
P Heterosiphonia plumosa
P Cystoclonium purpureum
P Chondrus crispus
P Fucus serratus

Fauna:

A Spirobinidae
P Patella vulgata
P Prawn

Species present and their abundance: Rockpool D

Flora:

A Enteromorpha intestinalis
A Lithothamnium spp.
C Ascophyllum nodosum (fringing)
C Ulva spp.
C Corallina officinalis
F Mastocarpus stellatus
F Chondrus crispus
F Palmaria palmata
F Fucus vesiculosus
F Fucus serratus
P Polysiphonia spp. (on fucoid)
P Ceramium rubrum agg.
P Gigartina acicularis
P Phycodrys rubens
P Cladophora rupestris

Fauna:

O Monodonta lineata
O Actinia equina

P Patella vulgata
P Gibbula umbilicalis
P Gobinidae

Species present and their abundance: Rockpool E

Flora:

A Corallina officinalis
A Melobesia spp. (on Corallina)
A Laurencia pinnatifida
C Fucus serratus (east side of pool)
C Gastroclinum ovatum
C Ulva spp.
F Cladophora spp.
F Palmaria palmata
F Mastocarpus stellatus
F Lomentaria articulata
F Lithothamnium spp.
F Hildenbrandia spp.
F Chondrus crispus
O Fucus vesiculosus (north side of pool)
O Laminaria digitata
O Heterosiphonia plumosa
O Bifurcaria bifurcata
R Griffithsia flosculosa
R Membranoptera alata
P Polysiphonia spp.
P Ceramium rubrum (epiphytic on Palmaria)
P Chondria dasyphylla
P Gelidium latifolium
P Rhodomela confervoides
P Cystoseira tamariscifolia
P Nemalion helminthoides (on limpet)
P Pterocladia capillacea

Fauna:

O Spirobinidae
C Anemonia sulcata
F Actinia equina
P Asterina gibbosa
P Monodonta lineata
P Littorina obtusata

Species present and their abundance: Rockpool F

Flora:

S Corallina officinalis
A Ulva spp.
C Fucus serratus
C Fucus vesiculosus
C Cladophora spp.

C Chondrus crispus
C Mastocarpus stellatus
F Laurencia pinnatifida
F Melobesia (on Corallina)
F Palmaria palmata
R Lomentaria articulata
R Laminaria digitata
P Delesseria sanguinea
P Gastroclinium ovatum
P Gelidium pusillum
P Gelidium latifolium
P Ahnfeltia plicata
P Ectocarpus agg. (on Fucus vesiculosus)
P Lithothamnium spp.

Fauna:

A Spirobinidae
C Anemonia sulcata
C Asterina gibbosa
R Patella vulgata
P Gibbula cineraria

Species present and their abundance: Rockpool G

Flora:

A Fucus serratus
A Palmaria palmata
A Corallina officinalis
C Lithothamnium spp.
C Mastocarpus stellatus
C Ulva spp.
C Cladophora spp.
C Laurencia pinnatifida
C Chondrus crispus
F Hildenbrandia spp.
O Enteromorpha spp.
R Ahnfeltia plicata
R Gastroclinium ovatum
R Melobesia spp. (on Corallina)
P Pterocladia capillacea
P Gelidium pusillum
P Gelidium latifolium
P Ceramium rubrum agg. (on Palmaria)
P Furcellaria lumbricalis
P Polyides rotundus
P Gigartina acicularis
P Arthrocladia villosa
P Gymnogrongus griffithsia

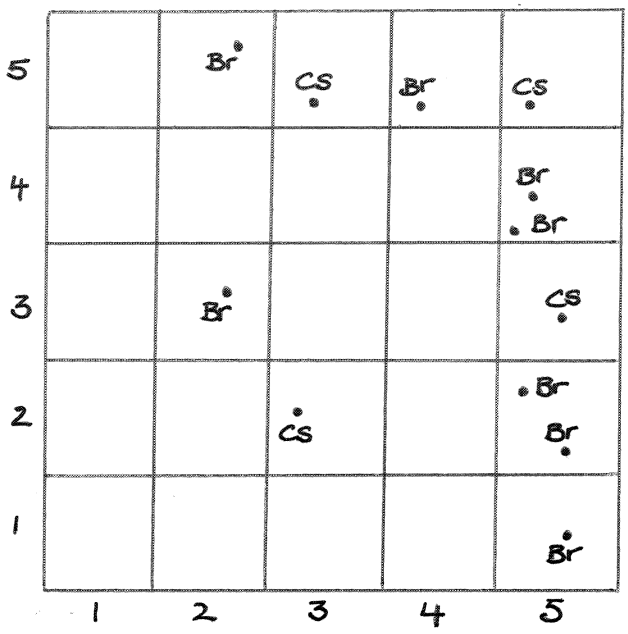
Fauna:

C Spirobinidae
C Anemonia sulcata

O Gibbula umbilicalis
R Dynamena pumila
R Patella depressa
P Gammaridae (mainly under boulders)
P Carcinus maenus
P Gobinidae
P Hermit crab (not identified)
P Tube building amphipods on Pterocladia capillacea

APPENDIX 4 - Cupcorals at Devil's Kitchen

The mapping and measurement of Balanophyllia regia and Caryophyllia smithii on 17 September 1989 by Stephen Warman (NCC) and Andrew Gibson (Lundy Warden):



Grid coordinates (in 50 x 50 cm quadrat)	Species	Max rim diameter (mm)
2,5	B. regia	6.1
4,5	" "	7.2
5,4 (upper)	" "	7.3
2,3	" "	7.3
5,4 (lower)	" "	-
5,2 (upper)	" "	7.5
5,2 (lower)	" "	6.2
5,1	" "	6.3
3,5	C. smithii	6.4
3,2	" "	9.9
5,3	" "	8.7
5,5	" "	7.3

APPENDIX 5 - Comments on photographs of road construction at landing bay

Photographs of landing beach/divers beach and road

Photos taken of Fish Palace, June 1989

These show the demolition of an old slate building between diver's beach and landing beach with the path up to the lighthouse passing behind it. Looking down to the shore below it shows a cobbly beach with a few largish boulders and prominent slabs of slate. There appear to be quite a lot of small slate cobbles in the upper shore/strandline with a few boulders overlying the slabs in the middle shore. The sea appears to be at about half tide level.

Other photos taken at the same time show the path leading up to the lighthouse with a wooden fence to the seaward side and consisting of broken slate. Photos taken looking at Fish Palace and back towards the bottom of the road coming down to landing beach show flat slate slabs in the intertidal, with green seaweed at their lower edge and boulders below. Certainly they don't show much of a slatey beach - other than at the top of the shore.

Photos of Access road, March 1990

Photos show the construction of a track from the bottom of the road to landing beach leading up and around to diving beach (also track across beach). Slate rock face must have been cut through (blasted) and has pins holding it up. Much slate on beach and sliding down from cliff. No sign of slabs that were visible in June 1989. Also appear to be constructing foundations for track: slate boulders in mesh piled up between large slate rocks and even larger slate boulders piled up without mesh around them.

Aerial photos show landing beach covered at high tide - hence need for road?

Photos of 'Access road' show production of tremendous amounts of loose slate right along from landing to divers beach.

Photos of road (including early beach road project) show:

Blasting of cliff
Diggers moving loose slate
Excessive slate on shore
Rocky shore covered in fucoids/limpets/barnacles prior to blasting?
Landslide (caused by blasting?) - loose slate on rocky shore and where cliff was previously
Signs of path to Fish Palace and steps to shore
Lots of slate on divers beach, even in early stages of construction

Diggers appear to have started digging into the cliff from divers beach end (in early photos just rocky cliff between it and landing beach). Loose slate where diggers working otherwise vegetated slate cliffs going straight down into water.

Left of divers beach (jetty in existence) rocky shore with fucoids, limpets etc and very large slate boulders as well as some small slate on shore. When constructing road, slate boulders don't appear to have many rocky shore species on them.

*Not as much slate now as in some of photos!

APPENDIX 6

List of Lundy Littoral Monitoring Slides 1991

Slide No.	Subject	Date	Taken By
LLM91/1/1	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/1/2	Rat Island Cave	05.10.91	C Eno
LLM91/1/3	Rat Island Cave Transect Frame 0 (end of transect)	05.10.91	C Eno
LLM91/1/4	Rat Island Cave Transect Frame 1	05.10.91	C Eno
LLM91/1/5	Rat Island Cave Transect Frame 2	05.10.91	C Eno
LLM91/1/6	Rat Island Cave Transect Frame 3	05.10.91	C Eno
LLM91/1/7	Rat Island Cave Transect Frame 4	05.10.91	C Eno
LLM91/1/8	Rat Island Cave Transect Frame 5	05.10.91	C Eno
LLM91/1/9	Rat Island Cave Transect Frame 6	05.10.91	C Eno
LLM91/1/10	Rat Island Cave Transect Frame 7	05.10.91	C Eno
LLM91/1/11	Rat Island Cave Transect Frame 8	05.10.91	C Eno
LLM91/1/12	Rat Island Cave Transect Frame 9	05.10.91	C Eno
LLM91/1/13	Rat Island Cave Transect Frame 10	05.10.91	C Eno
LLM91/1/14	Rat Island Cave Transect Frame 11	05.10.91	C Eno
LLM91/1/15	Rat Island Cave Transect Frame E	05.10.91	C Eno
LLM91/1/16	Rat Island Cave Transect Frame 12	05.10.91	C Eno
LLM91/1/17	Rat Island Cave Transect Frame R12	05.10.91	C Eno
LLM91/1/18	Rat Island Cave Transect Frame 13	05.10.91	C Eno
LLM91/1/19	Rat Island Cave Transect Frame 14	05.10.91	C Eno
LLM91/1/20	Rat Island Cave Transect Frame 15	05.10.91	C Eno
LLM91/1/21	Rat Island Cave Transect Frame 16	05.10.91	C Eno
LLM91/1/22	Rat Island Cave Transect Frame 17	05.10.91	C Eno
LLM91/1/23	Rat Island Cave Transect Frame R17	05.10.91	C Eno
LLM91/1/24	Rat Island Cave Transect Frame 18	05.10.91	C Eno
LLM91/1/25	Rat Island Cave Transect Frame 19	05.10.91	C Eno
LLM91/1/26	Rat Island Cave Transect Frame 20	05.10.91	C Eno
LLM91/1/27	Rat Island Cave Transect Frame 21	05.10.91	C Eno
LLM91/1/28	Rat Island Cave Transect Frame 22	05.10.91	C Eno
LLM91/1/29	Lundy Island Cave	05.10.91	C Eno
LLM91/1/30	Lundy Island Cave	05.10.91	C Eno
LLM91/1/31	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/1/32	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/1/33	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/1/34	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/1/35	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/1/36	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/1/37	Lundy Rat Island Cave	05.10.91	C Eno
LLM91/2/1	Southern end of Lundy Island from the sea	05.10.91	C Eno
LLM91/2/2	Landing Bay looking North	05.10.91	C Eno
LLM91/2/3	Rat and Mouse Island	05.10.91	C Eno
LLM91/2/4	Landing Bay from Lighthouse	05.10.91	C Eno
LLM91/2/5	Diver's Beach and Rat Island	05.10.91	C Eno
LLM91/2/6	Lundy Devil's Kitchen, Rock Pool G	06.10.91	C Eno
LLM91/2/7	Lundy Devil's Kitchen, Rock Pool G	06.10.91	C Eno
LLM91/2/8	Lundy Devil's Kitchen, Rock Pool F	06.10.91	C Eno

LLM91/2/9	Lundy Devil's Kitchen, Rock Pool E	06.10.91	C Eno
LLM91/2/10	Lundy Devil's Kitchen, Rock Pool D	06.10.91	C Eno
LLM91/2/11	Lundy Devil's Kitchen Shore	06.10.91	C Eno
LLM91/2/12	Lundy Devil's Kitchen, Rock Pool C	06.10.91	C Eno
LLM91/2/13	Lundy Devil's Kitchen, Rock Pool B	06.10.91	C Eno
LLM91/3/1	Lundy, Square Cottage	07.10.91	C Eno
LLM91/3/2	Lundy, Square Cottage	07.10.91	C Eno
LLM91/3/3	Church on Lundy	07.10.91	C Eno
LLM91/3/4	Landing Bay/Diver's Beach/Rat Island	07.10.91	C Eno
LLM91/3/5	Rat Island/Oldenburg	07.10.91	C Eno
LLM91/3/6	Landing Bay & Road Development	07.10.91	C Eno
LLM91/3/7	Rat Island/Diver's Beach	07.10.91	C Eno
LLM91/3/8	Landslide above Landing Beach	07.10.91	C Eno
LLM91/3/9	Oldenburg & Landing Craft	07.10.91	C Eno
LLM91/3/10	Rocky Shore - *Pelvetia* zone on Landing Beach	07.10.91	C Eno
LLM91/3/11	Road Construction	07.10.91	C Eno
LLM91/3/12	Landslide above Landing Beach	07.10.91	C Eno
LLM91/3/13	Road to Diver's Beach from Landing Beach	07.10.91	C Eno
LLM91/3/14	Shoreward side of Landing Bay ½ way between Diver's Beach and Landing Beach	07.10.91	C Eno
LLM91/3/15	New road being constructed towards Diver's Beach	07.10.91	C Eno
LLM91/3/16	Diver's Beach	07.10.91	C Eno
LLM91/3/17	Road to Diver's Beach	07.10.91	C Eno
LLM91/3/18	Road to Diver's Beach	07.10.91	C Eno
LLM91/3/19	Road to Diver's Beach	07.10.91	C Eno
LLM91/3/20	Road to Diver's Beach	07.10.91	C Eno
LLM91/3/21	Landing Beach from Sea	07.10.91	C Eno
LLM91/3/22	Landing Beach from Sea	07.10.91	C Eno
LLM91/3/23	Landing Craft	07.10.91	C Eno
LLM91/3/24	Jetty & Diver's Beach	07.10.91	C Eno
LLM91/3/25	Lundy Island	09.10.91	C Eno
LLM91/3/26	Lundy Island	09.10.91	C Eno
LLM91/3/27	Lundy Island	09.10.91	C Eno
LLM91/3/28	Lundy Island	09.10.91	C Eno
LLM91/3/29	Lundy Island	09.10.91	C Eno
LLM91/3/30	Lundy Island	09.10.91	C Eno
LLM91/3/31	Lundy Island	09.10.91	C Eno
LLM91/3/32	Lundy Island	09.10.91	C Eno
LLM91/3/33	North Devon Coast	09.10.91	C Eno
LLM91/3/34	North Devon Coast	09.10.91	C Eno
LLM91/3/35	North Devon Coast	09.10.91	C Eno
LLM91/3/36	North Devon Coast	09.10.91	C Eno
LLM91/3/37	North Devon Coast	09.10.91	C Eno
LLM91/4/1	Lundy: Cup Coral Site North of Gannet's Rock - Central photo of 5 *B. regia* in group	08.10.91	C Eno
LLM91/4/2	Lundy: Cup Coral Site North of Gannet's Rock - Overlapping Frame 1	08.10.91	C Eno
LLM91/4/3	Lundy: Cup Coral Site North of Gannet's Rock - Overlapping Frame 1 and 2	08.10.91	C Eno

LLM91/4/4	Lundy: Cup Coral Site North of Gannet's Rock - To right of previous 3 Frames, 2 *B. regia* and one *C. smithii*	08.10.91	C Eno
LLM91/4/5	Lundy: Cup Coral Site North of Gannet's Rock - Overlapping Frame 4	08.10.91	C Eno
LLM91/4/6	Lundy: Cup Coral Site North of Gannet's Rock - Overlapping Frame 5	08.10.91	C Eno
LLM91/4/7	Lundy: Cup Coral Site North of Gannet's Rock - Large *C. smithii* to right of Frame 5	08.10.91	C Eno
LLM91/4/8	Lundy: Cup Coral Site North of Gannet's Rock - *C. smithii* and *B. regia* behind northern-most boulder	08.10.91	C Eno
LLM91/4/9	Lundy: Cup Coral Site North of Gannet's Rock - *C. smithii* and *B. regia* behind northern-most boulder	08.10.91	C Eno
LLM91/4/10	Lundy: Cup Coral Site North of Gannet's Rock - *C. smithii* in slot	08.10.91	C Eno
LLM91/4/11	Lundy: Cup Coral Site North of Gannet's Rock - *B. regia* in letterbox	08.10.91	C Eno
LLM91/4/12	Lundy: Cup Coral Site North of Gannet's Rock - 2 *C. smithii* & Kelp holdfast	08.10.91	C Eno
LLM91/4/14	Lundy: Cup Coral Site North of Gannet's Rock - lefthand letterbox	08.10.91	C Eno
LLM91/4/15	Lundy: Cup Coral Site North of Gannet's Rock - Close up of lefthand letterbox	08.10.91	C Eno
LLM91/4/16	Lundy: Cup Coral Site North of Gannet's Rock - kelp stipe and 5 *B. regia* underwater	08.10.91	C Eno
LLM91/4/17	Lundy: Cup Coral Site North of Gannet's Rock - underwater shot of 2 *C. smithii* and 6 *B. regia*	08.10.91	C Eno
LLM91/4/18	Lundy: Cup Coral Site North of Gannet's Rock - 3 *B. regia* underwater	08.10.91	C Eno
LLM91/4/19	Lundy: Cup Coral Site North of Gannet's Rock - *B. regia* and kelp	08.10.91	C Eno
LLM91/4/20	Lundy: Cup Coral Site North of Gannet's Rock	08.10.91	C Eno
LLM91/4/21	Lundy: Cup Coral Site North of Gannet's Rock - 2 *B. regia*	08.10.91	C Eno
LLM91/4/22	Lundy: Cup Coral Site North of Gannet's Rock	08.10.91	C Eno
LLM91/4/23	Lundy: Cup Coral Site North of Gannet's Rock - 2 *B. regia* further left above water level	08.10.91	C Eno
LLM91/4/24	Lundy: Cup Coral Site North of Gannet's Rock - 2 *B. regia* further left above water level	08.10.91	C Eno
LLM91/4/25	Lundy: Cup Coral Site North of Gannet's Rock - 3 *B. regia* underwater (below last frame)	08.10.91	C Eno
LLM91/4/26	Lundy: Cup Coral Site North of Gannet's Rock - 1 *B. regia* on back of rock, south side of Site 2	08.10.91	C Eno
LLM91/4/27	Lundy: Cup Coral Site North of Gannet's Rock - 3 *C. smithii* (1 damaged) general shot	08.10.91	C Eno
LLM91/4/28	Lundy: Cup Coral Site North of Gannet's Rock - *C. smithii* on west wall of Site 2	08.10.91	C Eno
LLM91/4/29	Lundy: Cup Coral Site North of Gannet's Rock - *B. regia* and small kelp below last frame		
LLM91/4/30	Lundy: Cup Coral Site North of Gannet's Rock - *B. regia* in unmapped slot	08.10.91	C Eno

LLM91/4/31	Lundy: Cup Coral Site North of Gannet's Rock - Cup Corals east of Site 1	08.10.91	C Eno
LLM91/4/32	Lundy: Cup Coral Site North of Gannet's Rock - East side of Site 1, *C. smithii* in crack	08.10.91	C Eno
LLM91/4/33	Lundy: Cup Coral Site North of Gannet's Rock - Starfish	08.10.91	C Eno
LLM91/4/34	Lundy: Cup Coral Site North of Gannet's Rock - Starfish	08.10.91	C Eno
LLM91/5/1	Lundy	08.10.91	C Eno
LLM91/5/2	Lundy: Devil's Kitchen Shore - Rock Pool F	08.10.91	C Eno
LLM91/5/3	Lundy: Devil's Kitchen Shore - Rock Pool E	08.10.91	C Eno
LLM91/5/4	Lundy: Devil's Kitchen Shore - Rock Pool D	08.10.91	C Eno
LLM91/5/5	Lundy: Devil's Kitchen Shore - Rock Pool C	08.10.91	C Eno
LLM91/5/6	Lundy: Devil's Kitchen Shore - Rock Pool B	08.10.91	C Eno
LLM91/5/7	Lundy: Devil's Kitchen Shore - Rock Pool A	08.10.91	C Eno
LLM91/5/8	Photographs of shore taken from boat, West Coast of Lundy	08.10.91	C Eno
LLM91/5/9	Photographs of shore taken from boat, West Coast of Lundy	08.10.91	C Eno
LLM91/5/10	Photographs of shore taken from boat, West Coast of Lundy	08.10.91	C Eno
LLM91/5/11	Photographs of shore taken from boat, West Coast of Lundy	08.10.91	C Eno
LLM91/5/12	Shore near Gannet's Rock	08.10.91	C Eno
LLM91/5/13	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - far side of boulder (back of Site 1)	08.10.91	C Eno
LLM91/5/14	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - looking up far side of gulley (from boulder)	08.10.91	C Eno
LLM91/5/15	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 1, south side	08.10.91	C Eno
LLM91/5/16	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 1, south-east side	08.10.91	C Eno
LLM91/5/17	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 1, south-east side (under exposed)	08.10.91	C Eno
LLM91/5/19	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 1 from a distance (very poor quality)	08.10.91	C Eno
LLM91/5/20	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 2 (very poor quality)	08.10.91	C Eno
LLM91/5/21	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 2 (very poor quality)	08.10.91	C Eno
LLM91/5/22	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 2 headwalls (west)	08.10.91	C Eno
LLM91/5/23	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - Site 2 headwalls (west)	08.10.91	C Eno
LLM91/5/24	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - west side of Site 1	08.10.91	C Eno
LLM91/5/25	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - west side of Site 1 (close up of *C. smithii*)	08.10.91	C Eno
LLM91/5/26	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - east of Site 1 (over exposed)	08.10.91	C Eno
LLM91/5/27	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - close up of east side of Site 1 looking north	08.10.91	C Eno

LLM91/5/28	Lundy: Cup Coral Site (gulley) North of Gannet's Rock - close up of *C. smithii* on east side looking north	08.10.91	C Eno
LLM91/5/29	Lundy: Cup Coral Site (gulley) North of Gannet's Rock	08.10.91	C Eno
LLM91/5/30	Lundy	08.10.91	C Eno
LLM91/5/31	Lundy	08.10.91	C Eno
LLM91/5/32	Lundy	08.10.91	C Eno
LLM91/5/33	Lundy	08.10.91	C Eno
LLM91/5/34	Lundy	08.10.91	C Eno
LLM91/5/35	Lundy	08.10.91	C Eno
LLM91/5/36	Lundy: Collage of photographs taken of Landing Bay Development	08.10.91	C Eno
LLM91/5/37	Lundy: Landing Bay prior to road construction	08.10.91	C Eno
LLM91/5/38	Lundy: Collage of photographs taken of Landing Bay Development	08.10.91	C Eno

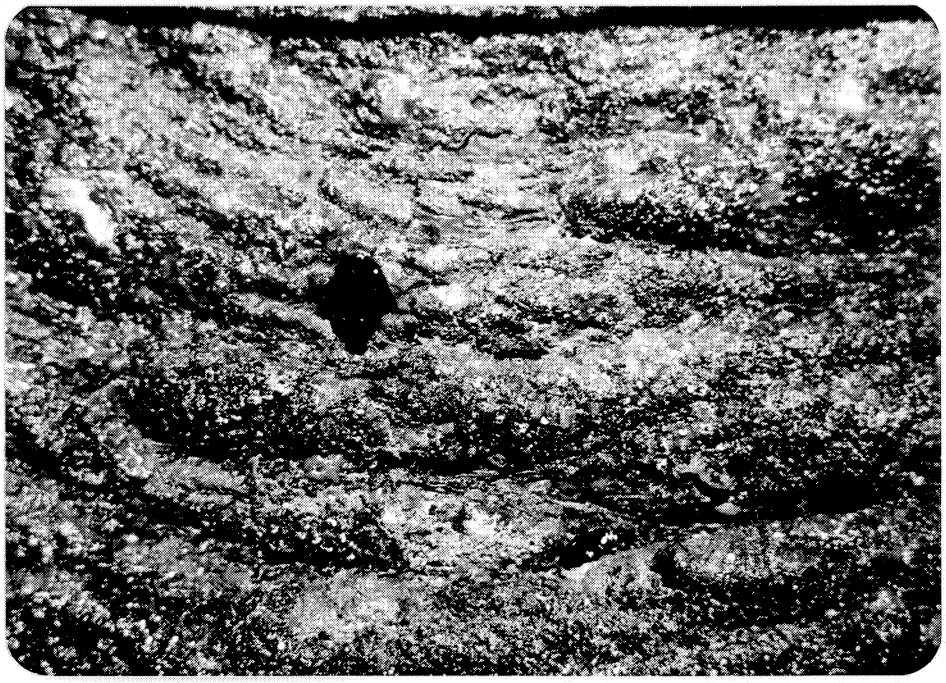


Plate 1: Rat Island Cave, Frame 1, 1986 (LLM/28/86)

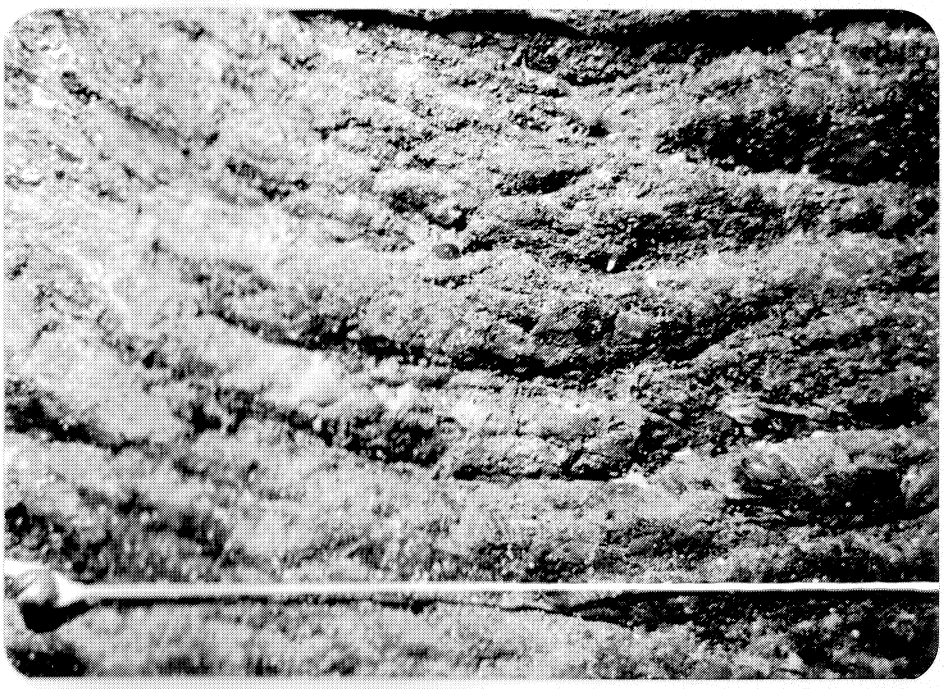


Plate 2: Rat Island Cave, Frame 1, 1991 (LLM91/1/4)

Plate 3: Rat Island Cave, Frame 13, 1986 (LLM/40/86)

Plate 4: Rat Island Cave, Frame 12, 1991 (LLM91/16)

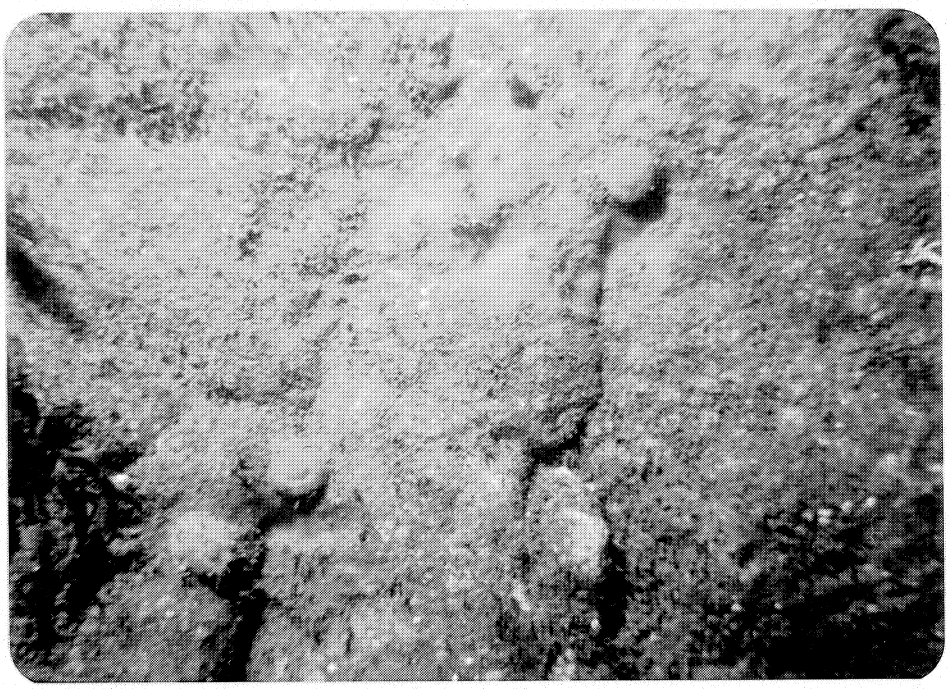


Plate 5: Balanophyllia regia underwater North of Gannet's Rock (LLM91/4/25)

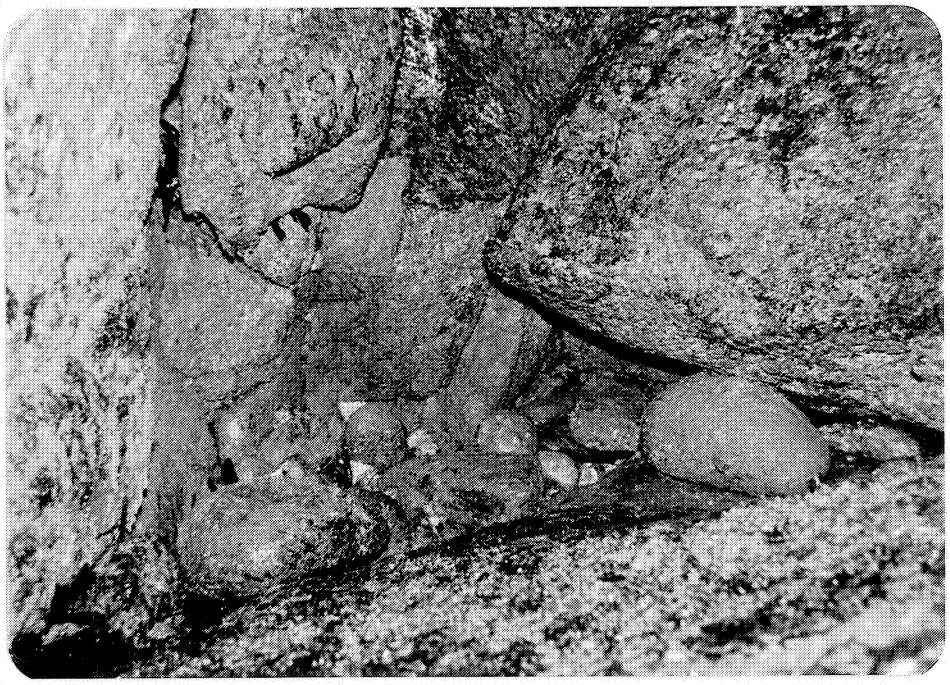


Plate 6: South side of site 1 at North of Gannet's Rock (LLM91/5/15)

Plate 7: Balanophyllia regia at site 2, North of Gannet's Rock 1986 (LLM/26/86)

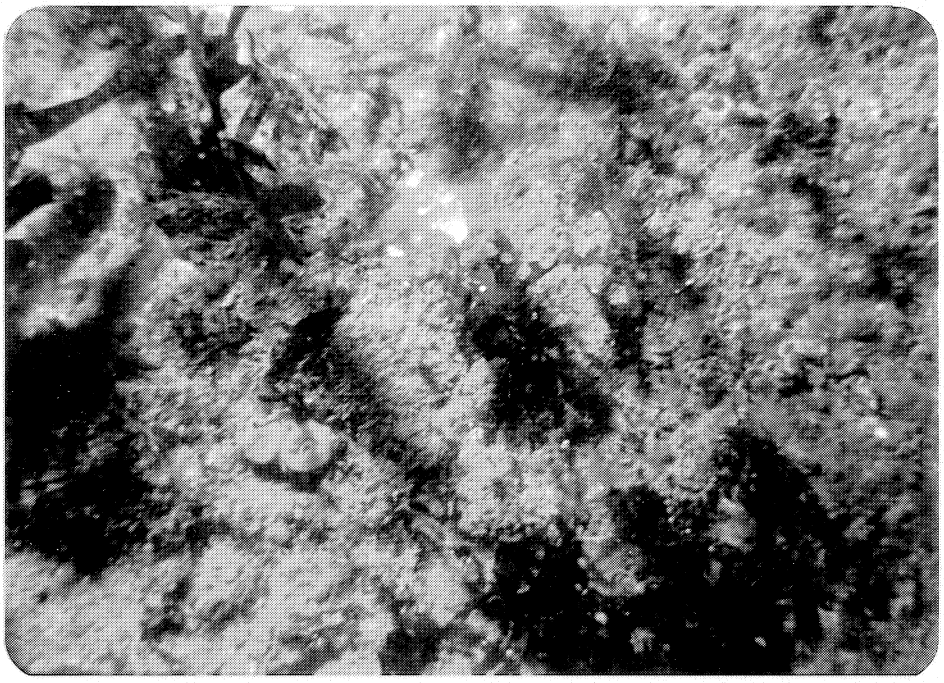


Plate 8: Balanophyllia regia at site 2, North of Gannet's Rock 1991 (LLM91/4/21)

Plate 9: Balanophyllia regia in letterbox at site 2, North of Gannet's Rock, 1986 (LLM/24/86)

Plate 10: Balanophyllia regia in letterbox at site 2, North of Gannet's Rock, 1991 (LLM91/4/11)

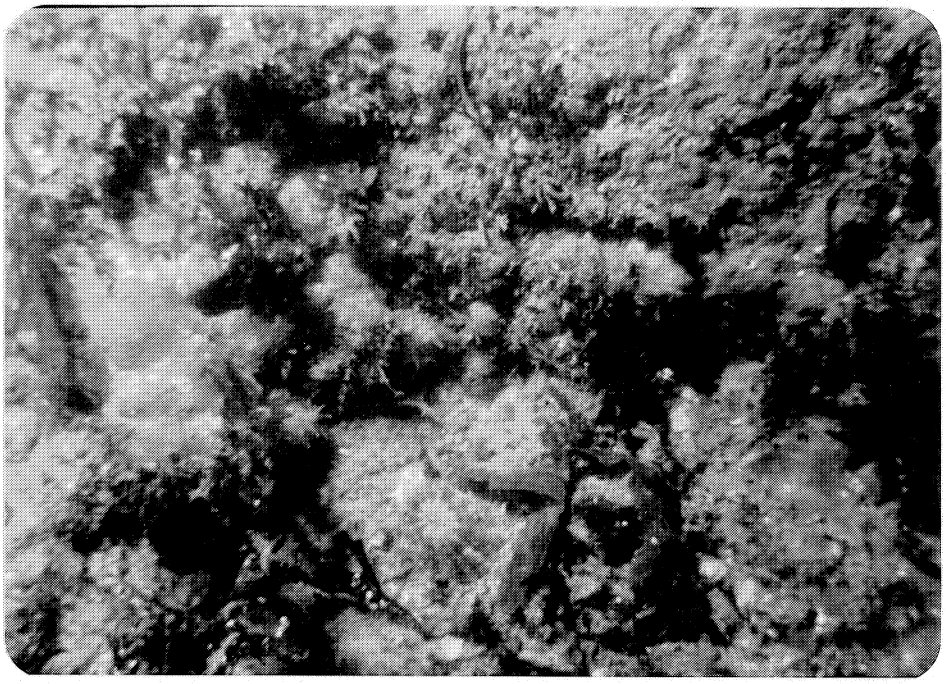


Plate 11: Lundy cup coral site, North of Gannet's Rock, overlapping frame 1, 1991 (LLM91/4/2)

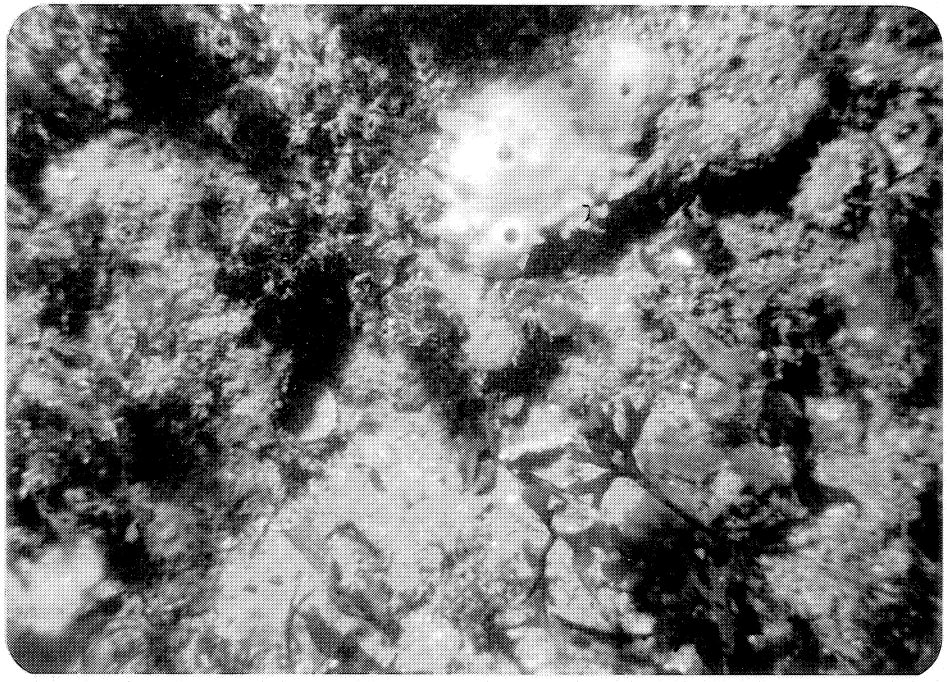


Plate 12: Lundy cup coral site, North of Gannet's Rock, overlapping frame 1 and 2, 1991 (LLM91/4/3)

Plate 13: Landing Bay and road development, 1991 (LLM91/3/6)

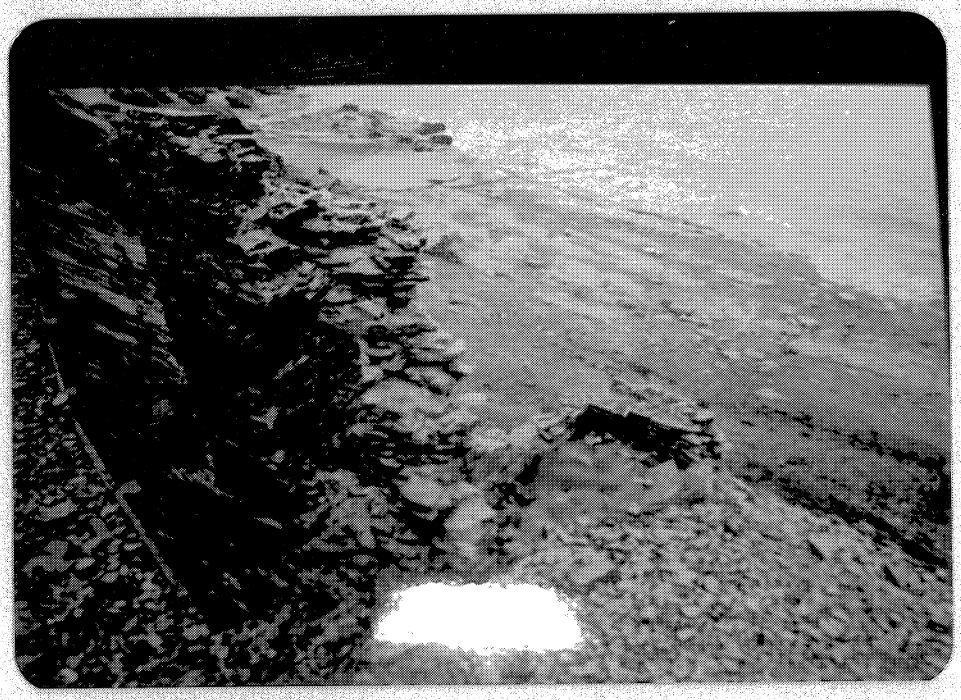


Plate 14: Landing Bay prior to road construction (LLM91/5/37)