

Marine Biological Research at Lundy

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Introduction

The earliest recorded marine biological studies near to Lundy are noted in the work of Forbes (1851) who took dredge samples off the east coast of the island in 1848. The first descriptions of the seashore wildlife on Lundy are those published in 1853 by the foremost Victorian marine naturalist and writer, P.H. Gosse, in the *Home Friend* (reproduced later in Gosse 1865). However, his descriptions are unenthusiastic, reveal nothing unusual and draw attention to the very few species found on the granite shores. There are further brief references to Lundy in the literature of other Victorian naturalists. Tugwell (1856) found the shores rich collecting grounds and cites the success of a collecting party who (with the help of "an able-bodied man with a crowbar") returned from Lundy in 1851 "laden with all imaginable and unimaginable spoils". However, Lundy never achieved the popularity of the nearby North Devon coast amongst Victorian sea-shore naturalists and significant published studies of the marine life of the island did not appear until the 1930s.

Each summer between 1934 to 1937, G.F. Tregelles visited Lundy to collect seaweeds. His records are

summarised in Tregelles (1937) and are incorporated into the *Ilfracombe fauna and flora* (Tregelles, Palmer & Brokenshire 1946) and the *Flora of Devon* (Anonymous 1952).

The first systematic studies of marine ecology at Lundy were undertaken by Professor L.A. Harvey and Mrs C.C. Harvey together with students of Exeter University in the late 1940s and early 1950s (Anonymous 1949, Harvey 1951, Harvey 1952). These studies again emphasised the richness of the slate shores especially when compared to the relatively impoverished fauna on the granite shores. A later study (Hawkins & Hiscock 1983) suggested that impoverishment in intertidal mollusc species was due to the isolation of Lundy from mainland sources of larvae.

When marine biologists started to use diving equipment to explore underwater around Lundy at the end of the 1960s, they discovered rich and diverse communities and many rare species leading to a wide range of studies being undertaken, both underwater and on the shore, in the 1970s and early 1980s. Ecological studies resulted in a detailed knowledge of the inshore marine biology of the island and contributed significantly to understanding of sublittoral marine ecology in Britain. More recently, particularly as Lundy became Britain's first marine nature reserve, surveillance studies have revealed the great longevity of many species and their likely irreplacibility if damaged.

Intertidal marine ecology

As with any island, the different exposures of shores to wave action leads to the presence of a wide variety of communities. These range from those typical of wave-sheltered situations, especially in the Landing Bay, where dense algal dominated communities occur, to those exposed to the full force of Atlantic gales on the west coast where algae are sparse and colonisation is mainly by limpets, barnacles and low algal turfs. The granite shores also provide a harsh environment for intertidal species. Granite does not hold water and has few crevices in which species may hide or which may become enlarged into rockpools.

The only sediment shore on Lundy is in the Landing Bay and this is of very mobile coarse shingle devoid of species which can be seen with the naked eye except at the strandline where the sandhopper *Talitrus saltator* may be found. (The scientific names used in this paper are those in Howson & Picton in prep. where authorities can be found.). On the lowest tides, some sand is exposed below the jetty. This has not yet been sampled on the shore but probably contains an extension of the communities known from the adjacent subtidal sediments.

Harvey (1951) lists 141 algae and 226 animal species for Lundy shores and several other animal groups from which the species were not identified.

Rocky slopes

The great majority of the shoreline around Lundy is of steep bedrock or stable boulders. The character of these shores and the associated flora and fauna are described in the papers by Professor Harvey (cited earlier). The patterns of vertical zonation and the abundance of all of the conspicuous species present on four contrasting shores were described by Hiscock & Hiscock (1980). The main conspicuous species present on rocky shores and their zonation on exposed and sheltered coasts are illustrated in Figs 1 and 2. On exposed coasts, shores are dominated by limpets and barnacles with patches of small mussels. Turfs of erect coralline algae (*Corallina officinalis*) occur on the lower shore but other algae are very sparse. On sheltered shores, brown algae may be extensive and, on the most sheltered shores, there may be significant growths of red foliose algae.

Rockpools

When left by the tide, rockpools provide an oasis of life on an otherwise arid shore. The species present are mainly those characteristic of the damp lower shore but include some specialities. Three southern species of algae which occur at Lundy are especially notable: *Cystoseira tamariscifolia*, *Bifurcaria bifurcata* and *Jania rubens*. The pod-weed, *Halidrys siliquosa*, also occurs in pools but not elsewhere on the shore and the fine filamentous branching red alga *Ceramium nodulosum* (= *C. rubrum*) is especially abundant in

Yellow and grey lichens (species of *Xanthoria*, *Lecanora*, *Caloplaca*) (☁).

Black lichens (*Verrucaria maura*) (⦿) and *Melarhaphhe* (= *Littorina*) *neritoides* (♣).

Porphyra linearis (♣), *Lichina pygmaea* (✱), *Littorina saxatilis* (∅), *Melarhaphhe* (= *Littorina*) *neritoides*.

Barnacles (*Chthmalus* spp.) (⋮), limpets (*Patella* spp.) (△), *Littorina neglecta* (⋆), *Melarhaphhe* (= *Littorina*) *neritoides*, *Fucus vesiculosus* f. *linearis* (✱), amphipods (*Hyale nilssoni*), small mussels (*Mytilus edulis*) (♥).

Encrusting coralline alga, *Corallina officinalis* (⋮), beadlet anemones (*Actinia equina*) (●), limpets (*Patella ulysiponensis*).

As above plus sparse *Mastocarpus* (= *Gigartina*) *stellatus* (♣), *Alaria esculenta* (♣), *Himantalia elongata* (♣), keeled tubeworms (*Pomatoceros triqueter*).

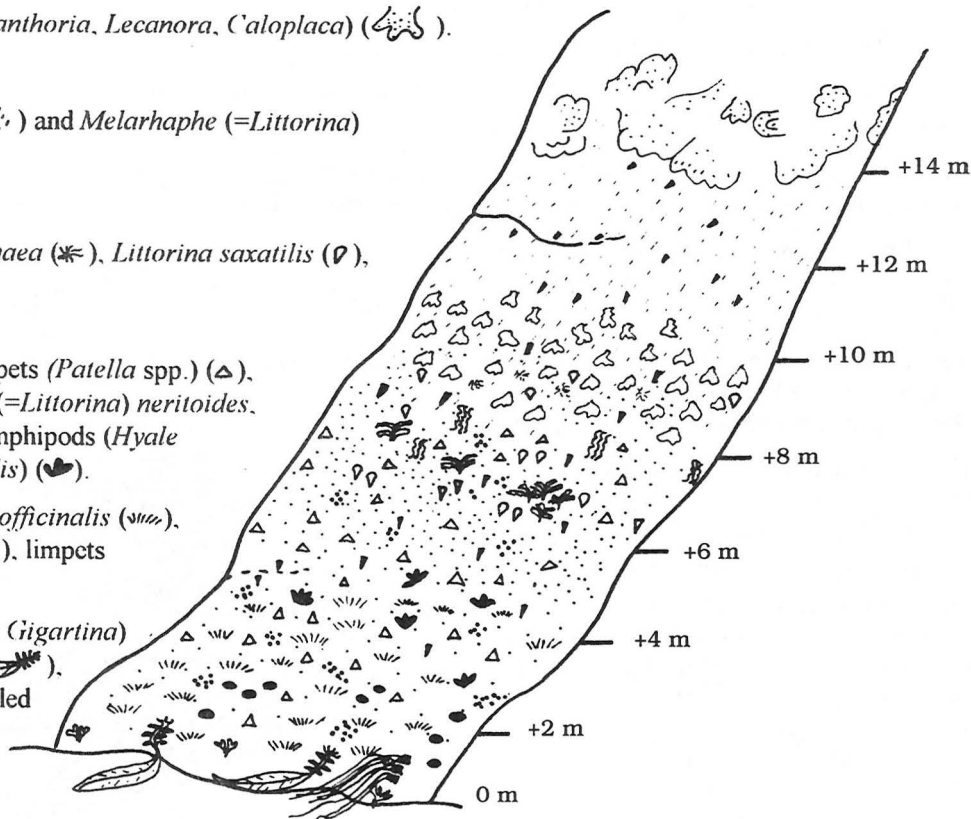


Fig 1. Illustration of zonation on an exposed granite shore on the west coast of Lundy. The descriptions of zonal communities are based on those for Dead Cow Point in Hiscock & Hiscock (1980) and are for major species only. There is overlap in the distribution of species between zones.

Flowering plants especially *Armeria maritima* (☞).

Yellow and grey lichens (☞), *Ramalina siliquosa*.

Black lichens (*Verrucaria maura*) (☞) and *Lichina confinis* (☞), *Melarhaphe* (= *Littorina*) *neritoides* (♣).

Channelled wrack (*Pelvetia canaliculata*) (☞), spiral wrack (*Fucus spiralis*) (☞), barnacles (*Chthamalus* spp., *Elminius modestus*) (☞), *Littorina saxatilis* (♣).

Black lichen (*Verrucaria mucosa*), barnacles (as above), limpets (*Patella* spp.) (△), *Littorina saxatilis*, beadlet anemones (*Actinia equina*) (●), dogwhelks (*Nucella lapillus*) (▽), filamentous green algae (*Enteromorpha* sp.) (☞).

As above plus knotted wrack (*Ascophyllum nodosum*) (☞), bladder wrack (*Fucus vesiculosus*) (☞), barnacles (*Balanus perforatus*), amphipod crustaceans (*Hyale nilssoni*).

As above plus sparse large mussels (*Mytilus edulis*) (♣), encrusting coralline algac, *Corallina officinalis* (☞), dulce *Palmaria palmata* (☞), serrated wrack (*Fucus serratus*) (☞), isopod crustaceans (*Idotea* spp., *Dynamene bidentata*).

As above plus *Osmundia* (= *Laurencia*) *pinnatifida* (☞), *Mastocarpus* (= *Gigartina*) *stellatus* (☞), thong-weed (*Himantalia elongata*) (☞), flat periwinkles (*Littorina obtusata*) (○), keeled tube-worms (*Pomatoceros triqueter*), kelp (*Laminaria digitata*) (☞).

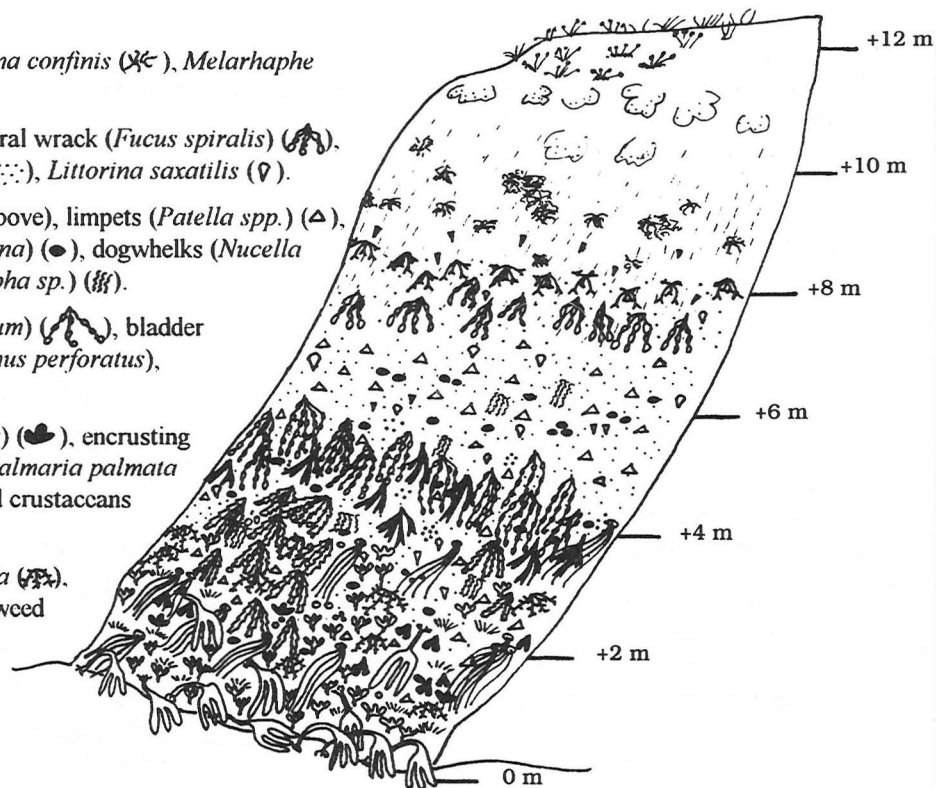


Fig 2 Illustration of zonation on a sheltered shore on the Landing Bay at Lundy. The descriptions of zonal communities are based those for the north shore of Rat Island in Hiscock & Hiscock (1980) and are for major species only. There is overlap in the distribution of species between zones.

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pools. Pools, and the damp rocks around them, provide a habitat for high numbers of the snakelocks anemone *Anemonia viridis* in the Devils Kitchen and Landing Bay. Blennies (*Lipophrys* (= *Blennius*) *pholis*) and prawns (*Palaemon serratus*) also occur in the pools. The flora and fauna of rockpools at the Devils Kitchen has been surveyed as part of the programme of monitoring commenced in 1984 for the then Nature Conservancy Council and now continued by English Nature (Fowler & Pilley 1992).

Underboulders

Although there are many boulder shores around Lundy, few of the boulders are capable of being turned to discover the often rich communities which live under them. Indeed, turning and replacing boulders is only to be undertaken with utmost care as the fauna below is easily crushed. Professor Harvey (Harvey 1951) described the fauna of boulders based mainly on many visits to the shore at Ladies Beach. Boulders not embedded in sediment are usually colonised on their lower sides and undersides by encrusting sea mats (Bryozoa), tube worms (Serpulidae) and anemones including the strawberry anemone *Actinia fragacea*. Blennies are often present and the Cornish lumpsucker, *Lepadogaster lepadogaster*, may be found. Small edible crabs, *Cancer pagurus*, may be common together with swimming crabs, *Liocarcinus puber* and the characteristic porcelain crab *Porcellana platycheles*.

Caves

The flora and fauna of the many deep intertidal caves of Lundy is generally unremarkable being mainly of barnacles and encrusting calcareous tubeworms. Small caves around Rat Island do provide a habitat for sea anemones and bryozoans not generally seen elsewhere. The greatest importance from a wildlife point-of-view of the majority of caves is probably as pupping sites for seals.

Overhangs and shaded places

These occur on the slate shores where the dip of the strata and erosion creates hollows which are always shaded and, on a few granite shores, where deep gullies and sometimes very large boulders create shade and damp. Here are likely to be found the scarce scarlet and gold star coral, *Balanophyllia regia*, and the much more widespread Devonshire cup coral, *Caryophyllia smithii*, together with encrusting sponges such as the blood red *Microciona atrasanguinea*, white calcareous sponges such as *Leuconia nivea* and small branching sponges, *Stelligera rigida*, together with other species rarely found on the shore. Certain seaweeds are also characteristic of this habitat including *Plumaria plumosa* (= *P. elegans*) and *Lomentaria articulata*.

Underwater hard substrata

Diving has been required to observe and sample underwater rocky areas. In 1969, a party of botanists supported by divers undertook a thorough study of the marine algae of Lundy (Irvine *et al.* 1972). 1969 was also the year in which the author first dived on Lundy as part of a three-day student excursion, during which time he was impressed by the richness of the fauna on underwater rocks and, perhaps emphasising the importance of Lundy to him personally, he discovered the Mediterranean coral *Leptopsammia pruvoti* in great numbers at the Knoll Pins. This beautiful bright yellow cup coral was, at the time, unrecorded from Britain, and Lundy remains only one of five locations from which it is known in the British Isles.

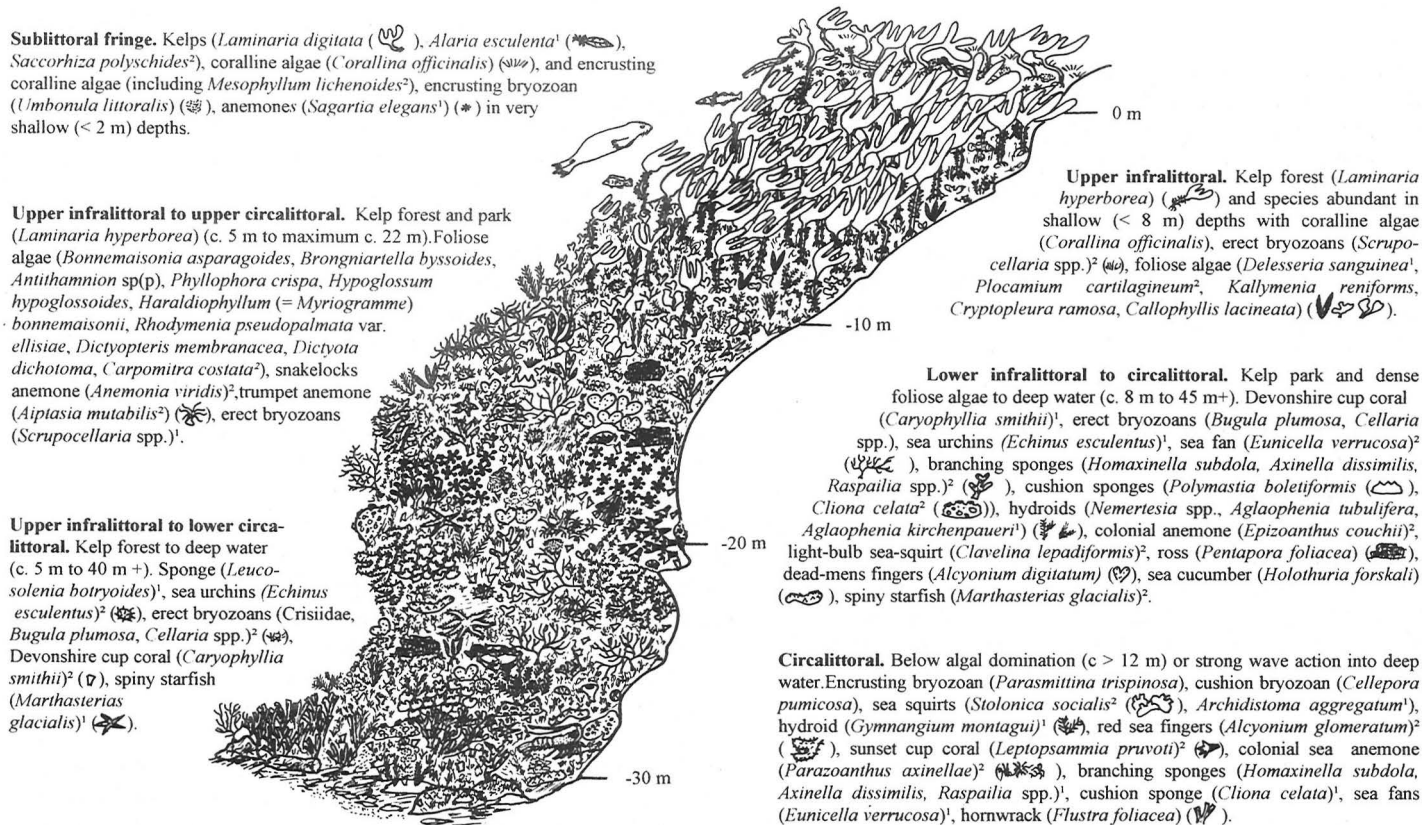
In an early paper, Hiscock (1971) compared the fauna of submerged rocks on south and east coasts. This work contributed to a PhD thesis (Hiscock 1976) where the fauna of the west, south and east coasts were compared to assess the effects of strength of wave action and tidal streams in determining the composition of sublittoral animal communities. By the time this material was published, a wide range of studies were underway on Lundy with annual expeditions of experienced marine biologists visiting the island to undertake a wide range of ecological investigations and collect specimens for the preparation of lists of the Lundy marine fauna. Much of the ecological information was published in reports of wider studies in Great

Britain (for instance, Hiscock 1983, 1985) or was published in limited circulation reports (for instance, Hiscock 1981).

Rocky slopes

Rocky surfaces extend to depths of about 40 m (all depths refer to below chart datum / Lowest Astronomical Tides level) around much of the island where they reach the level sediment or shingle plain. The depth is much less on the east coast south of the Knoll Pins where muddy sediments generally occur below depths of about 14 m. The presence of deep rocky surfaces afforded the opportunity to study the vertical zonation of species (related to light intensity and the severity of wave action, both of which are attenuated with depth) on very wave exposed to wave sheltered coasts. These studies contributed greatly to early understanding of the ecology of sublittoral rocky areas (for instance, Hiscock & Mitchell 1980; Hiscock 1983, 1985).

Some of the main species present and their zonation are illustrated in Fig. 3. In general, light around the island is sufficient to support the growth of a dense kelp (*Laminaria hyperborea* mainly) forest to a depth of about 8 m, followed by a kelp park and dense foliose red and brown algae to about 14 m, where upward facing rocks become dominated by animals (although some foliose red algae can be found to as deep as about 22 m).



Sublittoral fringe. Kelps (*Laminaria digitata*¹), *Alaria esculenta*¹, *Saccorhiza polyschides*², coralline algae (*Corallina officinalis*), and encrusting coralline algae (including *Mesophyllum lichenoides*²), encrusting bryozoan (*Umbonula littoralis*), anemones (*Sagartia elegans*¹) in very shallow (< 2 m) depths.

Upper infralittoral to upper circalittoral. Kelp forest and park (*Laminaria hyperborea*) (c. 5 m to maximum c. 22 m). Foliose algae (*Bonnemaisonia asparagoides*, *Brongniartella hyssoides*, *Antithamnion* sp(p), *Phyllophora crispa*, *Hypoglossum hypoglossoides*, *Haraldiophyllum* (= *Myriogramme*) *bonnemaisonii*, *Rhodymenia pseudopalmata* var. *ellisiae*, *Dictyopteria membranacea*, *Dictyota dichotoma*, *Carpomitra costata*²), snakelocks anemone (*Anemonia viridis*²), trumpet anemone (*Aiptasia mutabilis*²), erect bryozoans (*Scrupocellaria* spp.)¹.

Upper infralittoral to lower circalittoral. Kelp forest to deep water (c. 5 m to 40 m+). Sponge (*Leucosolenia botryoides*)¹, sea urchins (*Echinus esculentus*)², erect bryozoans (*Crisiidae*, *Bugula plumosa*, *Cellaria* spp.)², Devonshire cup coral (*Caryophyllia smithii*)², spiny starfish (*Marthasterias glacialis*)¹.

Upper infralittoral. Kelp forest (*Laminaria hyperborea*) and species abundant in shallow (< 8 m) depths with coralline algae (*Corallina officinalis*), erect bryozoans (*Scrupocellaria* spp.)², foliose algae (*Delesseria sanguinea*¹, *Plocamium cartilagineum*², *Kallymenia reniformis*, *Cryptopleura ramosa*, *Callophyllis lacineata*).

Lower infralittoral to circalittoral. Kelp park and dense foliose algae to deep water (c. 8 m to 45 m+). Devonshire cup coral (*Caryophyllia smithii*)¹, erect bryozoans (*Bugula plumosa*, *Cellaria* spp.), sea urchins (*Echinus esculentus*)¹, sea fan (*Eunicella verrucosa*)², branching sponges (*Homaxinella subdola*, *Axinella dissimilis*, *Raspailia* spp.)², cushion sponges (*Polymastia boletiformis*), *Cliona celata*², hydroids (*Nemertesia* spp., *Aglaophenia tubulifera*, *Aglaophenia kirchenpaueri*), colonial anemone (*Epizoanthus couchii*)², light-bulb sea-squirt (*Clavelina lepadiformis*)², ross (*Pentapora foliacea*), dead-mens fingers (*Alcyonium digitatum*), sea cucumber (*Holothuria forskali*)², spiny starfish (*Marthasterias glacialis*)².

Circalittoral. Below algal domination (c > 12 m) or strong wave action into deep water. Encrusting bryozoan (*Parasmitina trispinosa*), cushion bryozoan (*Cellepora pumicosa*), sea squirts (*Stolonica socialis*), *Archidistoma aggregatum*¹, hydroid (*Gymnangium montagui*)¹, red sea fingers (*Alcyonium glomeratum*)², sunset cup coral (*Leptopsammia pruvoti*)², colonial sea anemone (*Parazoanthus axinellae*)², branching sponges (*Homaxinella subdola*, *Axinella dissimilis*, *Raspailia* spp.)¹, cushion sponge (*Cliona celata*)¹, sea fans (*Eunicella verrucosa*)¹, hornwrack (*Flustra foliacea*).

Fig 3 Illustration of zonation on underwater rocks around Lundy. Only dominant or most characteristic seabed species are illustrated and captioned. Depictions of species are not to the same scale. ¹ = characteristic of exposed coasts. ² = characteristic of sheltered coast. Some species (for instance, the jewel anemone *Corynactis viridus*) do not show a consistent distribution with depth and wave exposure and are influenced by other factors.

The major turf-forming species in this animal-dominated zone are erect Bryozoa (sea mats), amongst which live encrusting and erect sponges, sea firs, sea anemones, sea fans and sea squirts. Samples of the bryozoan turf reveal a rich variety of small animals including bristleworms, amphipod crustaceans, small snails, bivalve molluscs and small crabs. In samples collected to study the distribution of small turf-living animals with depth at Dead Cow Point on the west coast and Brazen Ward on the east coast, 228 and 172 animal taxa were recorded from this turf on west and east coasts respectively. Some of the most beautiful creatures to be found on Lundy are the sea slugs, usually closely associated with the species on which they feed. Forty-seven species were recorded in Brown & Hunnam (1977) and more have been added to the list since. Fish living on the rocky seabed are well camouflaged and include the sea scorpion *Taurulus bubalis*. Wherever there are boulder holes or other sheltered places, cuckoo wrasse (*Labrus mixtus*) and goldsinny wrasse (*Ctenolabrus rupestris*) will be seen – the bright blue male cuckoo wrasse being particularly inquisitive.

The strength of wave action and tidal streams at a particular location are most important in determining which species survive and characterise particular areas. The turf of erect Bryozoa with scattered colonies of sea firs occurs at wave exposed locations. Where such conditions have, in addition, strong tidal streams (the south-west and north-west corners), rocks are dominated by the tubes of the sea fir *Tubularia indivisa*

amongst sheets of jewel anemones, *Corynactis viridis*. In wave sheltered conditions, erect sponges and delicate sea anemones thrive. The richest animal communities are found where there is shelter from prevailing wave action but with fairly strong tidal flow bringing food and preventing siltation. Some species are characteristic of particular conditions other than water movement and depth. For instance, where sand covers rocks, the algae *Jania rubens*, the Falkenbergia-phase of *Asparagopsis armata* and *Furcellaria fastigiata* occur in shallow depths (the Landing Bay), whilst the sponges *Ciocalypta penicillus* and the nationally rare *Adreus fascicularis* are present in deeper water (for instance, Rattles Anchorage).

Canyons, cliffs and caves

Some of the most spectacular underwater scenery in Britain is found around Lundy. In shallow depths, the underwater gullies between Mouse Island and Rat Island provide vertical and overhanging surfaces covered by characteristic tide-swept communities of sponges and hydroids, often with rare or unusual sea slugs (and playful seals). Off the west coast, are granite gullies which, in the gloom and limited visibility, seem like canyons. The land-bound can best imagine these by going to the 'Earthquake' on the west coast of the island where topographical features are very similar. Off Gannets Rock is a submerged feature very similar to that of the Rock itself with extensive cliffs and overhanging surfaces on the north side and a gravel bank

piled by the prevailing currents against the south side. Cliffs of creviced slate occur in massive underwater pinnacles off Black Rock, the south-west corner of Lundy. There are no true caves yet found underwater although many overhanging surfaces create cave-like features. It is on the vertical or overhanging shaded surfaces which these features create that some of the most fascinating and unusual species occur. Four of the five British shallow-water species of cup coral can be found on these shaded surfaces (the fifth, the scarlet and gold star coral, occurs in the kelp forest zone). Soft corals, including the spectacular red sea fingers *Alcyonium glomeratum* are often abundant, although careful searching is required to discover the much rarer pink soft coral *Parerythropodium coralloides*. Under overhangs and in fissures wherever there is shelter, the leopard spotted goby *Thorogobius ephippia-tus* is likely to be found. Crawfish, *Paltnurus elephas*, were once frequently observed in depressions on cliffs or broken rock slopes but are now very rarely seen. Sheets of highly coloured jewel anemones occur particularly in tide-swept areas whilst, in more sheltered locations can be found the beautiful yellow colonial anemone *Parazoanthus axinellae* and its much rarer white relative *Parazoanthus angulcomus*.

Wrecks

An account of the most conspicuous species colonising some of the wrecks is given by Heyes (1995). Very little is left of the vast majority and, in many cases (for

instance, the wreck of the *Carmine Filomena* off Rat Island and of HMS *Montagu* off Shutter Rock) most of the remains are scarcely distinguishable from the surrounding rock. The wreck of the small coaster, the MV *Robert*, which sank off Tibbets Point in 1975, is an exception and provides a fascinating contrast to rock communities. The marine life colonising the *Robert* was described by Hiscock (1982) and the port side of the wreck was used in a programme of sampling undertaken to investigate the smaller fauna present in 1980 (K. Hiscock and D. Rostron, unpublished). The *Robert* is largely intact and lies on her starboard side with the port side at a depth of about 15 m. The marine communities are distinctly different to the coastal rocks about 1 km to the west and are visually dominated by the plumose anemone *Metridium senile*, erect Bryozoa and the sea fir *Nemertesia antennina*. By the time of the wreck's discovery in 1979, the port side had been colonised by the barnacle *Balanus crenatus* and the tube worm *Sabellaria spinulosa* together with other tube worms which provided a substratum blocking any effects of anti-fouling paints. This allowed for further colonisation by erect sea mats amongst which lived marine bristleworms, small snails, small bivalve molluscs and crabs. In total, 192 species were recorded from 1.4 m² sampled. The darker parts of the wreck provided a habitat for conger eel, *Conger conger*, and for the squat lobster *Munida rugosa*, whilst the still water in the hold created a habitat suitable for active suspension feeders with large numbers of the sea

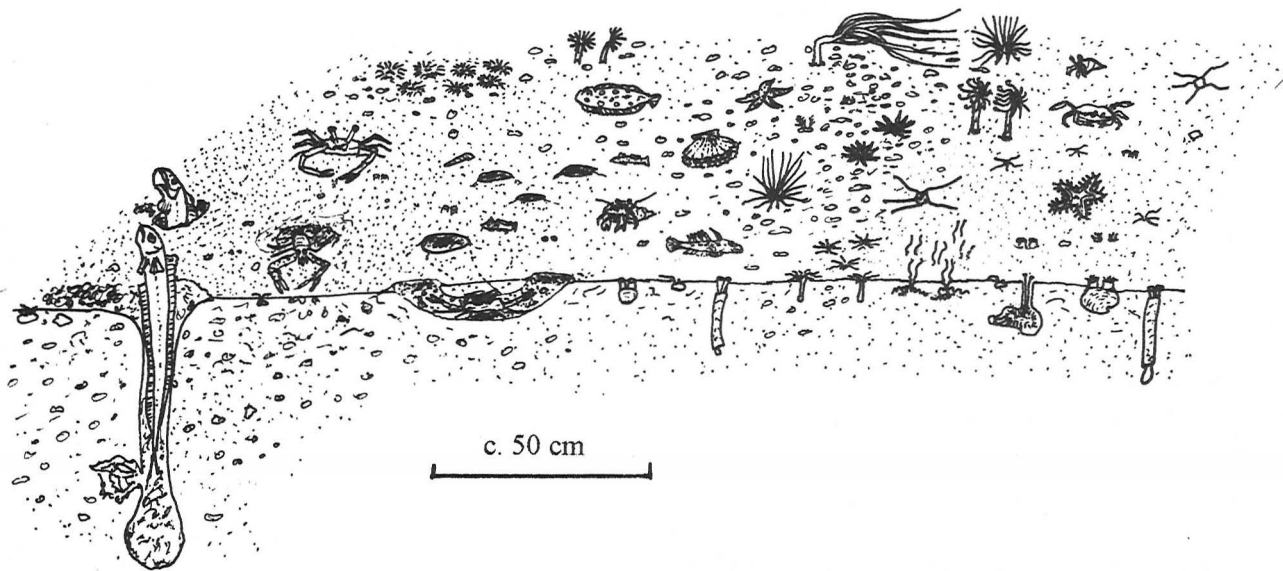




























Fig 4 Illustration of sediment fauna from the east coast of Lundy. The illustration is a composite from widely separated types. Depictions of species are not to the same scale. The sediment type is from muddy gravel overlain by mud (typical of the seabed at about 15m depth off the Quarries) through tide-swept gravel (typical of the banks built-up against the south side of the Knoll Pins and Gannets Rock at 20 to 30m depth) to muddy sand typical of areas near to rocks (for instance adjacent to rock at about 20m depth on the north part of the east coast with elements of shallow – about 6m depth – sediments in the Landing Bay). Species are named (at first occurrence) from left to right.

Epibiota

- daisy anemones *Cereus pedunculatus* ()
squat lobster *Munida rugosa* in burrow ()
fan worm *Sabella pavonina* ()
plaice *Pleuronectes platessa* ()
goby *Pomatoschistus* sp. ()
hermit crab *Pagurus bernhardus* ()
scallop *Pecten maximus* ()
dragonet *Callionymus lyra* ()
common starfish *Asterias rubens* ()
burrowing anemones *Cerianthus lloydi* ()
Halcampoides elongatus ()
Mesacmaea mitchelli ()
brittlestar *Ophiura ophiura* ()
hydroid *Corymorpha nutans* ()
brittlestar *Ophiura albida* ()
swimming crab *Liocarcinus depurator* ()
starfish *Astropecten irregularis* ()

Burrowing fauna in section

- Red band fish *Cepola rubescens* () with
burrow of the crustacea *Upogebia stellata* adjoining
angular crab *Goneplax rhomboides* ()
bivalve mollusc *Lucinoma borealis* ()
Bivalve mollusc *Abra nitida* ()
razor shell *Ensis siliqua* ()
burrowing anemone *Edwardsia claparedii* ()
burrowing brittlestars *Amphiura filiformis* ()
sea potato *Echinocardium cordatum* ()
bivalve mollusc *Arctica islandica* ()

Legend to accompany figure 4 (opposite)

squirt *Ascidia mentula*. The species present when the wreck was first investigated four and a half years after sinking provide an indication of those which are likely to (re)colonise rapidly in the event of disturbance. They included the cup coral *Caryophyllia smithii*, the rosette *Pentapora foliacea* and the feather star *Antedon bifida* which is rarely found elsewhere on Lundy. Wrecks may provide unusual substrata for species not often or not elsewhere recorded from Lundy. For instance, the limestone cannonballs on the Gull Rock wreck site (a protected site) off the east coast are colonised by the worm *Phoronis hippocreptia* (Heyes 1995, described as "Phoronida", identified by the author from photographs as *P. hippocreptia*).

Sediments

Although Lundy is surrounded by a wide variety of sediment types, very little has been done to sample them. Edward Forbes described the results of dredging off the east coast of Lundy in the Report of the British Association for the Advancement of Science (Forbes 1851) but it was more than one hundred years later that the seabed to the north and east of Lundy was sampled as a part of a study of the Bristol Channel and Severn Estuary (Warwick & Davies 1977) and nearshore sediments off the east coast were sampled by Hoare and Wilson (1977) using diver-operated cores.

Sediment communities

The sediment communities identified in these studies include examples of well-known assemblages dominated by the bivalve *Abra alba*, brittle stars *Amphiura filiformis*, the sea cucumber *Leptosynapta inhaerens* and, in more sandy sediments, the heart urchin *Echinocardium cordatum* and the bivalve mollusc *Timoclea* (= *Venus*) *ovata*. Those of the 'boreal offshore muddy-gravel association' (Holme 1966) are notable as they have a restricted distribution. However, some of the species present in sediments are infrequently recorded, especially in shallow depths. The most conspicuous and exciting find was of the red band fish *Cepola rubescens* in 1974. This eel-shaped orange-coloured fish up to 70 cm long excavates vertical shafts in muddy gravel and protrudes out of its burrows to snap at passing plankton. During 1977, the population was estimated to be about 14,000 individuals (Pullin & Atkinson 1978). In subsequent years the population has reduced enormously and only a few have been found in recent years even after intense searching. The muddy gravel also provides a habitat for the angular burrowing crab *Goneplax rhomboides* and for smaller burrowing crustaceans of the genus *Upogebia*. The nationally rare sea anemone *Halcampoides elongatus* was observed extending its long tentacles over the gravel bank at the Knoll Pins during a night dive in August 1982. The gravelly substrate appear to provide the most interesting of

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habitats with some occupied by dense colonies of the daisy anemone *Cereus pedunculatus*, by the fleshy hydroid *Corymorpha nutans* and, less frequently, and on clean gravel, the burrowing sea anemones *Mesacmaea mitchellii* and *Peachia cylindrica*. Scallops *Pecten maximus*, are occasionally seen. Other burrowing anemones encountered in more sandy or muddy substrata are *Cerianthus lloydii* and *Edwardsia clapedii*. Several fish species are likely to be observed on sediments including small gobies *Pomataschistus* spp., plaice *Pleuronectes platessa*, dogfish *Scylliorhinus canicula*, and, often near to rocks, the anglerfish *Lophius piscatorius*.

Slate pebble plains

Much of the sedimentary rock south and south-east of Lundy has collapsed into the sea and now lies strewn over the seabed as a level plain of flat slates amongst occasional rock outcrops. The strong currents keep the slates clear of silt and they are colonised by distinctive assemblages of species. The algae in shallow depths include species not found in other habitats such as *Stenogramme interrupta*, *Scinaia turgida* and species of *Schmitzia*. In deeper waters, encrusting and erect bryozoans (sea mats), including the fleshy *Alcyonidium diaphanum*, may dominate the slates whilst, in depths greater than about 20 m, extensive beds of the brittle stars *Ophiothrix fragilis* and *Ophiocomina nigra* occur.

Open waters

This is the world of the plankton, unicellular algae and microscopic animals, predominantly crustaceans and the larvae of seabed species and the larger nekton such as jellyfish and fish. The only records of planktonic species are those collected as part of the large scale studies of the Bristol Channel and Severn Estuary (Collins & Williams 1982; Williams & Collins 1985), those of fish plankton (Townley & King 1980) and those collected in association with studies of the red band fish (Atkinson, Pullin & Dipper 1977). Plankton communities near to Lundy are consistently characteristic of fully saline marine waters whilst those off the North Devon coast to the south and east are often characteristic of variable salinity waters.

Some of the larger open water species can be spectacular and include the basking shark *Cetorhinus maximus* and the sunfish *Mola mola*. Porbeagle and blue sharks (*Lamna nasus* and *Prionace glauca*) occur to the west of Lundy but have not been seen inshore. Compass jellyfish *Chrysaora hysoscella* and the large white jellyfish *Rhizostoma octopus* are frequently seen. Every few years, there are strandings of the oceanic by-the-wind sailor jellyfish *Vellella vellella*. However, Lundy is not sufficiently close to deep oceanic waters to attract significant numbers of large gelatinous plankton.

Species

The most comprehensive collection of algae was made in 1969, 1970 and 1971 by Irvine *et al.* (1972). They recorded 298 species (11 blue-green, 37 green, 1 prasinophycean, 80 brown and 169 red) and their lists incorporate previous records. Since then, a few significant additions have been made including the gametophyte form of *Asparagopsis armata* (recorded only once in September 1973) and 11 others noted in Hiscock & Maggs (1984). The flora is rich and includes many southern species seldom encountered in British waters and some universally rare species. Several lichen species occur in the littoral zone and are listed by Noon & Hawksworth (1973).

Animal species have been collected to prepare marine fauna lists for Lundy (various authors cited in the reference list). Seven hundred and fifty three macrofaunal species are recorded in those lists which lack only nemertean, barnacles (about nine species) and mammals (about four species).

Both flora and fauna are southern in character and Lundy represents the northern recorded limits for several species.

Origins, longevity and change

This title, taken from a paper describing observations of change in marine communities and species at Lundy (Hiscock 1994), expresses one of the most important aspects of marine ecology we need to understand if we are to ensure that the beauty and richness

of the marine life on Lundy is to be maintained. A formal monitoring scheme for the features of special nature conservation importance was commenced in 1984 and sites have been re-surveyed at irregular intervals since then (Fowler & Pilley 1992; Fowler & Laffoley 1993). Although there is an overall impression of constancy in the types of marine communities present at particular locations, there have been notable declines in abundance. Groups such as sea slugs may be expected to show marked fluctuations in abundance and the virtual loss of what were in the 1970s very large numbers of the spectacular orange and blue *Greilada elegans*, may be reversed in the future. Similarly, the high populations of the red band fish off the east coast in the 1970s may have been a chance or particularly successful recruitment which may not happen again for many years. Other species, for instance, the corals *Leptopsammia pruvoti* and *Hoplatria durotrix* appear not to have reproduced since monitoring commenced and numbers of *Leptopsammia* have declined significantly. Similarly, the branching axinellid sponges which may be up to 250 mm high have been found to grow at a rate of no more than 2 mm a year. Some monitored individuals were lost and others damaged during prolonged easterly gales in 1986 although a great deal more damage might have been rendered during scientific collecting in the 1970s when examples were collected to demonstrate the range of growth forms – of course, at a time when the slowness of growth was not realised.

The past and the future

Much remains unpublished from work on Lundy. The lists of fauna from kelp holdfasts and *Corallina* turf collected by Professor Harvey could not be published in full. The detailed studies of vertical zonation on underwater rocks including the quantitative samples of smaller fauna and the sampling from the wreck of the MV *Robert* have not been published. Nevertheless, the records are held by the author (those from Professor Harvey lent to me to copy many years ago) and, particularly those studies of sublittoral zonation and sampling, might one day see publication. The *Annual Report of the Lundy Field Society* has provided an important and a comprehensive vehicle for the publication of results of work on and around Lundy and, even where work has been published elsewhere, it should be noted in that *Report*.

There continue to be many gaps and opportunities in the study of marine ecology around Lundy. We know little of the fauna of sediments and this should be addressed by a programme of sampling. It is important to continue studies which will help us to better understand variability (including recruitment, longevity and growth) and its causes in marine communities and species. Such studies will especially help to manage the marine nature reserve to ensure the continued presence of its special features. Recent developments in using video cameras on remotely operated underwater vehicles may open-up exploration of underwater

areas to a larger audience and allow exploration of deeper areas than by diving.

Lundy is a fabulous place to explore marine wildlife. There are doubtless new discoveries to be made by both amateur and professional naturalist and some of the species and scenery are a photographers dream. Enabling the pursuit of fisheries, recreation, educational activities and scientific study in ways which do not damage the diversity and special features of marine ecosystems around Lundy requires careful management underpinned by sound science.

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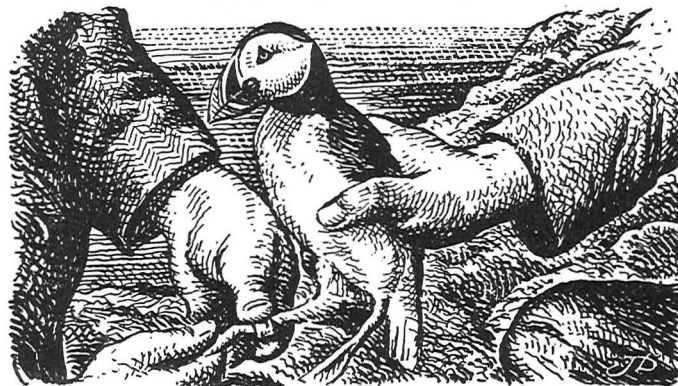
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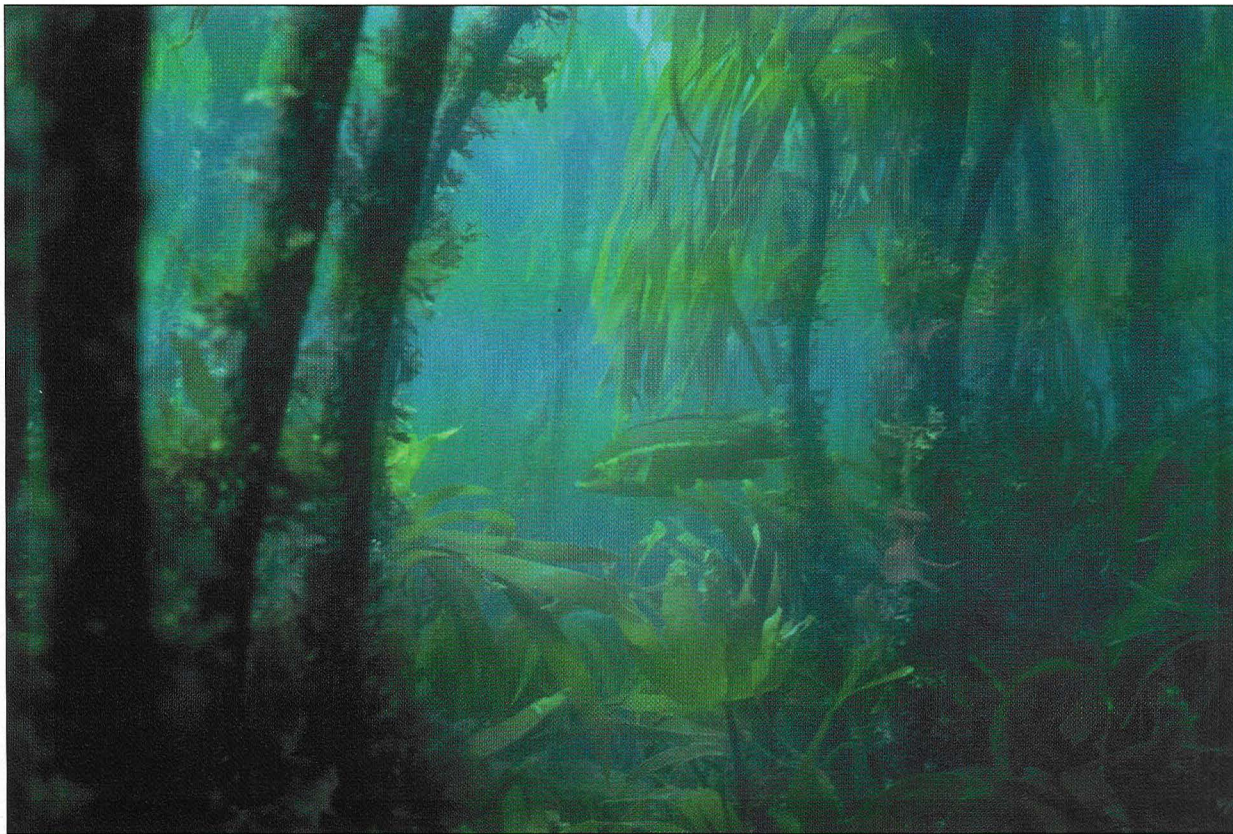


Plate 34

A ballan wrasse swims through the kelp forest in shallow water at Montagu Bay. The kelp stipes are colonised by a distinctive assemblage of red algae. Picture width c. 2m.

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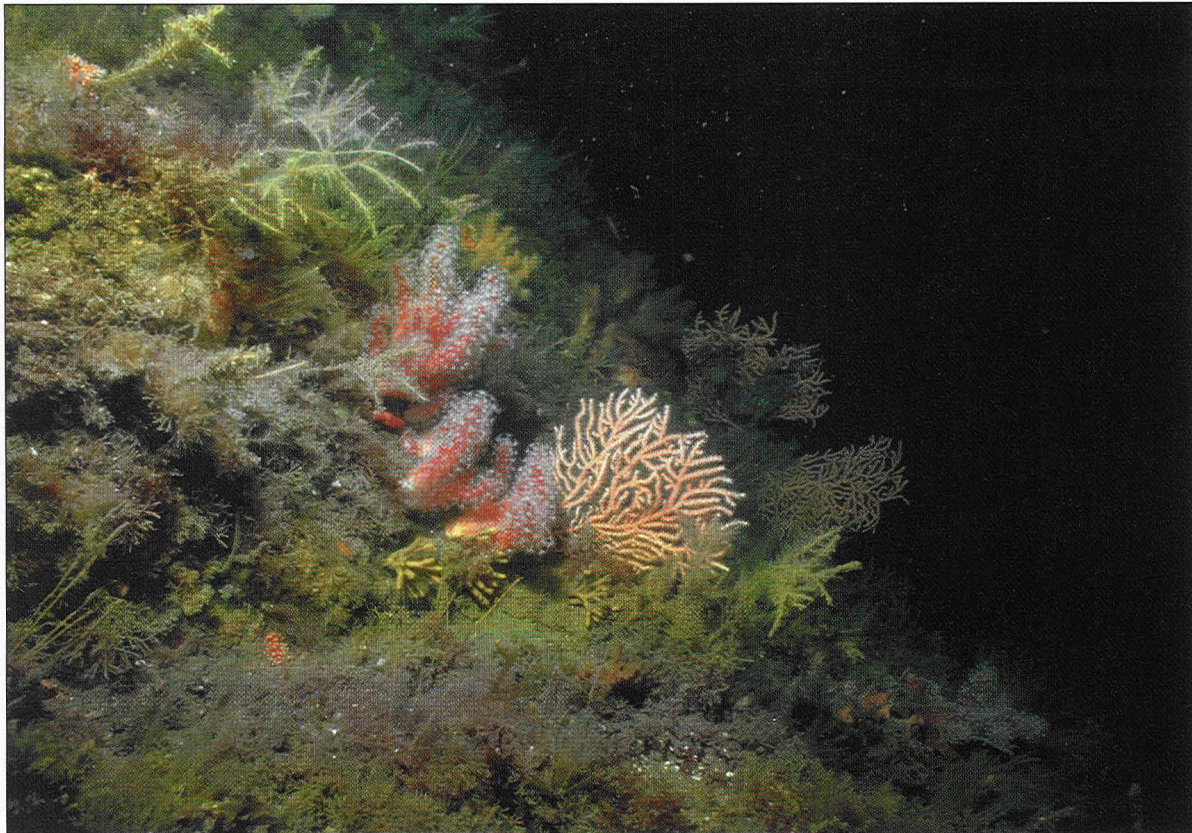


Plate 35

Animal dominated rocks with a red algae at 20m depth on the sheltered east coast off the Knoll Pins. The rocks are dominated by a turf of sea fans and branching sea mats with sea fans and red sea fingers present. Picture width c. 1.5m.

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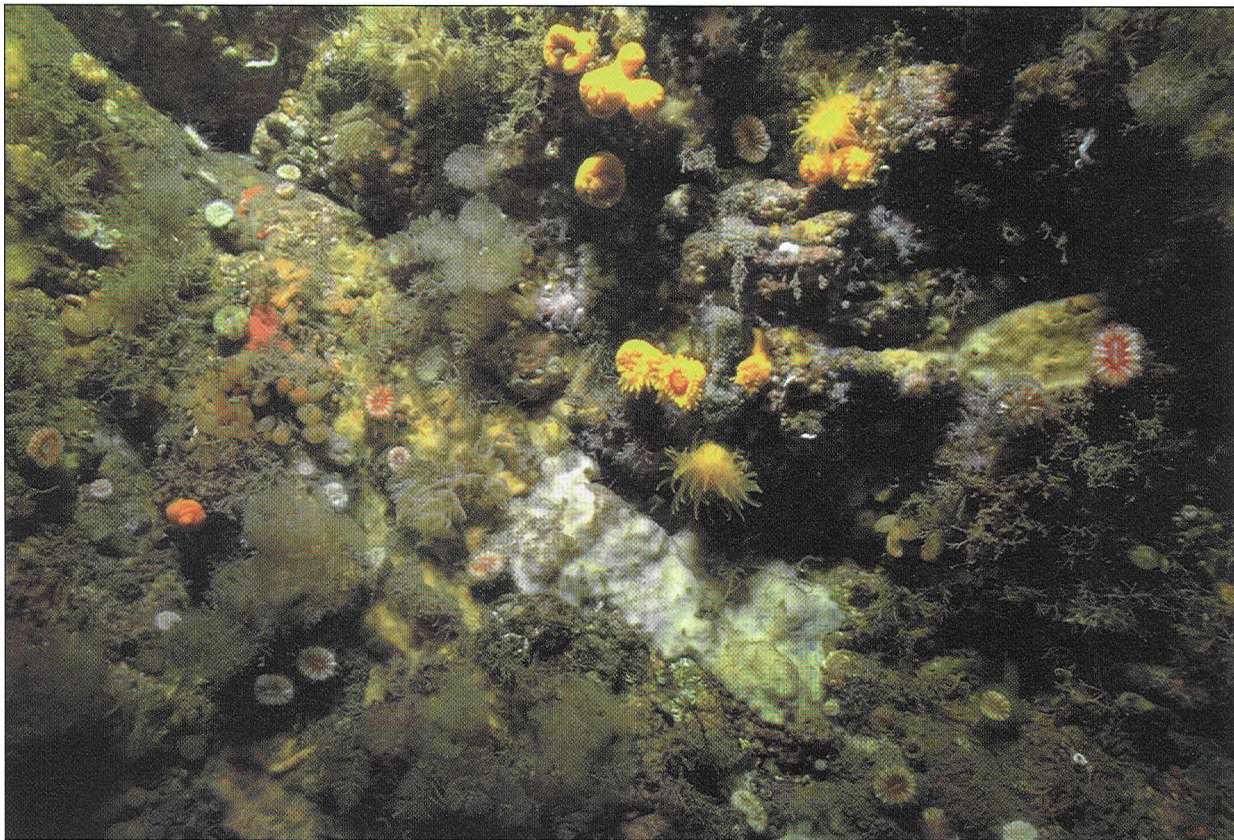


Plate 36

A concentration of rare species under an overhang at the Knoll Pins. The sunset cup coral, carpet coral (scarcely visible), brown cup coral, pink sea fingers and the white sponge are nationally rare or scarce species. Picture width c. 60cm.

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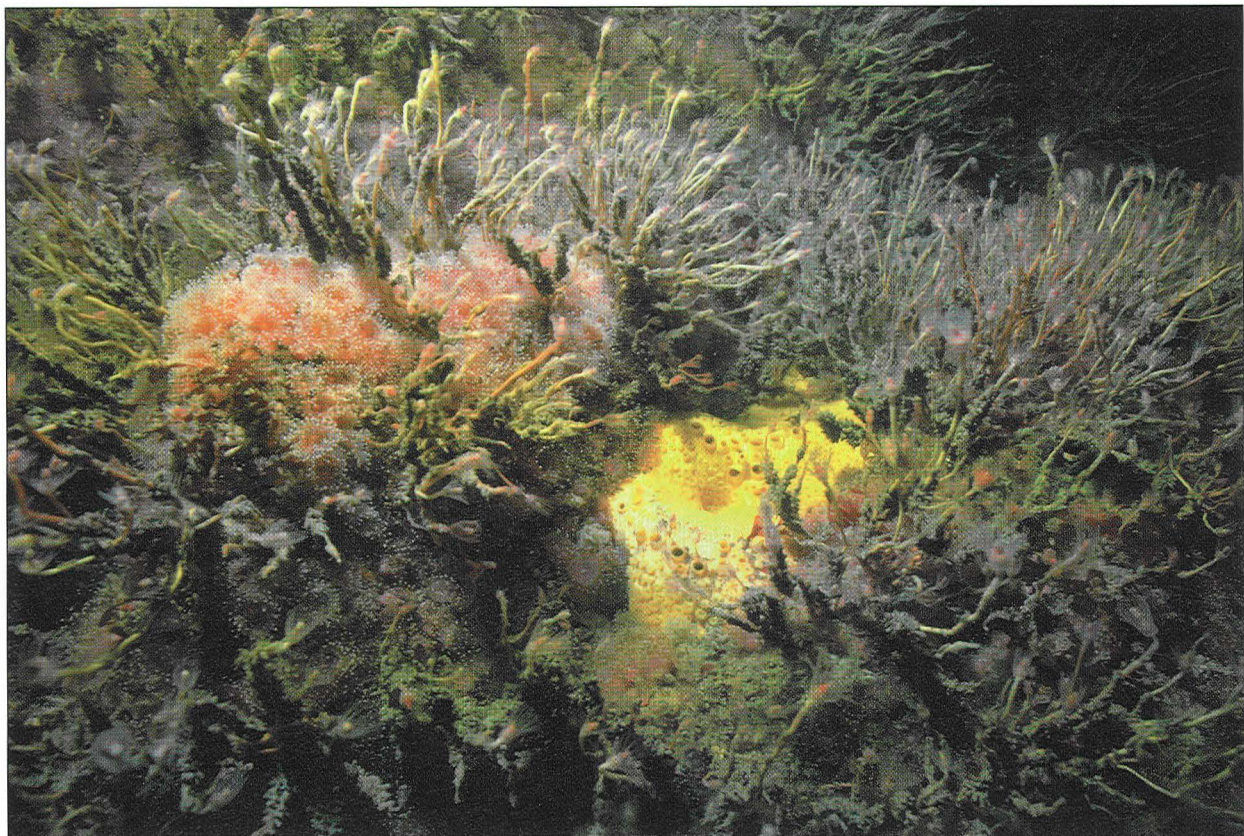


Plate 37

Community off the Hen and Chickens at 25m depth typical of tide-swept underwater rocks and including jewel anemones, oaten pipes hydroid and yellow cushion sponge. Picture width c. 20cm.

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