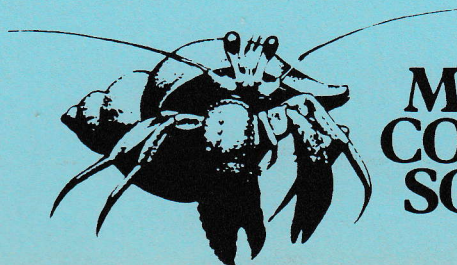


**SUBLITTORAL
OBSERVATIONS IN THE
BAY OF MORLAIX, BRITTANY**



**MARINE
CONSERVATION
SOCIETY**

SUBLITTORAL OBSERVATIONS IN THE
BAY OF MORLAIX, BRITTANY.

A Report of the MCS Brittany Trip
9-16 August 1985

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1. Introduction

1.1. Background

This is an account of an MCS expedition to north Brittany from 9th to 16th August, 1985. The purposes of the trip were -

a. To survey habitats and the distribution of conspicuous flora and fauna.

b. For all participants to survey in detail, groups in which they are particularly interested.

c. To produce an expedition report.

d. To have a holiday !

Participants were Graham Ackers (organiser and leader), Teresa Bennett, Norma Brandt, Sue Davies, Catherine Gill, Keith Hiscock, Tony Hunt, Netty Little, Chris Lumb, Dick Manuel, Jane Yeatman and Lesley Williams. Eleven people travelled on the diving boat 'Chalice' on the return trip from Falmouth to Roscoff. Catherine Gill joined the party in Roscoff, where she was based at the marine laboratories as a post doctoral research fellow. Her local knowledge and linguistic abilities proved invaluable, and through her we were able to visit the marine laboratories during the week. Another research assistant, Bert Klein, was able to join us for a couple of dives.



Centre D'Océanologie et de Biologie Marine, Roscoff. K.Hiscock.

The 'Chalice' is a purpose built diving vessel, 21m. long, with a beam of 5m. Its equipment includes stabilizers, twin Dorman engines, Decca navigator, VHF radio, Radar, Echo sounder, automatic pilot and a 28 cfm 3600psi compressor. The sleeping cabins were relatively spacious, and the food excellent. The main cabin was a reasonable size for a boat of this type, but still proved cramped with a dozen people writing and sorting specimens. The foredeck was used for changing, as the gangways at each side were too narrow for this, but they served well for entering and leaving the sea. The owner / skipper Keith Roberts, and his crew,

were most helpful, and contributed in a major way to a most enjoyable week. However, partly because of the weekly scheduling system of the 'Chalice', and also because of the distance travelled and the inclement weather, only four days diving were possible, and this was felt by the participants to be a rather short 'week'.



'Chalice' in Roscoff ferry port terminal. K.Hiscock.

1.2. The Bay of Morlaix

The 'Chalice' sailed from Falmouth at 0400 on Saturday, 10th August, for Roscoff. The crossing took 14 hours, slightly more than predicted owing to the rough weather. Continual high winds during the preceding days resulted in a sea state 7, with the westerly winds of force 6, striking the vessel side on, so reducing the effectiveness of the stabilisers. These conditions confined most of us to our bunks for the crossing, but the couple or so hardy people not so afflicted had the pleasure of seeing some common dolphins riding the bow waves of the ship. This experience was enjoyed by more people during the return trip, which was marginally less rough, and by which time we had gained our sea legs.

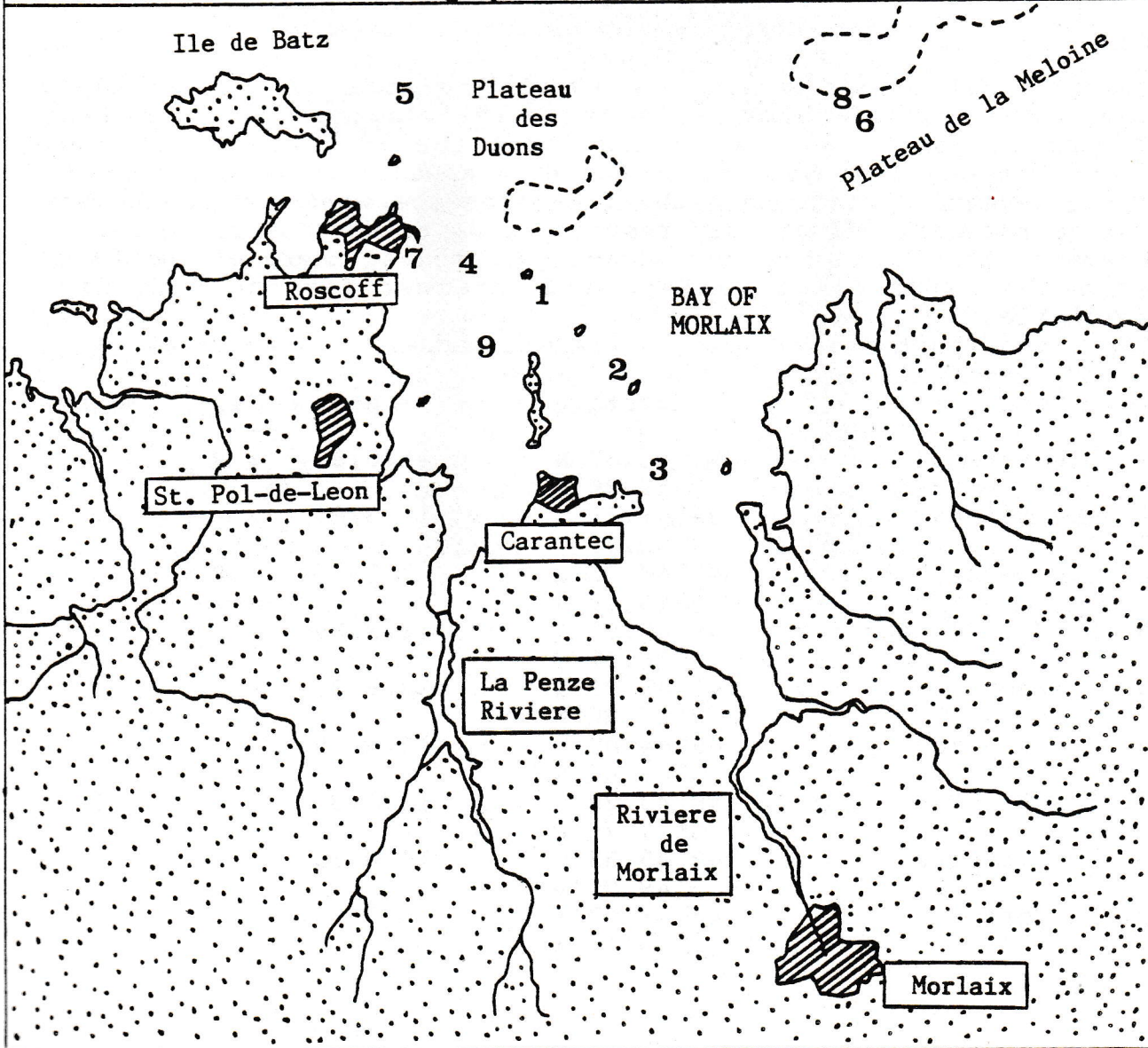
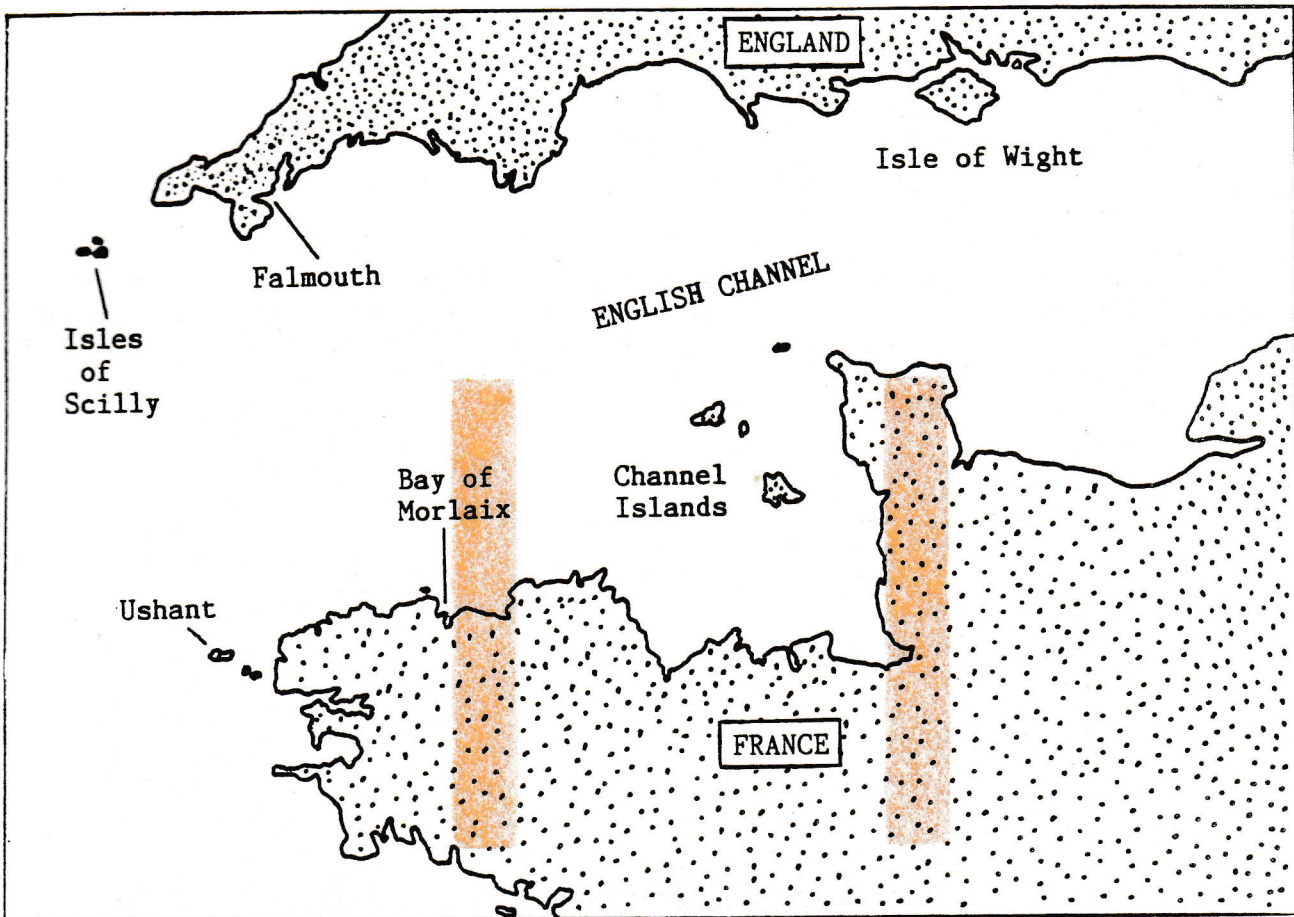


Common Dolphins. Channel. G.Ackers.

The original intention had been to visit a variety of sites along the north Brittany coast. (It is worth noting in passing, that diving by non French nationals along the north-west Brittany coast between Aber Benoit and Audierne appears to be prohibited). In any event, continuing high winds from the west and south-west during the week effectively restricted us to the Bay of Morlaix. However, this turned to our advantage, because there proved to be more than sufficient variety and interest for the four days available.

The sites visited are shown on the map and are listed below -

No.	Name	Location	Date	Type	Rating
1.	Le Paradis	48° 42.67 'N 3° 55.36 'W	11.8.85.	R	5
2.	La Noire	48° 41.71 'N 3° 53.93 'W	11.8.85.	R	4
3.	Le Corbeau	48° 40.72 'N 3° 53.19 'W	12.8.85.	R	7
4.	S.of Le Cordonnier	48° 42.96 'N 3° 56.52 'W	12.8.85.	S	8
5.	Astan	48° 45.03 'N 3° 57.88 'W	13.8.85.	B	1
6.	Basse Brien	48° 44.88 'N 3° 49.65 'W	13.8.85.	B	3
7.	Roscoff Ferry Port	48° 43.28 'N 3° 57.73 'W	13.8.85.	S	9
8.	Les Trepieds	48° 45.33 'N 3° 49.95 'W	14.8.85.	B	6
9.	La Tortue	48° 42.07 'N 3° 56.51 'W	14.8.85.	R	2



Roscoff Ferry Port (site 7) was a dive undertaken after dark by four divers. Everyone dived all the other sites. Owing to sea conditions, the site actually dived at Les Trepieds (site 8) was not the one originally intended.

The notations for the site types are - B = open water, bedrock dominated, R = ria dominated scenery, S = sediment dominated. All the sites are described in greater detail in subsequent sections.

'Rating' is a highly subjective editors 'score' of the excellence of the dive, from best (1) to least interesting (9).

The Bay of Morlaix is a north facing bay about 5 miles east-west by 6 miles north-south. It is fed by two rivers - Morlaix and La Penze, which form sublittoral ria channels in the bay itself. Many small islands and rock outcrops occur above chart datum. These, together with their submerged equivalents required careful navigation. Depths range from 0-25m BCD, and bottom types include pebbles, coarse sand / gravel, fine (homogenous) sediments, four major maerl beds, coastal land sediments, and rock (Boillot, 1961 and Cabioch, 1969). Six of the sites were within the bay, but three (sites 5, 6 and 8) were just to the north.

1.3. Methods

Diving was undertaken in pairs, under the supervision of a marshall appointed for each day. A diving log was kept. Surface marker buoys were used for open water sites, although currents proved far less problematical than anticipated. Whenever possible, diving took place at slack water, insofar as this was possible to calculate. The only site where some current was noted on the dive was Les Trepieds (site 8).

A combination of photography, recording and collecting was undertaken during the dives. For the most part, records are confined to species easily visible whilst diving, and collecting was minimal. However, representative collections of algae and sponges were made.

Each member of the party was asked to 'specialise' in a particular group of species / habitats and these specialisations are reflected in the contributions to this report (see section 1.4. below).

Species records were built up using a single sheet per species, kept in bundles in alphabetical order by phyla. The bundles were circulated for additions and, despite the risk of sheets going astray, this did not happen and the system worked well. Habitat details were recorded on the 'professional', 4 page 'Sublittoral Habitat Record' developed jointly by the Field Studies Council, the Marine Conservation Society and Nature Conservancy Council. This form is quite detailed, and only really suitable for the trained and experienced observer as it requires the collection of a large amount of data in a relatively short time. Apart from Chris Lumb (who was assigned the habitats), only a few other members of the party attempted to complete the form. In addition to the 'official' records, one or two people kept their own

personal accounts and records.

With the proximity of the Roscoff marine station, obviously much work has already occurred in this region. For example, marine floras and faunas have been published for most groups (e.g. Levi, 1955, Tessier, 1965, etc.). However, many of those lists were compiled without recourse to diving methods, which can provide valuable ecological observations. In recent years, many such studies have been undertaken in British waters by MCS and NCC expeditions, and it seemed logical to extend such studies to adjacent waters for comparative purposes. A French equivalent to MCS, called Association pour la Decouverte du Monde Sous-marin (ADMS) was formed by Annie Castric and colleagues in 1980, and should increase the potential for sublittoral surveys along the Brittany coast. It is worth noting in passing that Bob Earll (MCS Secretary General), Graham Ackers and Catherine Gill attended the inaugural ADMS Annual Meeting in Concarneau in November 1985 to help forge links between the two organisations.

1.4. The Report

The remainder of this report consists of general comments and summaries on ecology (section 2), individual site descriptions (section 3), with a summary of habitat types in Appendix 1, accounts of the flora and fauna (sections 4 and 5), with lists of these in appendices 2, 3, and 4. The contributors to the report were as follows -

Graham Ackers - general editorial, Introduction (1); Ecology (2.2, 2.3, 2.4, 2.5, 2.6, 2.7) and Ascidiaceans (5.12.1)
 Teresa Bennett - Echinoderms (5.11)
 Sue Davies - Sponges (5.1)
 Catherine Gill - Bryozoans (5.9)
 Keith Hiscock - editorial advice, Ecology (2.1, 2.8, 2.9)
 Polychaetes (5.5), and Crustaceans (5.6)
 Tony Hunt - Molluscs (5.8)
 Netty Little - Algae (4)
 Chris Lumb - Site Description (3), including the drawings
 Dick Manuel - Coelenterates (5.2)
 Lesley Williams - Fishes (5.12.2) and the typing of the report.

In addition, a general de-briefing at the end of the trip yielded several of the points made in the Introduction (1) and Ecology (2) sections.

Photographers are acknowledged with their photographs.

The chart copies in section 3 are from Admiralty Chart 2745, Approaches to Roscoff and Morlaix, at a scale of 1:20000.

Throughout, depths are expressed in metres below chart datum.

The nomenclature used follows these sources -

Algae - Irvine 1983, Dixon and Irvine 1977 and Parke and Dixon 1976.

Fauna - Marine Biological Association, 1957, but where appropriate with references listed below taking priority

Sponges - Ackers, Moss et al, 1985 and Borojevic, Cabioch and Levi 1968.

Hydroids - Cornelius, 1979
 Anthozoans - Manuel, 1983
 Polychaetes - Knight-Jones (unpublished m/s)
 Barnacles - Bassindale, 1964
 Decapod Crustaceans - Crothers and Crothers, 1983
 Nudibranch Molluscs - Brown and Picton, 1979
 Bryozoans - Haywood, 1985; Haywood and Ryland, 1979; Ryland and Haywood, 1977
 Brachiopods - Brunton and Curry, 1979
 Echinoderms - Clark, Lumb et al, 1985; Cherbonnier, 1951
 Ascidians - Picton, 1985; Levi, 1955
 Fishes - Wheeler, 1978.

Where not explicitly stated, comparative comments relate to similar sites in south-west Britain, which are influenced by Atlantic-Mediterranean (Lusitanian) water masses.

The abundance notations used in Appendices 2 and 4 are -

A - Abundant
 C - Common
 F - Frequent
 O - Occasional
 R - Rare

which are defined on page 50 of Hiscock, 1976.

P - Present

is also used in Appendix 2 to indicate specimens found in collections.

The Key for Appendix 1 is -

- * = communities described (in section 3) - although descriptions may be merged
- = communities noted as present but not described

2. Ecology

2.1. Sites Visited

Dives were undertaken at nine sites ranging from locations exposed to strong wave action, (Astan (site 5), Basse Brien (site 6), Les Trepieds (site 7)), to those in deep channels amongst the rocks and islets of the Bay of Morlaix, (Le Paradis (site 1), La Noire (site 2), Le Corbeau (site 3) and La Tortue (site 9)). The sites of S. of Le Cordonnier (site 4) and Roscoff Ferry Port (site 7) were level seabeds, of maerl, sand and rock outcrops in the former and muddy sand with occasional boulders in the latter. In the main, then, the study was limited to rocky areas experiencing varying degrees of exposure, and such habitats as Zostera beds and sediment plains were not visited.

2.2. Abundance of Flora and Faunal Groups

The sponges were richest in numbers and diversity and formed the most significant faunal component of the underwater scenery at most sites. Ascidians were second in this respect. There was a smaller variety of algae than expected, with few species not present in Britain. The species component was different from S.W. Britain. Fewer and different species were present on kelp stipes (with none on Laminaria ochroleuca). Anthozoa were fairly low in diversity, and low in abundance. Hydroids were very poorly represented, and nowhere appeared in sufficient numbers to constitute a turf. Similarly, bryozoans rarely forming turfs, were low in diversity (but probably under-recorded). Lack of such suitable food also resulted in few nudibranchs being recorded. Decapod crustaceans were low in diversity and abundance, the low numbers of both commercial and non-commercial species being quite striking.

2.3. Southern Species Rare or Unknown from the British Isles

One of the highlights of the expedition was to encounter prominent species that are rare or unknown in British waters. These were-

2.3.1. Ulosa digitata. This large, salmon pink, 'Dysidea like' sponge was recorded from 3 sites. Although known from the Channel Isles, it is very rarely recorded off Plymouth.

2.3.2. Axinella flustra. Only one specimen of this erect, flabellate axinellid sponge was encountered, at Astan (site 5). It is known to be commoner in deeper water (Borojevic, Cabiocch and Levi, 1968) at Roscoff. It has been sighted off W. Ireland (B. Picton, pers. comm.), but is otherwise unrecorded in the waters of the British Isles.

2.3.3. Cerianthid 'Dorothy'. This large, tube dwelling Pachycerianthus sp. anemone was recorded from 4 sites - see section 5.2.2. below for further comments.

2.3.4. Pseudosabella (Sabella) variabilis. This fan worm formed forests of long, thin, erect parchment tubes on rock at 4 sites. It is very rarely recorded from British waters, and then only in

the extreme south-west.

2.3.5. Sabella (Spirographis) spallanzini. This is a spectacular and large fan worm seen as single individuals at 8 sites. It is unknown in British waters.

2.3.6. Echinaster sepositus. This bright red starfish was seen at 5 sites. It is unknown from British waters.

2.3.7. Polysyncraton lacazei. This is a dark red, very distinctive didemnid sea squirt, and occurred in patches several cms. across at 4 sites. It is unknown from British waters.

2.4. Species Occurring in Relatively Greater Abundances than in the British Isles

Most conspicuous in this category was Eunicella verrucosa, which occurred in dense linear stands along gullies, and in 'park' proportions elsewhere. The higher numbers of white specimens, which are rare in British waters, is a 'southern' phenomenon. Four species of sea squirts were locally numerous, often being the dominant 'turf' component - Polycarpa rustica, Distomus variolosus, Stolonica socialis and Botryllus schlosseri. The kelp Laminaria ochroleuca also occurred in greater abundance than in S.W. Britain, being the major component of the kelp parks.

2.5. Sizes of Species

The repent branching sponge Haliclona simulans formed large stands at sheltered sites and in sheltered microhabitats. These were particularly striking and characteristic, with the sponge branches 'looping' from one rock attachment to the next, forming an open but irregular massive network upto 1m. across.

The sponge Myxilla incrustans assumed the same massive habit as Cliona celata in exposed locations. Tethya aurantium specimens were also noticeably larger than their British counterparts.

Although most specimen sizes of Dysidea fragilis were not unusual, those on the sides of the ria at La Tortue (site 9) were large, and similar to those found in Milford Haven, and deep waters off Sussex. This species appears to favour silty, current swept locations.

Several divers independently commented also on the large sizes of Ballan Wrasse at some sites.

Foliose red algae were felt to be smaller than their British counterparts.

2.6. Northern Species

The low numbers recorded of some species indicated they were reaching their southern distribution limits in the Bay of Morlaix. These were Hydrallmania falcata, Alcyonium digitatum, Urticina felina, Asterias rubens and Echinus esculentus. Northern species which might have been expected but were not recorded at all were Nemertesia ramosa and Flustra foliacea.

2.7. Other Uncommon or Absent Species

There were fewer records of the algae Cryptopleura ramosa, Polyneura spp and Carpomitra than expected, and Membranoptera alata was not recorded at all. Of the anthozoans, Aiptasia mutabilis and Metridium senile were unrecorded, and Parazoanthus axinellae, Alcyonium glomeratum and Leptopsammia pruvoti were seen in smaller than expected numbers. Corynactis viridis rarely occurred in the vast sheets so characteristic of vertical rock in S.W. Britain. Despite apparently suitable habitats, Caryophyllia inornata, Hoplangia durotrix and Alcyonium coralloides were not recorded. Similarly, the sponge Halichondria panicea was rarely recorded, and H. bowerbanki was unrecorded. Both species are recorded as common in the area in Borojevic, Cabioch and Levi, 1968.

2.8. Zonation

In the exposed sites, sparse kelp extended to 21m. bcd at Astan (site 5) (a little deeper than the Isles of Scilly), but there was no extensive zone of foliose algae. At Basse Brien (site 6), the depth to which sparse kelp extended was 18m. but again, deeper, there was little foliose algae, but dense erect and encrusting Bryozoa and Corynactis.

In the extreme wave shelter and probably often high turbidity of the deep channels within the bay, kelp forest extended to 4-5m. at La Noire (site 2). However, animal populations, particularly sponges, were dense at such sites, and competition for space might be important in determining the lower limits of algae. However, sparse kelp extended to 12m. at La Tortue (site 9). The deepest foliose algae were recorded at 15 m. at Le Corbeau (site 3).

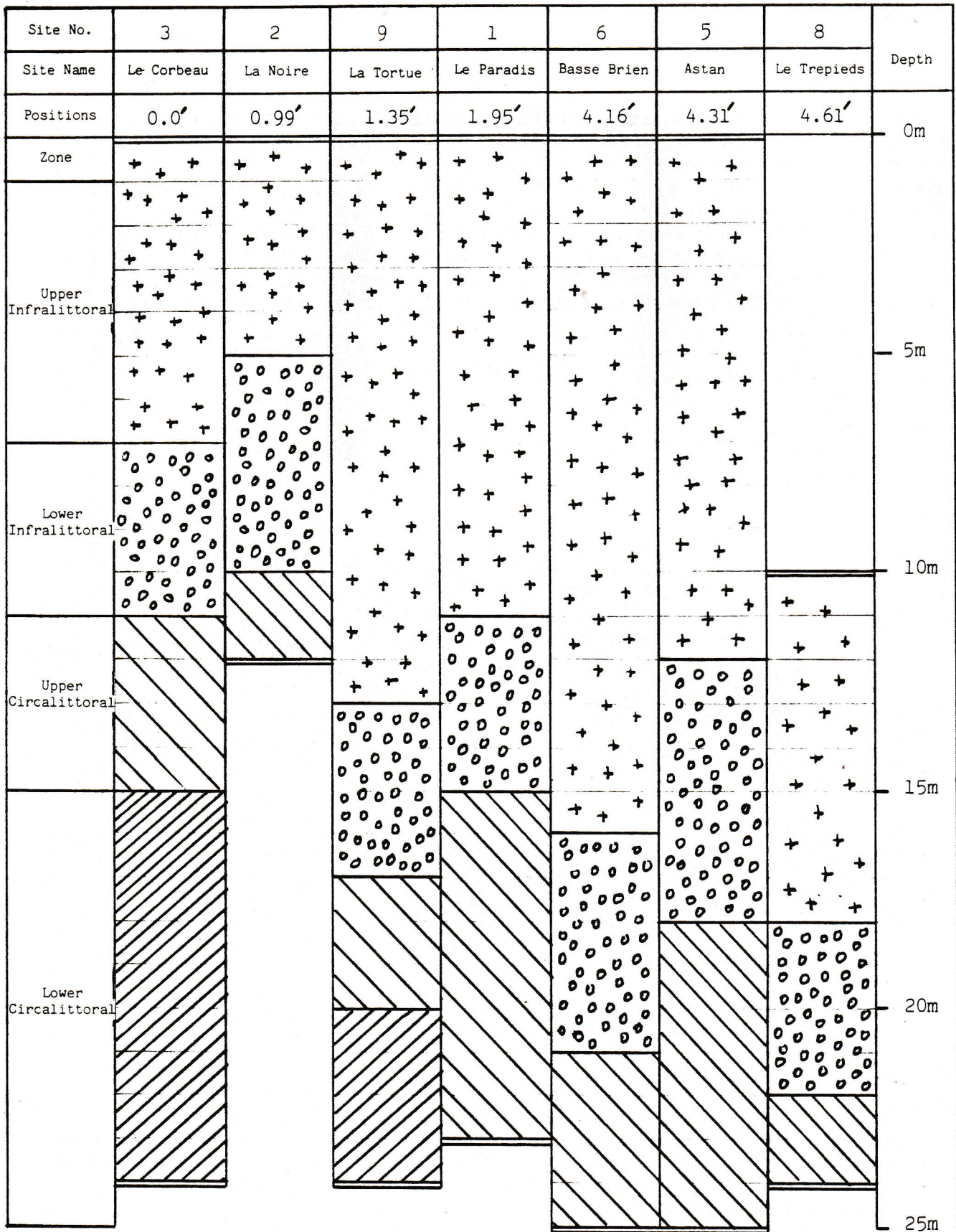
2.9. Comparison With South-West Britain

The communities encountered were broadly similar to those in similar locations in south-west Britain, except that, in general, there were larger quantities of southern species, including those not recorded from Britain, and lower quantities of northern species.

Astan (site 5) was very similar in physical appearance to the Western ledges, Maiden Bower ledges, etc. of the Isles of Scilly, except that, most conspicuously, there were fewer Echinus and more Eunicella. Also, there were more Stolonica, and Polycarpa which is not present in the Isles of Scilly. Astan was not so exposed as the western parts of the Isles of Scilly.

In the narrow, deep ria channels within the Bay of Morlaix, the sponge dominated communities were very similar to those of rias in south-west Britain, except for the paucity of Halichondria, Nemertesia and Hydrallmania. Although the currents appeared low in the channels, there was not the degree of siltation one would expect in apparently tide sheltered areas. Perhaps lack of silt in wave sheltered areas is important to sponge growth.

The maerl bed at S.E. of Le Cordonnier (site 4) was less than



==== = upper/lower depth limits of dive or site

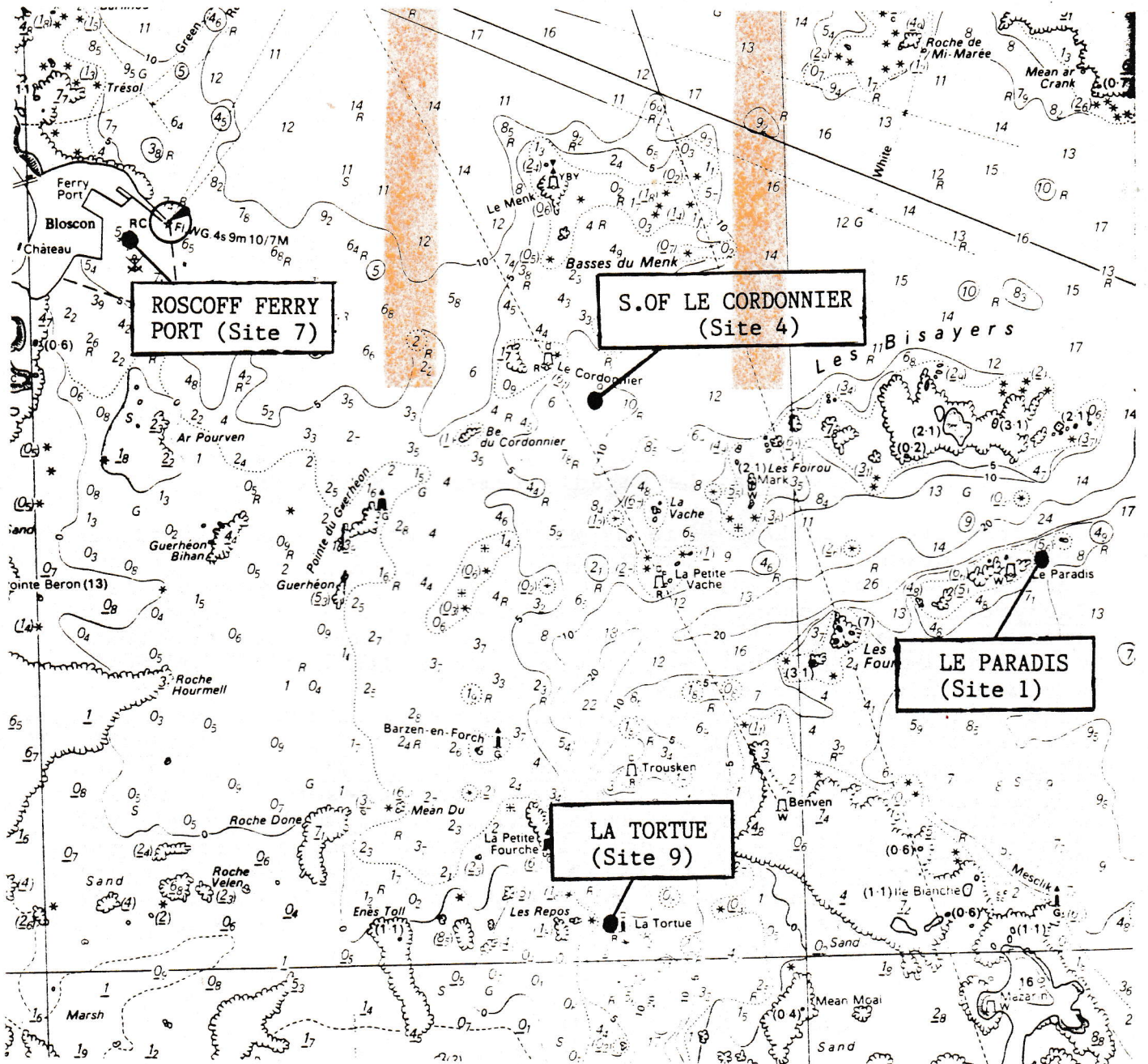
Positions are minutes North relative to Le Corbeau

TABLE SHOWING EXTENTS OF DEPTH ZONES WITH INCREASING SITE PROXIMITIES TO OPEN WATER

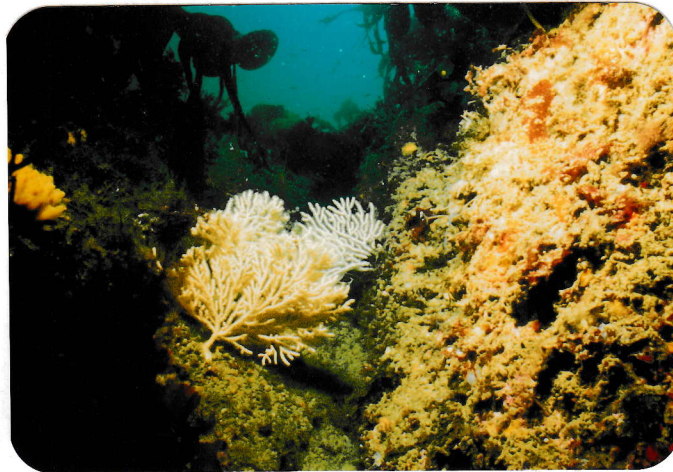
spectacular, and compared unfavourably with St.Mawes Bank. However, there are extensive maerl beds in the Bay of Morlaix, and other sites may have richer communities. Animals (particularly sponges and ascidians) frequently formed major components in the lower infralittoral at most sites, providing considerable competition for the foliose algae, and even tending to displace the kelp stipe flora. This is similar to the situation in Jersey, but unlike other south-west Britain areas where the foliose algae dominate the lower infralittoral.

3. Site Descriptions

3.1. Le Paradis (Ø-23m.bcd)



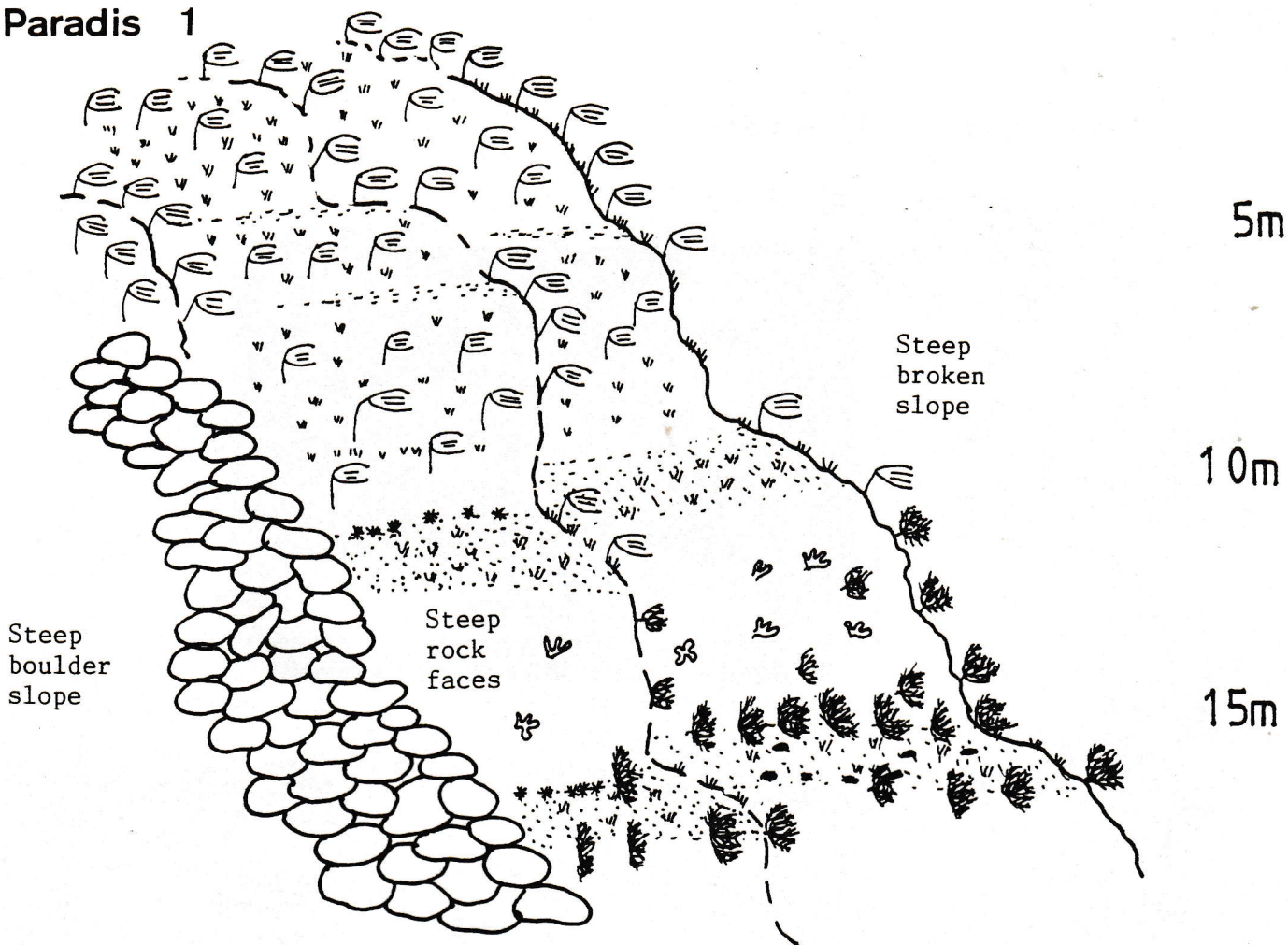
This site was semi-exposed to wave action, being partially sheltered by offshore rocks, and subject to weak tidal streams. A slope descended from the offshore rock / islet into a deep channel. There was a steep bedrock slope overall consisting of a series of rock walls and ledges. A stable boulder slope was also present. The bed of the channel consisted of stones and shell / gravel.



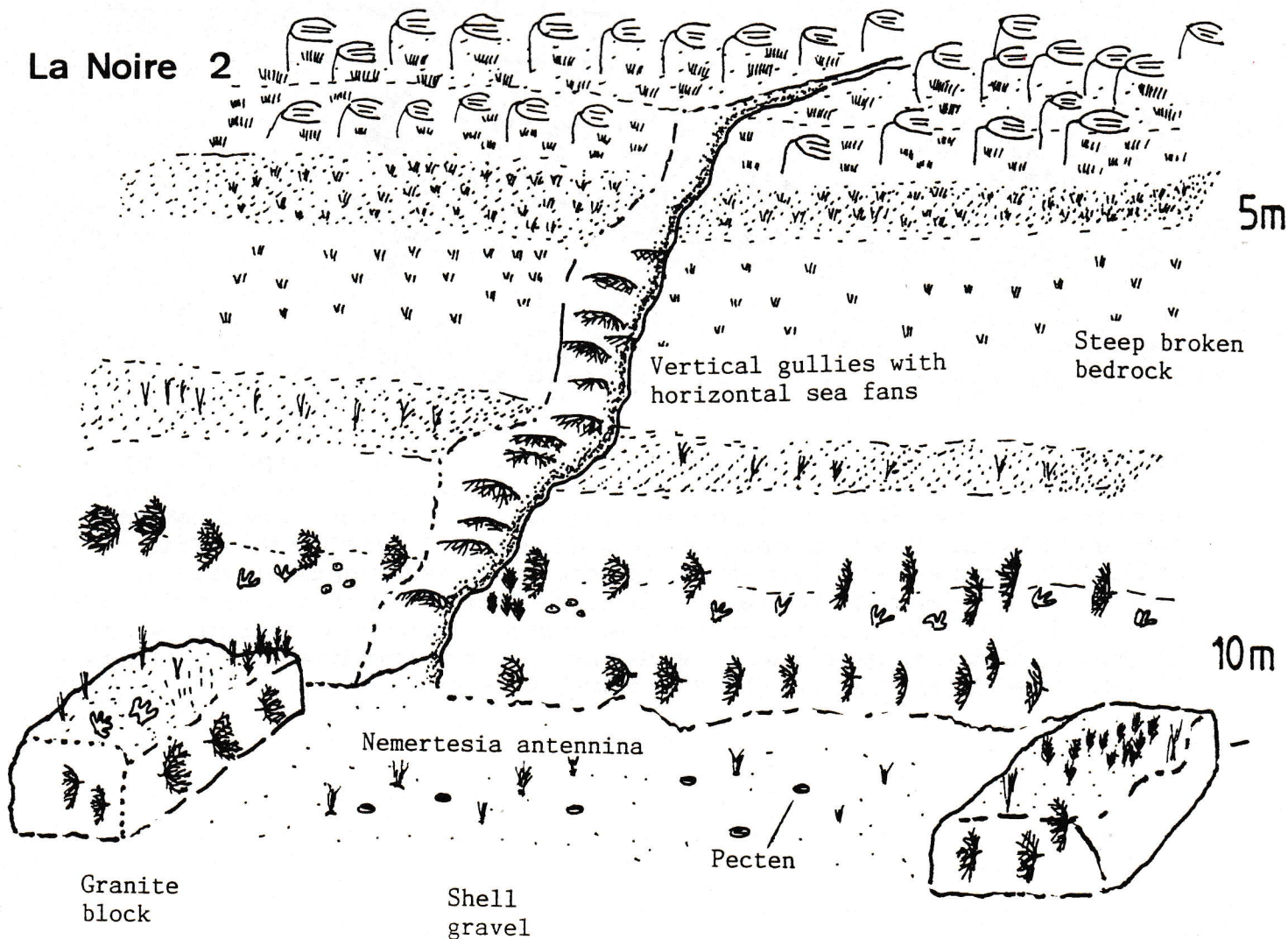
Gulley at about 12m. showing typical habitat of Eunicella verrucosa. Le Paradis (site 1). K. Hiscock.

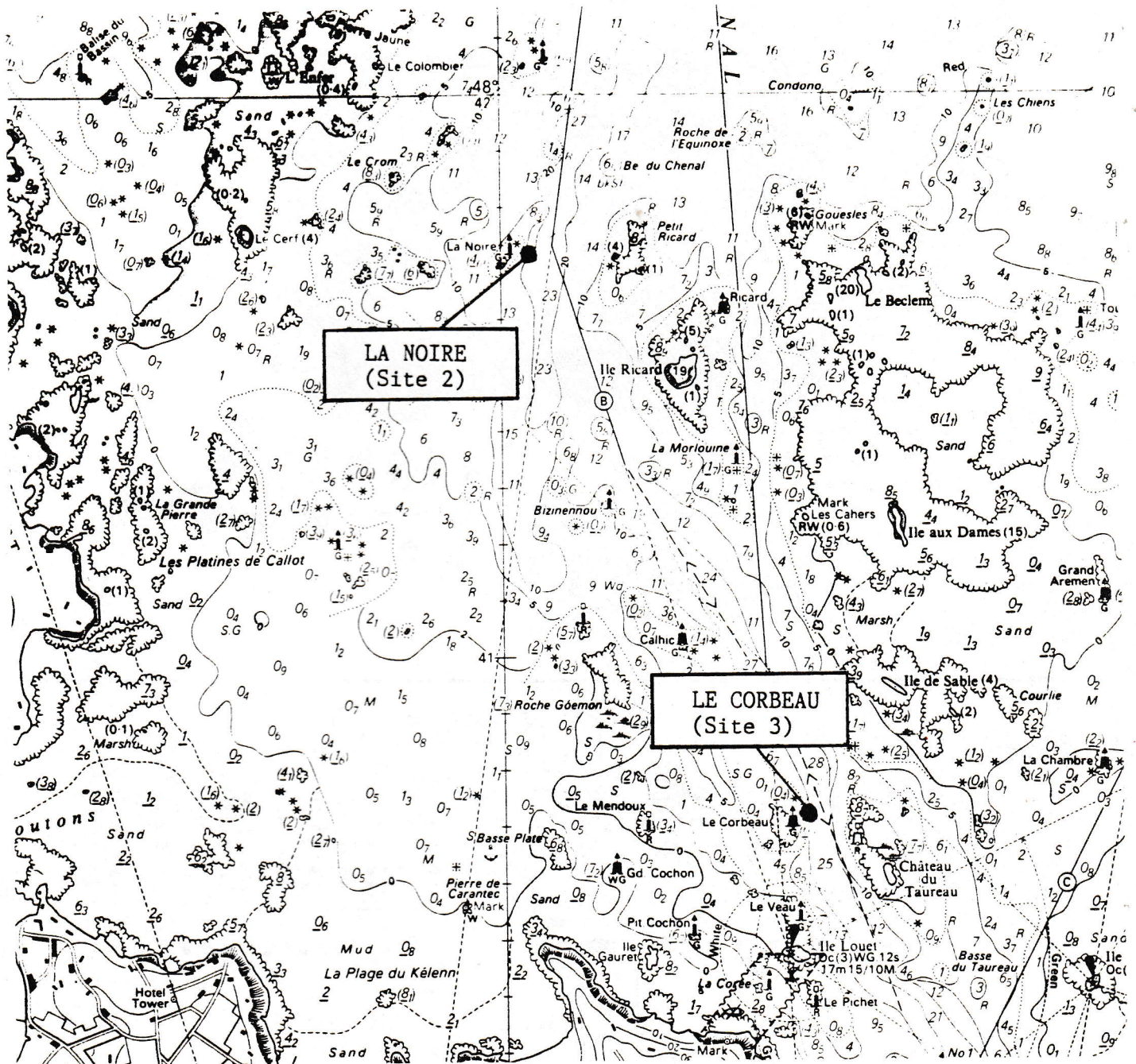
An extensive mixed Laminaria hyperborea / L. ochroleuca forest was present down to 11m. Saccorhiza polyschides was frequent. Vertical bedrock supported a wide range of sponges including Pachymatisma johnstonia, Cliona celata and numerous encrusting species. Eunicella verrucosa was frequent where water movement was enhanced. Bedrock was covered by a dense turf of erect bryozoa, hydroids were absent from this site (and most of the others). This bryozoan turf was common on shallow sloping rock and consisted predominantly of Securiflustra securifrons, Chartella papyracea, Omalosecosa ramulosa and Cellaria sp / Crisiidae. Crevices were present and densely colonised by the large Cerianthid, Aslia lefevrei and Ophiopholis aculeata. Vertical rocks in deeper water were colonised by Stolonica socialis. Boulders supported similar communities but these were generally less well developed. The bed of the channel was not surveyed. Echinaster sepositus was recorded from this site.

Le Paradis 1



La Noire 2



3.2. La Noire (Ø-11+m.bcd)

This site was sheltered from wave action by numerous offshore rocks and islets. It was exposed to moderately strong tidal streams. Extensive broken bedrock and boulders gave way to a series of rock walls and ledges dissected by large vertical gullies. These extended down to the rock-sediment interface at about 11m. Here there were flat bedrock outcrops and large boulders present. Shell gravel sediment formed a 'steep' slope dropping into deeper water and the bed of the channel proper. Stones and shells provided additional substratum.



Communities at the base of the Kelp forest at 4m. Note the large patches of the red ascidian Distomus variolosus on the kelp stipes. La Noire (site 2). K.Hiscock.

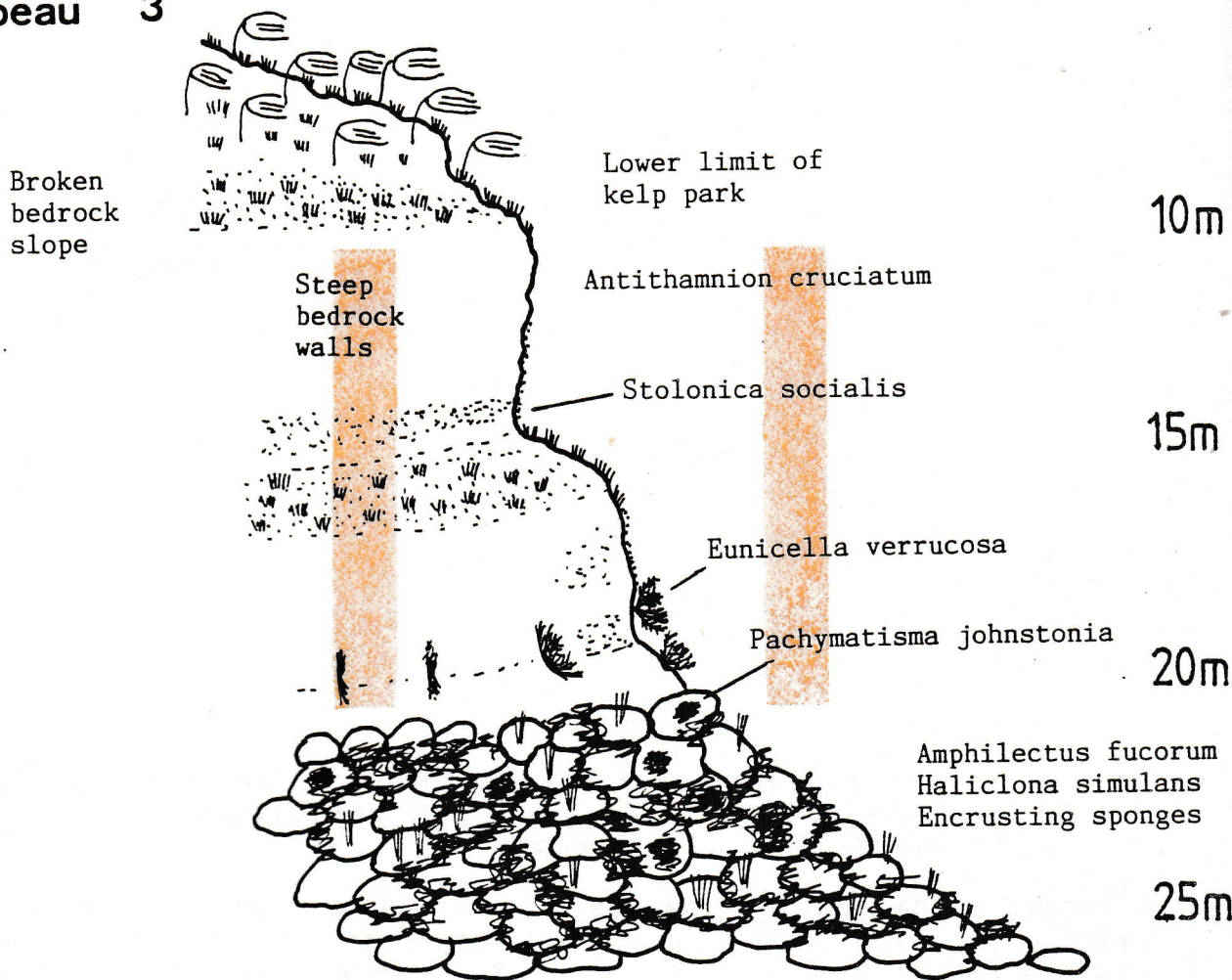
A forest of Laminaria hyperborea extended to depths of 5m.bcd and below. A dense algal turf was present under the forest, extending to a depth of 8-10m. Algae present included Dictyota dichotoma, Cryptopleura ramosa, Antithamnion cruciatum and Plocamium cartilagineum. Vertical gullies were densely colonised by Eunicella verrucosa, with their axes orientated horizontally, presumably to interrupt some of the vertical currents in these gullies. These presented some of the most spectacular displays of seafans recorded. Sponge populations were rich just above the sediment-rock interface where there were often some shell fragments present. Ciocalyptra penicillus, Cliona celata and Polymastia boletiformis were frequent or common. In addition aggregations of Haliclona simulans, H.viscosa, Halichondria spp.? and the encrusting 'Myxillids' were of particular interest. Sabella spallanzani, Bispira volutacornis and Pseudosabella variabilis were frequent. The shell gravel sediment contained Neopentadactyla mixta and Pachycerianthus sp. while the small stones, shells and Pecten maximus present supported a variety of small algae and Nemertesia antennina.

3.3. Le Corbeau (0-24 m.bcd)

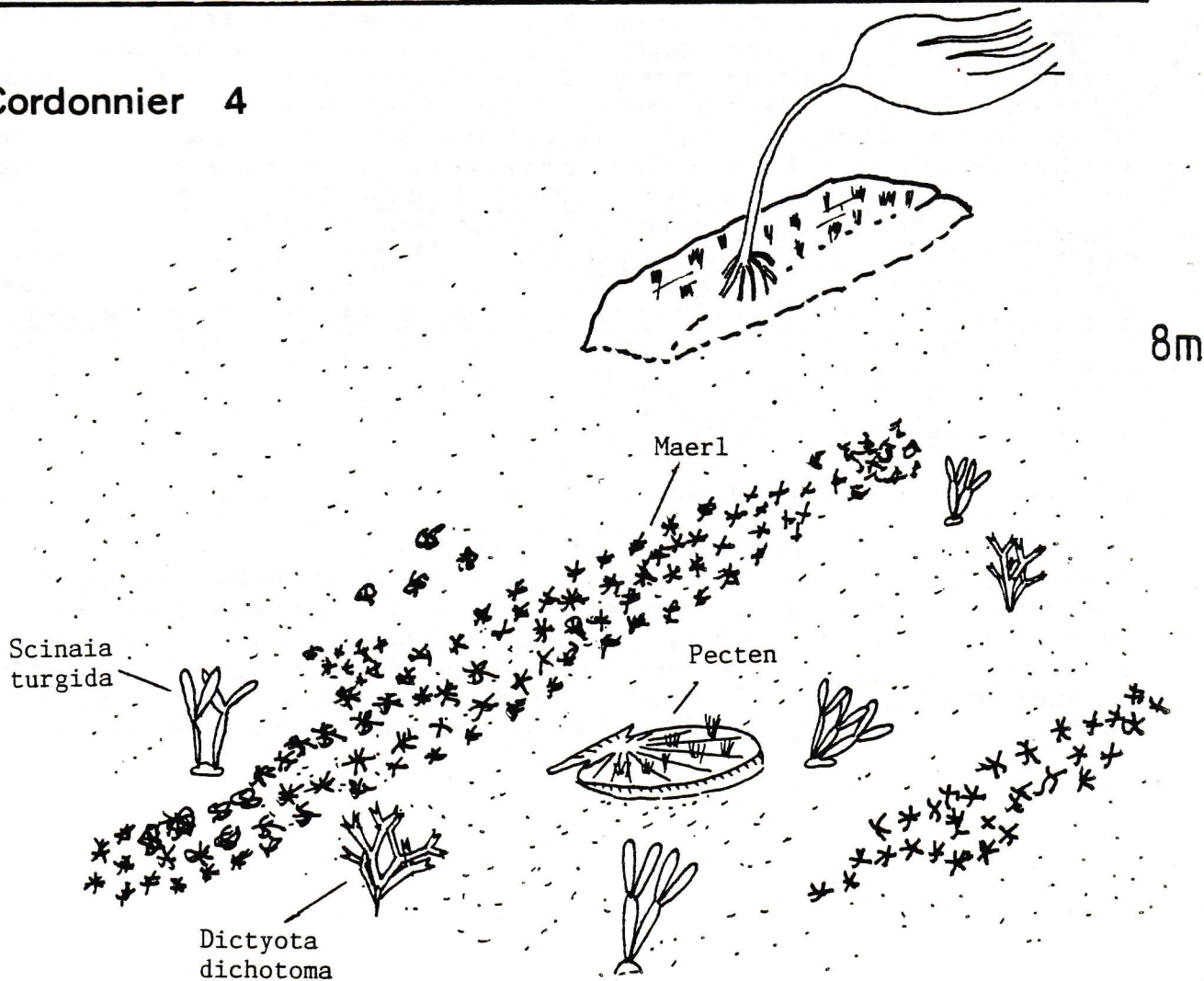
(see section 3.2.above for chart)

This site was very sheltered from wave action but exposed to moderately strong tidal streams (?1+ knots). It was sited in the main channel up to Morlaix. Broken bedrock in the infralittoral gave way to steep rock surfaces descending to the bed of the channel at around 24m. Small overhangs and vertical faces were common. In addition a boulder slope extended from 16-24m.

Le Corbeau 3



Le Cordonnier 4





Communities at about 20m. Le Corbeau (site 3). K. Hiscock.

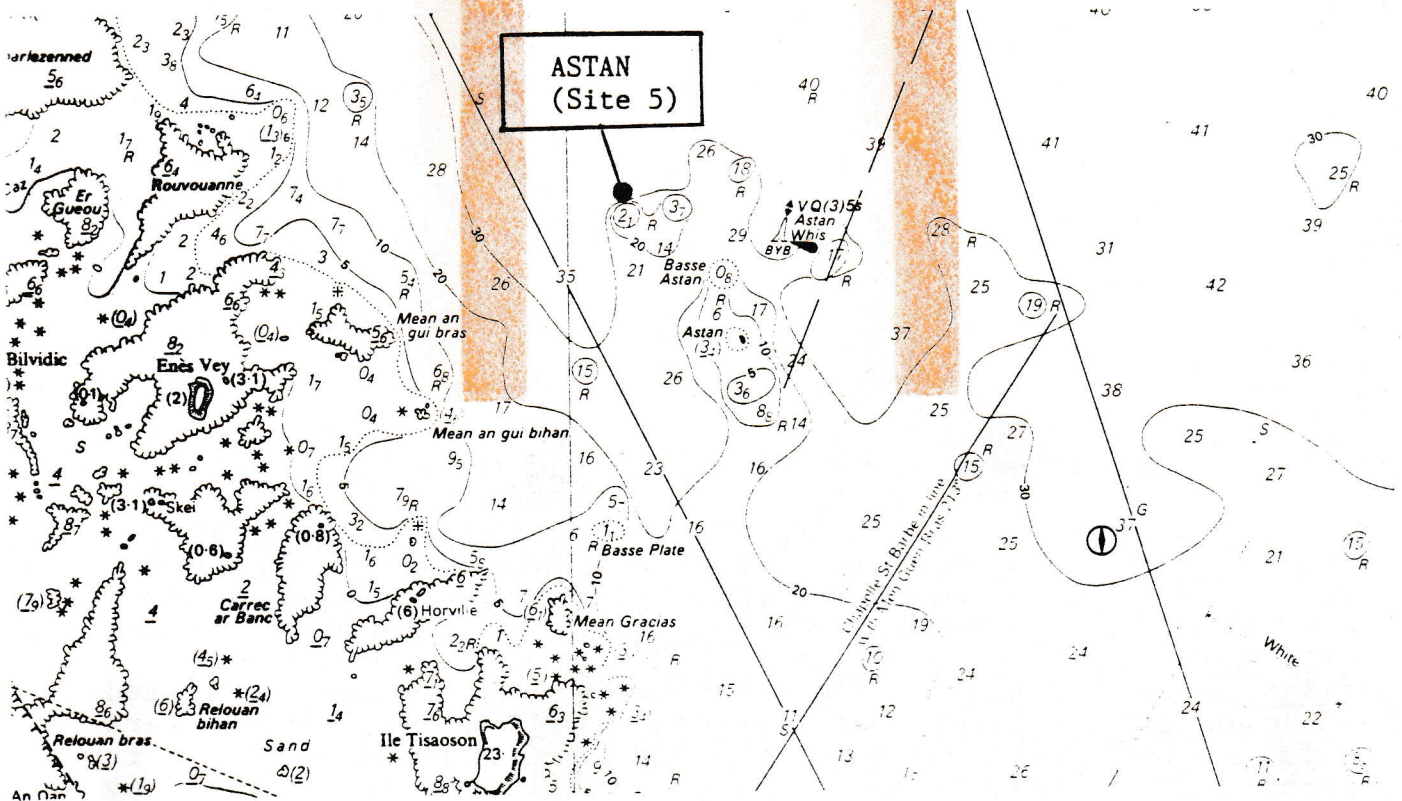
The infralittoral was dominated by Laminaria hyperborea and Antithamnion cruciatum, the latter forming a fine filamentous turf in the lower part of the zone. The steep rock walls present were dominated by Pachymatisma johnstonia, Cliona celata and Stolonica socialis. Encrusting sponges, including Dysidea fragilis, were frequent. Upwards facing surfaces were dominated by Nemertesia antennina and Chartella papyracea. The boulders supported a rich, profuse growth of sponges dominated in particular by tasseled forms of Amphilectus fucorum and by Haliclona simulans. In addition Haliclona elegans, Halichondria sp. and Polymastia mamillaris were frequent. Erect bryozoans present on steep rocks included Chartella papyracea, Securiflustra securifrons, Bugula plumosa and B. turbinata.

3.4. Le Cordonnier (S.E. of) (8m. bcd)

(see section 3.1. above for chart)

This site was semi-exposed to wave action and exposed to moderate tidal streams. Isolated outcrops of low-lying bedrock and boulders were present, mainly sediment scoured. There was an extensive plain of maerl, maerl gravel and shell gravel although boulders and bedrock were present near to the rock outcrops of Le Cordonnier itself.

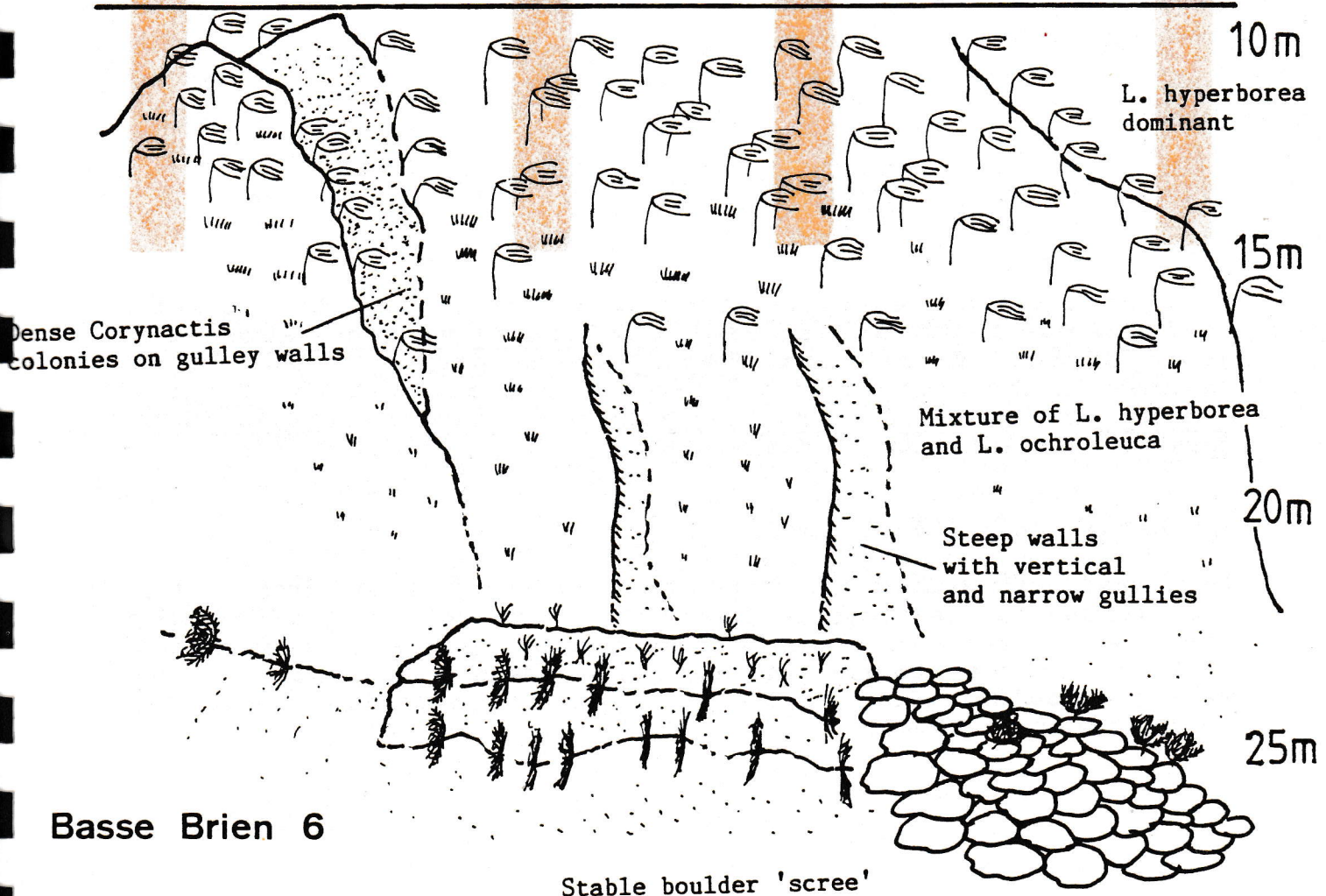
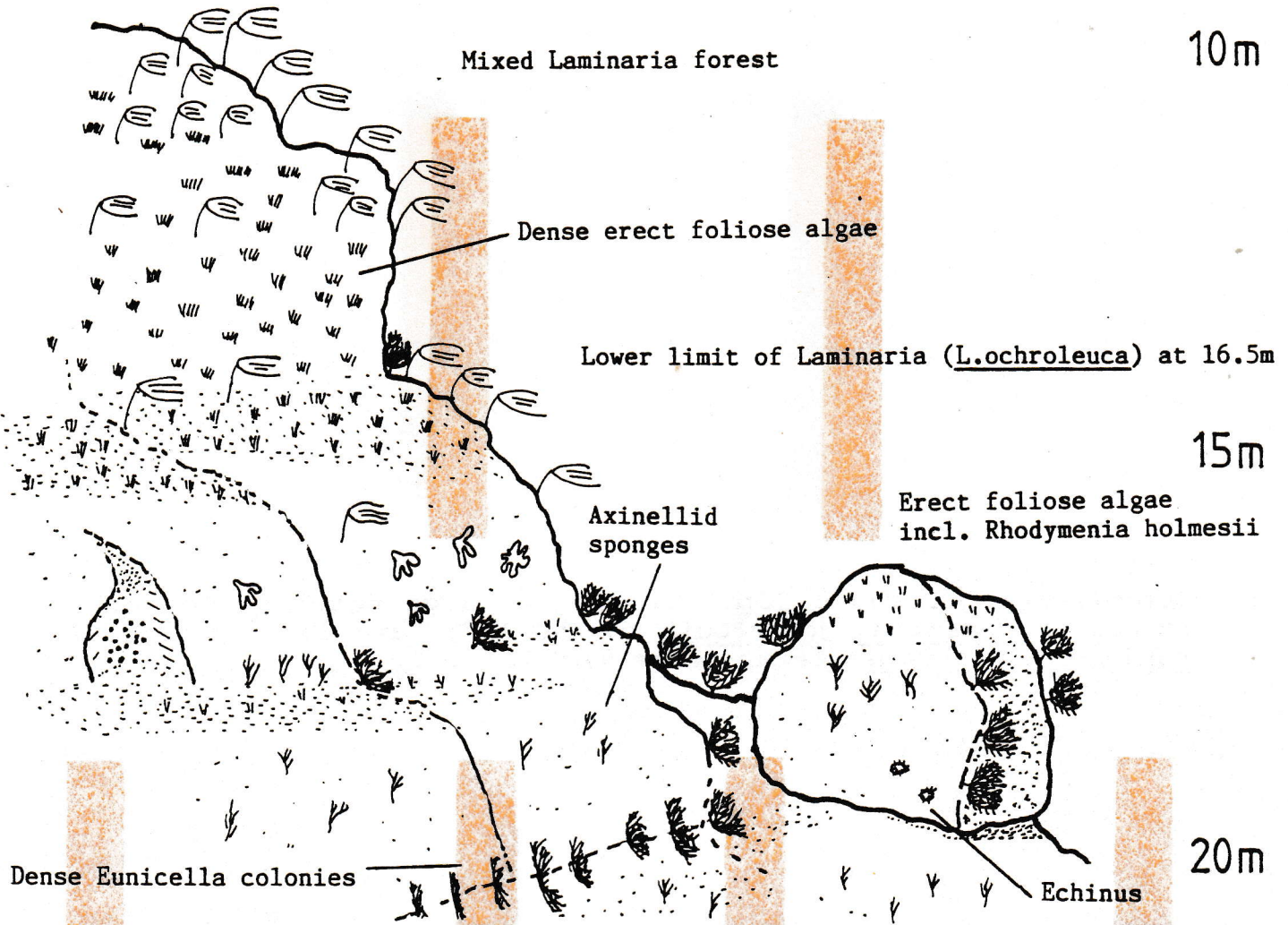
Bedrock and boulders were dominated by Laminaria hyperborea and L. ochroleuca. Some Halidrys siliquosa and Sacchoriza polyschides were present. A sparse algal meadow was present dominated by Dictyota dichotoma, Arthrocladia villosa, Scinaia turgida and Dudresnaya verticillata. This was attached to small stones and shells, or to the maerl, which consisted of Lithothamnion coralloides and Phymatolithon calcareum. Most of the maerl present was dead and no extensive maerl bed was recorded. There was a sparse epifaunal component. Aplysia punctata was occasional - apparently feeding on Scinaia. Natica alderi was occasional although egg masses were common.

3.5. Astan (Ø-21m.bcd)

This site was exposed to wave action although sheltered from the prevailing swell by Ile de Batz. It was subject to moderate tidal streams although it is possible that strong tidal streams may occur here at certain stages of the tide. Broken bedrock dropped steeply into deeper water. Areas of upward facing bedrock were present but extensive rock walls were predominant, with some overhangs and caves.

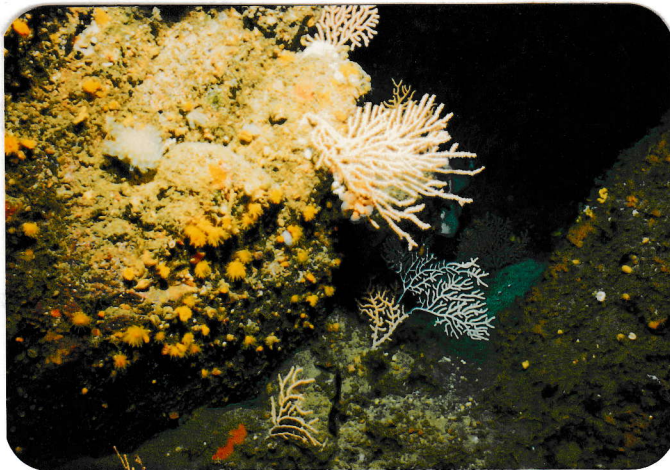
The infralittoral was dominated by a mixed forest of Laminaria hyperborea and L. ochroleuca. Dense foliose algae were present with a sparse hydroid turf. The lower infralittoral supported a moderate algal population of a depauperate nature, dominated by Rhodymenia holmesii, Rhodymenia sp., Meredithia microphylla and Phyllophora crista. In part this might have been due to a low Echinus grazing pressure. An erect bryozoan turf was present. Eunicella verrucosa and Alcyonium glomeratum became increasingly common with depth. The former was concentrated in habitats of enhanced water movement. Alcyonium digitatum was present but rare. Echinaster sepositus was occasional. Steep rock surfaces, overhangs and caves supported Stelligera stuposa, Parazoanthus axinellae and Leptopsammia pruvoti. Homaxinella subdola, Stryphnus ponderosus and encrusting sponge species were common. Dense colonies of Corynactis viridis were recorded.

Astan 5





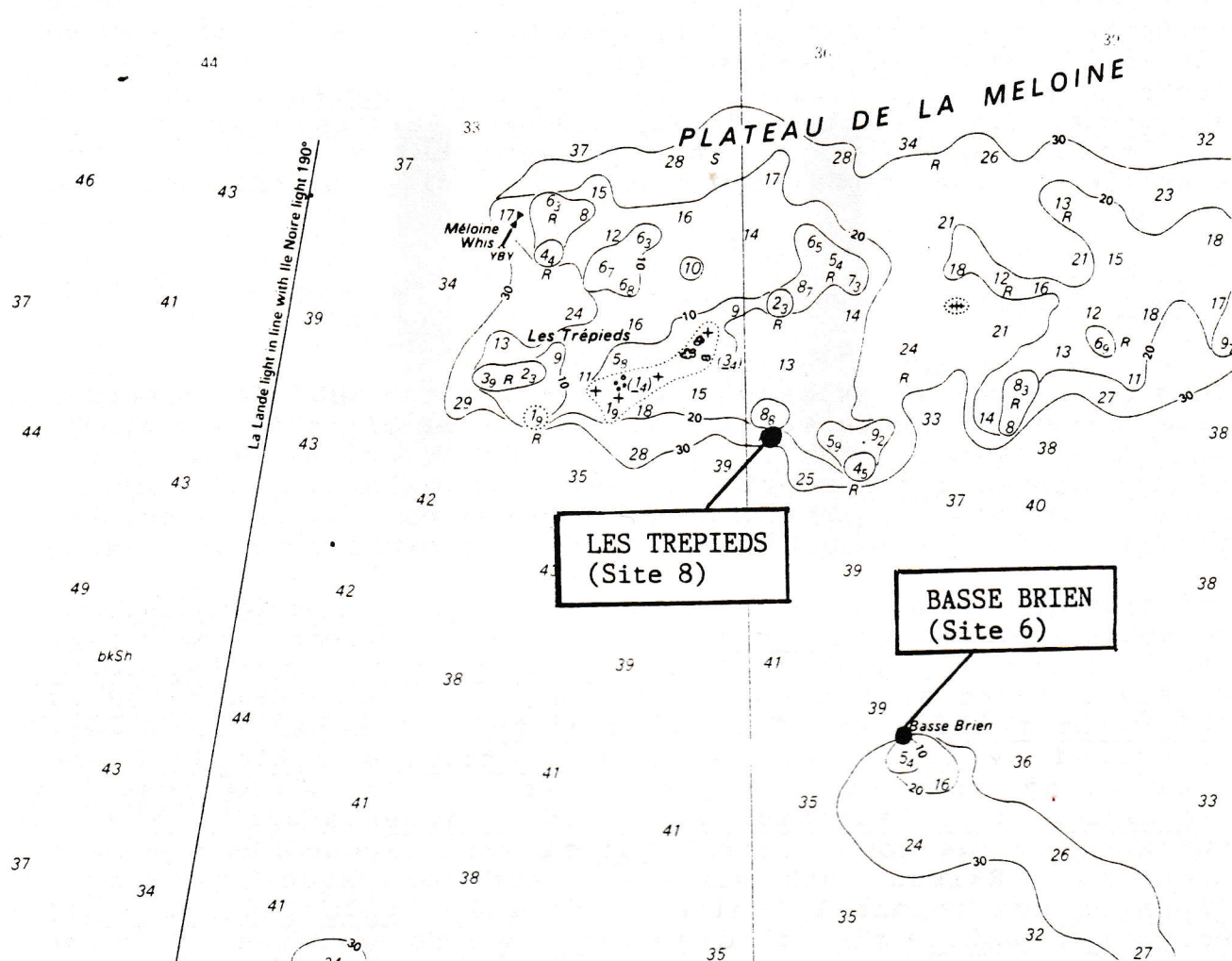
Communities at about 20m. including a large patch of the grey sponge Pachymatisma johnstonia to the left, and large stands of Eunicella verrucosa. Astan (site 5). C. Lumb.



Communities and scenery at about 22m. The picture on the left includes one colony of the ascidian Diazona violacea amongst a group of the yellow coral Leptopsammia pruvoti. The large animals in the picture on the right are (left to right) Echinus esculentus, Eunicella verrucosa, Haliclona viscosa and Holothuria forskali. Astan (site 5). K. Hiscock.

3.6. Basse Brien (Ø-25m bcd)

This was very exposed to wave action and subject to strong tidal streams due to its offshore position. There were extensive rocky reefs with steep rock walls fissured by open and steep-sided gullies. Bedrock became increasingly broken with depth, giving way to a boulder slope at 20-21m. This extended down to depths in the order of 30-40m.



Infralittoral bedrock was dominated by Laminaria hyperborea. The dominant epiphyte on the side of the Laminaria was Palmaria palmata, with Membranipora membranacea present on the fronds. Steep walls in the infralittoral zone were dominated by a total cover of Corynactis viridis, with Balanus crenatus common elsewhere. A mixed hydroid and bryozoan turf was present towards the lower limit of this zone. Cliona celata and Pachymatisma johnstonia were frequent. Eunicella verrucosa became increasingly common in deeper water. Axinella polypoides was frequent and found incidentally with Balanus crenatus and encrusting sponges.

3.7. Roscoff Ferry Port (approx. 7m.bcd)

(see section 3.1. above for chart)

This was a muddy sand sediment plain with occasional boulders present. It was generally very sheltered from wave action with little in the way of tidal streams present.

Rocks present were dominated by Laminaria saccharina, Halidrys siliquosa, Ulva lactuca and , apparently, Sargassum muticum. A few mounds and burrows were present but without obvious characteristic epifaunal component. This site was only surveyed at night.

3.8. Les Trepieds (10-24m.bcd)

(see section 3.6. above for chart)

This site was very exposed to wave action and subject to strong tidal streams. There was an extensive area of reefs surrounded by a deep sediment plain. Broken bedrock was present in the infralittoral and circalittoral, with a wide range of small scale microhabitats including gullies and rock walls. Sediment scoured bedrock and boulders and mobile cobbles were present also.

Infralittoral bedrock was dominated by Laminaria hyperborea down to about 17m.bcd. Some L. ochroleuca was also present. The former had a sparse epiphytic cover of Palmaria palmata and Phycodrys rubens. Rocks at the bottom of this zone were dominated by Polycarpa rustica and Balanus crenatus. Steeper rocks were colonised by Corynactis viridis, Botryllus schlosseri and encrusting sponges. Algae present included Acrosorium uncinatum, Calliblepharis jubata and Rhodymenia spp. Many rock surfaces in the lower infralittoral were exposed to sediment scouring. Raised rock surfaces were dominated by Balanus crenatus and colonial tunicates, mainly Stolonica socialis, Polycarpa rustica and Aplidium punctum. No epifauna / infauna was recorded on the sediment. It is likely that this substratum continued into deeper water.

3.9. La Tortue (0-20m.+bcd)

(see section 3.1. above for chart)

This site was sheltered from wave action but exposed to moderate tidal streams. La Tortue forms a submerged pinnacle of rock within the bed of a ria channel. The west channel was deeper dropping to over 20m., probably around 26 m. Broken bedrock and boulders in the infralittoral give way to a series of steep rock walls and overhangs terminating in a steep and stable boulder slope at around 20m.

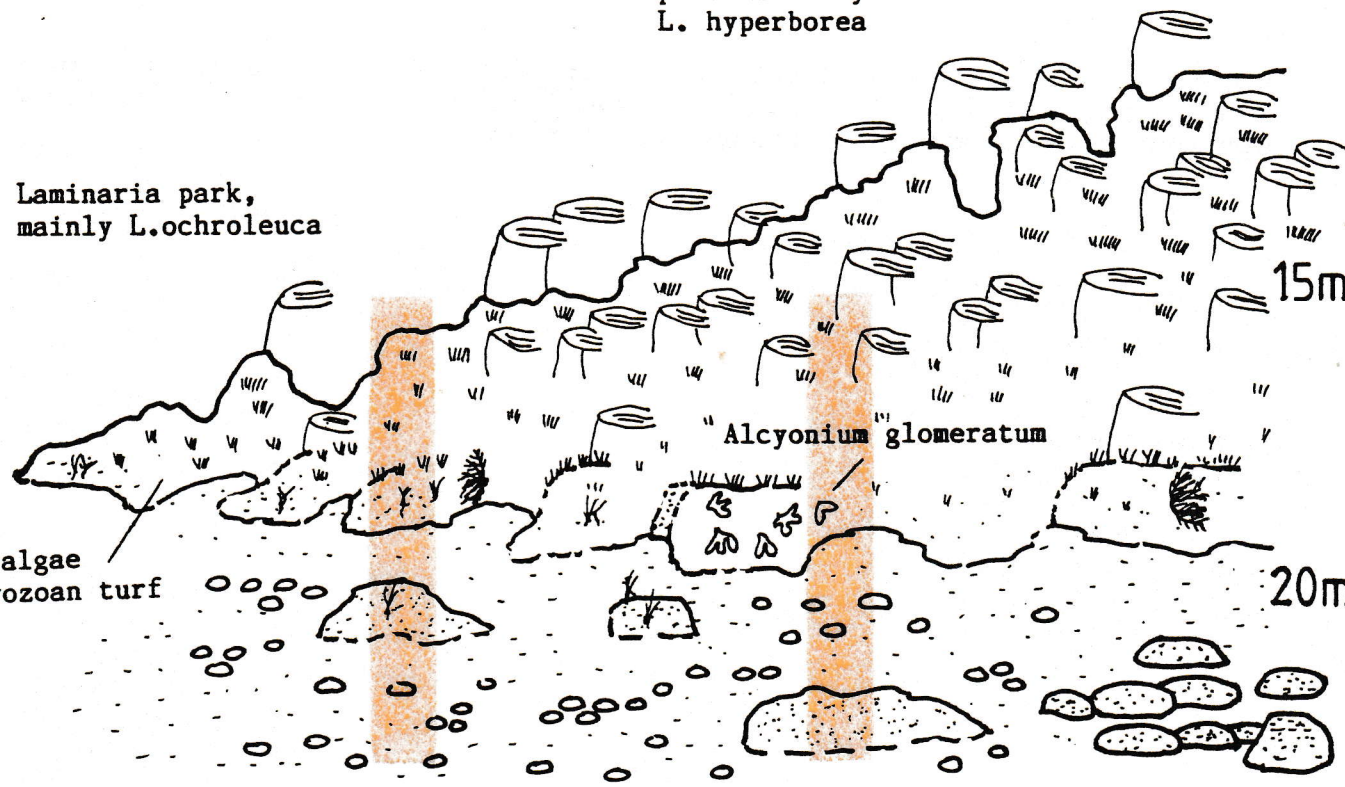
An extensive and well developed forest of Laminaria hyperborea and L. ochroleuca was present in the upper infralittoral. A turf of dense foliose algae was present throughout. Antithamnion cruciatum was the dominant alga in the lower infralittoral although on steep surfaces Pachymatisma johnstonia and colonial tunicates were dominant organisms. Rich populations of erect bryozoa and sponges were present on upward facing surfaces in the

Les Trepieds 8

Laminaria forest,
predominantly
L. hyperborea

10m

Laminaria park,
mainly *L. ochroleuca*



15m

"*Alcyonium glomeratum*"

Foliose algae
with bryozoan turf

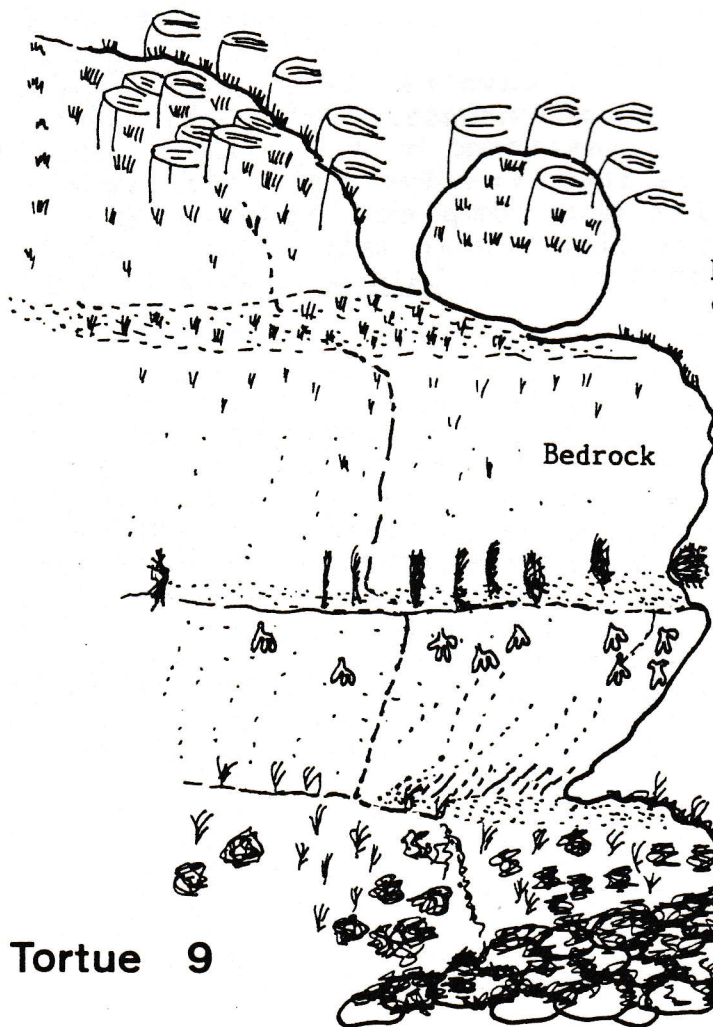
20m

Mobile cobbles and shell gravel

Boulder patches

Broken
bedrock

10m



Large boulders with
overhang faunas

Bedrock

15m

Extensive overhangs and caves

Dense sponge cover

20m

La Tortue 9

Steep boulder bedrock slope

upper circalittoral. Pentapora foliacea and Haliclona viscosa were frequent or common. On steep rock surfaces encrusting sponges were common and occurred extensively.



Sponge community at about 18m., including Ulosa digitata (salmon pink), Amphilectus fucorum (orange tassles) and Haliclona simulans (dark green branches). La Tortue (site 9). K. Hiscock.

In addition Eunicella verrucosa was common together with Caryophyllia smithii, Aslia lefevrei (in crevices) and Polycarpa rustica. Several representatives of cave habitats were present at the site, exhibiting restricted and unusual faunal components. The richest habitat at this site was found on the boulder slope, which was dominated by encrusting, massive and erect sponge species forming an extensive and complete cover over the boulders. This provided a three dimensional matrix for a number of other organisms and the population of Labrus mixtus in this habitat was high.

4. Account of Flora

4.1. General Comments

Firstly it is important to bear in mind that only nine sites were recorded and surveyed thoroughly from the lower limit of algae up to the infralittoral fringe, therefore the picture presented by these records will of necessity be incomplete. In particular three sites were systematically surveyed in water too deep for all but the few algae found below 20m. These sites were Basse Brien (site 6) and Astan (site 5), both outside the main area of the Bay, and Le Corbeau (site 3), one of the most sheltered sites. The two former sites probably due to their clearer open water position had a larger variety of species. These are listed in Appendix 2. At le Corbeau brief observations were made during surfacing and a collection made from 10m. The only species present in any numbers were -

Antithamnion cruciatum

Dasya hutchinsiae

Griffithsia ? devoniensis

Dictyota dichotoma

This was similar to the assemblage found in the Fal estuary and in Milford Haven, where wave sheltered bedrock is exposed to relatively strong tidal streams possibly in variable salinity.

Generally both species diversity and weed cover were low, the only site surveyed with a varied and luxurious flora was La Tortue (site 9).

The other sites had a sparse flora with Acrosorium uncinatum the most common red alga; and had no red weed dominated zone below the kelp as is found throughout most of S.W. Britain. The only area so far surveyed in S.W. Britain with similar communities is on the south coast in the entrance to Plymouth Sound. The kelp stipe flora was also limited to one or two species.

4.2. Maerl Beds

Only one dive was conducted on a maerl bed. This was on the Guerheon bed, the second largest of the seven beds identified by Boillot, 1961. Our dive was on the edge of the bed where about 40% of the Lithothamnion coralloides was living. The algal variety was such that different species were being found throughout the dive and one suspects many more would have been encountered if a larger area had been covered.

From the above observations it would obviously be premature to try to compare the species variety with that found in Milford Haven or the Fal. Existing works (Boillot, 1961 and Cabioch, 1969) suggest that species richness is high in this bed, compared with others in the Bay of Morlaix, and that it is also a well developed bed with a very abundant epiflora.

The maerl beds would be worthy of extensive study.

4.3. Species of Interest

No species absent from S.W. Britain were recorded during this survey.

Several species rare in S.W. Britain or recently described from S.W. Britain were recorded including-

4.3.1. Gracilaria foliifera has so far only been recorded in the mouth of the Yealm and Salcombe estuaries in S.W. Britain. In the Bay of Morlaix it was recorded from two sites where occasional clumps were found attached to cobbles buried in the sand.

4.3.2. Gelidiella calcicola is a newly described species which has been recorded from several maerl beds in S.W. Britain including Falmouth and Milford Haven. It was found on maerl from the Guerheon bed.

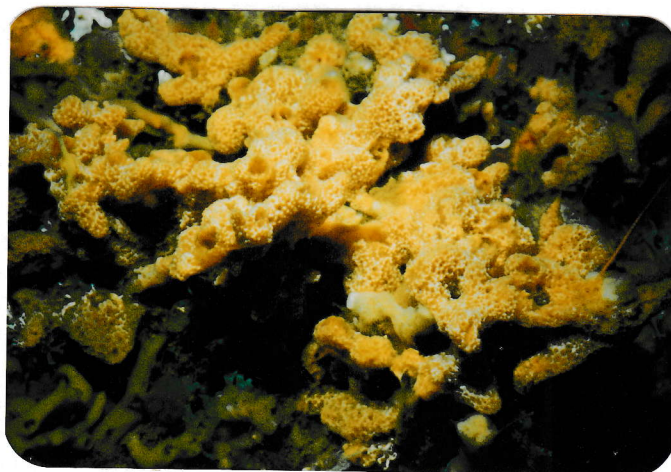
4.3.3. Schmitzia neapolitana is an annual species which is rarely recorded from storm mobile substrate around the coasts of Southern Britain.

4.3.4. Sargassum muticum is a relatively recent invading species to European waters and is obviously well established in the Bay of Morlaix as it is in Southern Britain where it is still restricted to the South coast.

5. Accounts of Fauna

5.1. Porifera

Within the limits of the survey (only 9 sites were visited and the abundance of individual species was not formally recorded), it is still possible to comment on the distribution and appearance of some of the sponges recorded and to compare these with records from S.W. Britain and the U.K. in general.



Ulosa digitata. La Tortue (site 9). K. Hiscock.

Most of the species encountered were familiar by U.K. standards with the exception of Ulosa digitata, Iophonopsis nigricans (both known from Channel Isles) and Axinella flustra (rarely recorded in U.K.). The latter species is probably nearer its centre of distribution off Brittany, as were the other axinellids, although fewer axinellids than expected were observed at most sites (e.g. A. infundibuliformis was not recorded and A. polypoides and Homaxinella subdola were not as frequent as off Lundy). Axinella damicornis and A. polypoides also exhibited a distinctive yet consistent form at all sites where recorded, which differed from that normally encountered in S.W. Britain at least. The axinellids in general, seemed to prefer upward facing, silty surfaces at otherwise exposed sites, whereas off Lundy and the Scilly Isles they are more characteristic of sheltered coasts. Other species which exhibited a different form than 'normal' were Tethya aurantium, which was slightly larger and more intensely orange, and Myxilla incrustans which reached large 'Cliona-sized' proportions on the exposed coasts. Notably large specimens of Haliclona simulans displaying repent branching were recorded at the more sheltered sites. The Haplosclerids in general were more prolific at more sites than around Britain, especially H. simulans and H. cinerea. The silty vertical rock faces, terraces, overhangs and caves at La Tortue (site 9) provided a wide range

of surfaces for the most spectacular growth of sponges with Haliclona spp., tassellated forms of Amphilectus fucorum and many encrusters contributing to a rich fauna. The least rich sites for sponges, as for other fauna, were at S. of Le Cordonnier (site 4) and at Les Trepieds (site 8). The former site was dominated by maerl and pebbles and the latter site dominated by boulders and pebbles with barnacle encrusted rock offering suitable surfaces for anything except perhaps small, thin encrusters. No sponges were recorded from Roscoff Ferry Port (site 7).

Generally, a fair range of sponges was observed or recorded at all sites, with the more exposed sites favouring a greater variety and larger growths of familiar species such as Cliona celata, Pachymatisma johnstonia and Myxilla incrustans. Axinellids and other branched species (Stelligera sp. and Raspailia sp.) occupied sheltered 'niches' or microhabitats at these sites, whereas the more sheltered sites favoured the branching Haliclona spp.

A notable absence of algal competition probably influenced infralittoral sponge communities (as all other faunal communities) but since few shallow sites were visited it is difficult to comment on the effect this might have had.

Notes on some individual species follow.

Leuconia nivea Grant, 1826 .

Recorded from cave roof at 3m and from overhangs. One patch seen on vertical rock at 23m.

Dercitus bucklandi (Bowerbank, 1858).

Recorded from its usual 'crevice-loving' habitat. One patch recorded from vertical rock.

Pachymatisma johnstonia (Bowerbank in Johnston, 1842).

Mostly found under overhangs but some individuals were on steep rock at the more exposed sites. Some were recorded as having pink or red algal 'dots' on their surfaces.

Thymosia guernei (Topsent, 1896).

This encruster occurred on vertical rock faces.

Tethya aurantium (Pallas, 1766).

Most specimens notably larger (8cm. diameter) than those seen elsewhere in S.W. Britain. A higher proportion of more orange coloured individuals was also noted.

Polymastia boletiformis (Lamarck, 1815).

Recorded from depths of 6-26m., generally on upward facing rock. Sizes about 4-5cm. diameter. Coloration varied from yellow-orange.

Polymastia mamillaris (Muller, 1806).

Recorded on upward facing rock and outcrops from 6-16m. A few were seen unusually vertically orientated. Some large individuals were found in silty niches at La Tortue (site 9).

Axinella damicornis (Esper, 1794).

Recorded in greater abundance than in S.W. Britain, due presumably to the axinellids favouring this more southerly location. Growth form was always low and stunted with individuals attaining diameters up to 8cm., which is larger than those found in the U.K. Found on boulders and bedrock.

Axinella polypoides Schmidt, 1862.

Individuals varied in form from small lamellate (even cup forms) to medium, erect branching forms (up to 18cm.) and the latter

form appeared 'glove-like', almost deformed compared to those commonly seen at Lundy and in S.W. Britain. Recorded as prolific at Basse Brien (site 6).

Homaxinella subdola (Bowerbank, 1866).

A few untidy looking specimens were recorded although confusion could have arisen between this species and Axinella polypoides due to the existence of uncharacteristic forms of the latter. Recorded as up to 15cm. high.

Adreus fascicularis (Bowerbank, 1866).

Recorded unusually, from the side of a rock, with purple tips indicating symbiotic algae.

Stelligera rigida (Montagu, 1818).

Recorded half buried in silt in crevices and usual habitats.

Stelligera stuposa (Ellis and Solander, 1786).

Almost always seen with red algal pigment in tips, but otherwise the form was similar to that seen in the U.K.

Raspailia hispida (Montagu, 1818).

Appeared in its typical more 'elegant' form on upward facing surfaces.

Raspailia ramosa (Montagu, 1818).

Slightly reddish-brown specimens observed, generally more stunted and smaller ones seen on the more open coast sites, possibly reflecting a preference for more sheltered locations. Habitats varied from inside a cave at 3m. to bedrock outcrops at 20m.

Ciocalypta penicillus (Bowerbank, 1864).

Several patches recorded from the lower infralittoral.

Halichondria panicea (Pallas, 1766).

Encrusting, yellow and glassy form was seen on kelp stipes at 2-8m. Also recorded from upward surfaces in the lower infralittoral and amongst Haliclonids at La Noire (site 2).

Hymeniacion perleve (Montagu, 1818).

Small specimens on silty rock in the lower infralittoral; possibly collected as encrusters on maerl and pebbles.

Ulosa digitata (Schmidt, 1866).

Appeared in similar form to that observed in the Channel Islands. Often loosely wrapped around soft yellow sponge.

Amphilectus fucorum (Esper, 1794).

Generally recorded in its tassellated form and sometimes extending down as far as 20m. Some recorded from roof of cave.

Iophonopsis nigricans (Bowerbank, 1858).

Citrus yellow or dark brown lumps were recorded from vertical walls and as forming loose lying cushions across boulders on upward facing rock surfaces at 23m.

Myxilla incrustans (Johnston, 1842).

Some specimens on the open coast vertical rock were large, ridged 'Cliona' sized individuals. Recorded from open ocean, clean water habitats from 15-20m.

Hemimycale columella (Bowerbank, 1874).

Small patches seen some noted as thicker than usual. From 2-20m.

Haliclona cinerea

Various colours ranging from yellow, orange, buff, pink to purple, with one form tassellated. Recorded from 6-15m.

Haliclona fistulosa (Bowerbank, 1866).

Recorded from usual habitat, often half buried in silt, with some fistulae emerged although cushion base buried. Probably far more

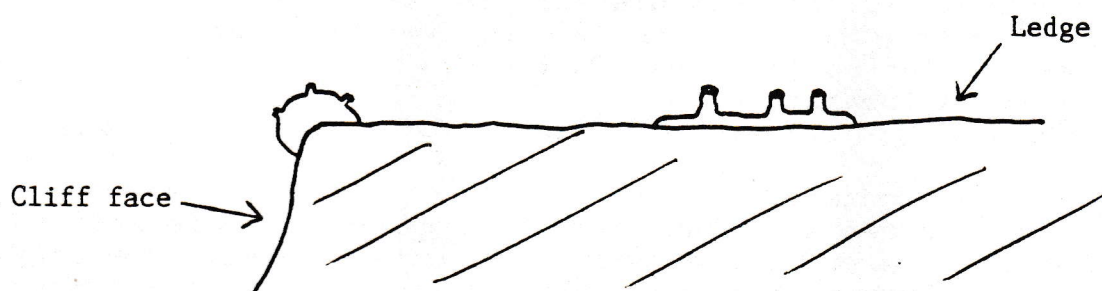
common than recorded as this species is easily overlooked.

Haliclona simulans (Johnston, 1842).

Often seen entwined around algae. Normally in a repent branching form, several cms. long and unattached, from 2-20m. depth. Commonly recorded at sheltered sites but absent or rarely recorded from more open coast, exposed sites. Lack of firm attachment and long branching specimens could probably only thrive in sheltered conditions, unless encountered in locally sheltered niches at otherwise exposed locations.

Haliclona viscosa (Topsent, 1888).

Orange, pink/purple and cream coloured forms seen, some forming chimneys in clumps at 3-5m. Specimens displayed variable shape depending on local microhabitat.



Both specimens depicted in the diagram were adjacent to each other at Astan (site 5). The one straddling the ledge and the cliff face was massive, with ridges formed by osculi lying on small, fused oscula chimneys. The specimen actually on the ledge was flattened, with tall oscula chimneys.

Dysidea fragilis (Montagu, 1818).

White and purplish varieties seen, with larger ones recorded from silty sides of ria. All habitats, 10-16m.

Encrusting orange thin channelled sponge

Thin extensive crusts in depths of 3-15m. Some 10cm. wide. Also found in dark locations.

Encrusting various yellow and orange sponges

Many seen in caves or on overhangs. Large red one (probably Microciona?) 1-2m. by 5m. wide at La Tortue (site 9).

5.2. Coelenterata

5.2.1. Hydrozoa.

Without constant practice most hydroids are difficult to identify underwater and hence were undoubtedly under-recorded on the survey. Two surprising absentees from our list are Gymnangium montagui and Nemertesia ramosa, both of which are relatively well known and easy to identify. Teissier, 1965 gives N. ramosa as common in the area, G. montagui as present at 60m+ N & W of the Ile de Batz. Nemertesia antennina was frequently found attached to the dorsal valve of the scallop Pecten maximus as well as its more usual situation on rocks. The single specimen of Corymorpha was seen on the night dive in Roscoff Harbour.

5.2.2. Anthozoa

The anthozoan fauna of the Bay of Morlaix is distinctly different in character from any known British site. Only one non-British species, the large cerianthid anemone (code-named 'Dorothy') was found, but this was quite common. Several other species that we had fully expected to find were, however, not observed: Parerythropodium coralloides, Anthopleura ballii, and Hoplangia durotrix, should all be common in the area, along with the burrowing anemones Peachia cylindrica, Halccampa chrysanthellum, Scolanthus callimorphus, Edwardsia spp, and perhaps Andresia parthenopea. Our lack of records must be due in part to few dives taking place on suitable substrata for some of these, but even so the total absence of records is surprising.

The following notes were compiled with reference to Teissier, 1965.

Actinothoe sphyrodeta Common but never as abundant as on many British sites; both colour forms: all white, and orange disc with white tentacles occurred.

Adamsia carcinopados Few specimens found; Teissier, 1965 considers it common at depths of more than 20m.

Alcyonium digitatum Definitely uncommon and presumably approaching the southern limits of its range here; white and orange forms seen.

Alcyonium glomeratum More common and abundant than A. digitatum and often occurring in habitats where, in Britain, one would expect to find the latter (i.e. more out in the open).

Anemonia viridis Probably much more common than our records suggest, presumably because most dives were too deep.

Aureliana heterocera One specimen only seen.

Balanophyllia regia Another species that was probably under-recorded, probably due to by-passing its shallow water habitats.

Calliactis parasitica Not uncommon but easy to overlook as, in spite of its size, this anemone is well camouflaged and often overgrown with algae.

Caryophyllia smithii Surprisingly uncommon, even at sites where one would expect it to be present in abundance (e.g. Astan). Teissier, 1965 does not comment on its abundance in the Bay, which suggests that our observations were fairly accurate.

Cereus pedunculatus Another species that was surprisingly uncommon, in spite of many suitable habitats; Teissier, 1965 suggests that it may be more abundant in shallow water and in the littoral zone.

Cerianthid sp. this is the species that appears in Manuel, 1983 as Cerianthus membranaceus which it certainly is not! (also in Teissier, 1965 under this name). The first specimen, from the MCS Channel Isles Expedition of 1982, was named 'Dorothy', for no particular reason, and the name seems to have stuck. Dissection of specimens from the present expedition has revealed that this is a species of Pachycerianthus but the specific identity is still unknown. It occurred mainly in crevices between boulders, typically with the thick tube winding down into the gravel beneath. At La Noire (site 2) it was found in coarse shelly gravel along with Mesacmaea and Cerianthus lloydii. The largest specimens were among rocks, with only small ones in the gravel at La Noire. Colours ranged from the 'normal' brown/cream pattern to purple, plain white and bright golden yellow.



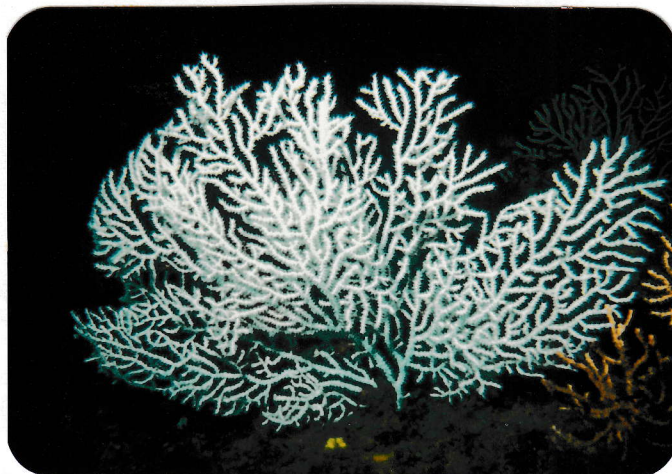
Cerianthid 'Dorothy'. Le Paradis (site 1). C.Lumb.

Cerianthus lloydii Recorded at only two sites; but not recorded at all in Teissier, 1965

Corynactis viridis Very widespread but rarely abundant and dominating the substratum in almost continuous aggregations, as in many British sites; such abundance was only seen at Basse Brien (site 6) and then only locally.

Epizoanthus couchii Very common on all rocky substrata, shells, and small cobbles; probably under-recorded.

Eunicella verrucosa Common at all rocky sites, typical habitats being across gullies, along ridges, and on the sides of cliffs. The number of white: pink specimens was estimated at 1:10. Some specimens were heavily overgrown with tunicates, bryozoans, etc, but most were very clean and healthy. The nudibranch Tritonia ohdneri, which feeds on Eunicella, was observed frequently.



White Eunicella verrucosa. Astan (site 5). R.L.Manuel.

Hormathia coronata One specimen only seen; common in deeper water (60m +) according to Teissier, 1965.

Isozoanthus sulcatus Apparently scarce in this area, but known to be common in S.Brittany.

Leptopsammia pruvoti Seen only at Astan (site 5) at about 25m; this agrees with Teissier, 1965 who says this species is usually found in deep water.

Mesacmaea mitchellii Quite common at La Noire (site 2) where the habitat was typical for this species.

Parazoanthus anguicomus This is the large white Parazoanthus which is presumably the P.marioni of some French lists. One extensive colony was found at Astan (site 5).

Parazoanthus axinellae Surprisingly scarce considering how abundant it is in the Channel Isles: Teissier, 1965 who lists it as P.haddoni, agrees.

Sagartia spp. Both S.elegans(var.venusta) and S.troglodytes were seen but most records were as Sagartia sp. so they have not been separated.

Sarcodictyon roseum One small colony seen.

Urticina (Tealia) felina Like Alcyonium digitatum this species is near its southern limits here, which should account for our paucity of records.

5.3. Platyhelminthes

5.3.1. Turbellaria. A few specimens of Prostheceraeus vittatus were recorded at S.of Le Cordonnier (site 4), and at La Tortue (site 9).

5.4. Nemertea

One specimen of Tubulanus annulatus of about 30cms long was seen on the maerl S.of Le Cordonnier (site 4).

5.5. Annelida

5.5.1. Polychaeta. The notes following are for those species easily recorded in situ.

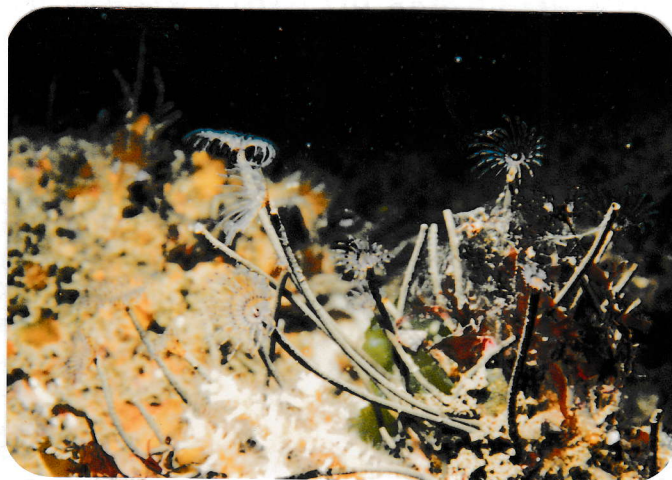
Bispira volutacornis. Occasional amongst boulders and in crevices in bedrock.

Branchiomma vesiculosum. Occasional in coarse shelly gravel and maerl and common in shell gravel patches in shallow depths at wave sheltered sites.

Lanice conchilega. On shell gravel and maerl in shallow wave sheltered areas and amongst boulders on the plains at 21-22m at Les Trepieds (site 8).

Pomatoceros triqueter. On boulders on the plain at 21-22m at Les Trepieds (site 8). Doubtless underrecorded.

Pseudosabella variabilis. Present in the lower circalittoral and only abundant deeper than about 24m on the open coast. Forming forests on vertical and steeply sloping rocks, and some on Eunicella verrucosa at Le Paradis (site 1) where it was present below 11m. This species is found in Britain only in the extreme south-west.



Pseudosabella variabilis, Le Paradis (site 1), R.L.Manuel.

Sabella pavonina Very rarely observed except at La Noire (site 2) where it was frequent in coarse shelly gravel.

Sabella spallanzani Rare individuals of this large spectacular worm were observed on cave roofs, on vertical rock, and amongst boulders at almost all sites. This species is not known from Britain.



Sabella spallanzani, S.of Le Cordonnier (site 4), K.Hiscock.

Salmacina dysteri. Occasional colonies attached to rocks and other sessile species mainly in the circalittoral.

Serpula vermicularis. Present at the back of a small bedrock cave

S. of Le Cordonnier (site 4), and in a small cave at Astan (site 5).

Spirorbinidae. This group was probably widely distributed but not generally searched for, collected or noted.

5.6. Crustacea

5.6.1. Cirripedia. Balanus crenatus was most abundant at open coast sites and particularly on the boulder plain at Les Trepieds (site 8). A large barnacle with a pointed tergum, possibly B. balanus, was present in the circalittoral at Le Corbeau (site 3), and noted as possibly present under-all at Basse Brien (site 6).

5.6.2. Decapoda.

Galathea strigosa. Present in crevices at some sites.

Liocarcinus puber. One or two seen at four sites, but recorded as occasional at La Tortue (site 9).

Paguridae. Solitary individuals sometimes identified as Pagurus bernhardus in the field. With Calliactis parasitica at Le Paradis (site 1) and S. of Le Cordonnier (site 4).

Pisa tetraodon. One at S. of Le Cordonnier (site 4) encrusted with algae and tunicates and many small individuals under stones at La Tortue (site 9).

Pisidia longicornis. Recorded from a sample from Le Paradis (site 1).

All other Decapod crustacean species recorded were observed as solitary individuals only.

5.7. Chelicerata

5.7.1. Pycnogonida. Unidentified pycnogonids were noted from two sites on other collected material.

5.8. Mollusca

Some 37 species of Molluscs were recorded during the 4 days of diving, of these only 10 were Nudibranchs and only 4 species of Nudibranch were reported more frequently than rare. These were; Antiopella cristata, Aplysia punctata, Cadlina laevis and Tritonia odhneri. These feed on Bugula, Algae, Porifera and Eunicella respectively. During the expedition it was noticed that there were relatively few hydroids and bryozoans and this shortage of common food species could account for the small number of species recorded. Of the four seen most frequently only one fed upon a bryozoan, Bugula, a species that was not uncommon. The large numbers of Tritonia odhneri seen were certainly related to the great quantities of Eunicella compared to British waters.

Two molluscs reported on almost every dive were Calliostoma zizyphinum, and Gibbula cineraria. This merely demonstrates that these species manage to find a suitable habitat in most terrains, and that algae were found and examined on most dives. The unique habitat of the maerl bed S. of Le Cordonnier (site 4) produced records of 9 molluscs that were not recorded elsewhere. These were Acmaea virginea, Buccinum undatum, Cantharidus clelandi, Ensis sp. Lepidochiton cinereus, Lutraria lutraria, Natica alderi, N. montagui and Venus sp. This may be partly attributed to the uniqueness of the habitat and partly to the general lack of variety in animals that concentrated the divers attention upon the molluscs to a greater degree than at other sites. However, this site did provide the only Chiton record for the expedition. On the other hand Roscoff Ferry Port (site 7) produced no Mollusc records at all. Whether this reflects the habitat (flat sand), the fact that it was dived at night, or the fact that only a few divers went in, is not known.

5.9. Bryozoa

Open rock surfaces below the Laminaria line were occasionally covered by a carpet of foliose red algae and erect Bryozoa such as Cellaria sp., also Crisiidae. A red encrusting bryozoan was noted at most sites.

Alcyonidium diaphanum was found on horizontal surfaces and reported at least occasionally from all sites. (Note—until recently this species was commonly being erroneously recorded as 'A. gelatinosum'. See Hayward 1985). Bugula spp were perhaps less frequent than in British waters. Bugula turbinata was rarer than B. plumosa, although they were found at the same sites. Chartella papyracea was frequent/common at all sites, except S. of Le Cordonnier (site 4), usually on vertical surfaces just below the Laminaria line. Reports of Securiflustra may have been Chartella.

Membranipora membranacea occasionally colonised kelp fronds, noticeably Laminaria hyperborea, but Phyllophora sicula at Astan (site 5) and Palmaria palmata at Les Trepieds (site 8) were colonised also. Omalosecosa ramulosa and Pentapora foliacea were noted at all sites except S. of Le Cordonnier (site 4). Pentapora specimens were smaller (max. 15cm compared to 30cm at other sites) and more irregularly shaped at Le Corbeau (site 3), and Basse Brien (site 6), and a white specimen was found inside a cave at Astan (site 5). The fewest bryozoan species were noted S. of Le Cordonnier (site 4), the most at Les Trepieds (site 8).

5.10. Brachiopoda

Terebratulina retusa occurred in small groups at depths around 25m at Astan (site 5) and Les Trepieds (site 8).

5.11. Echinodermata

Echinoderms of one sort or another were found at all sites. In general several species were found at each site although not in very large numbers.

5.11.1. Crinoidea

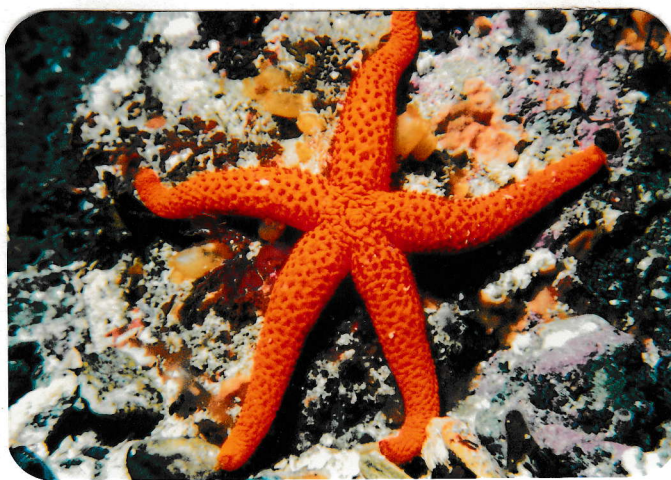
Antedon bifida was found at one site, Astan (site 5), and recorded as rare with only a few specimens observed. As Antedon is regarded as a N.E. Atlantic species, it is possible that it is reaching it's southern limits on the Brittany coast.

5.11.2. Asteroidea

Asterias rubens, again generally a N.E. Atlantic species in it's distribution was only found at one site, Basse Brien (site 6) and so again may be reaching it's southern limits. Henricia oculata, (N.E. Atlantic in it's distribution) and Marthasterias glacialis (N.E. Atlantic and Mediterranean distribution) were present at most sites as Rare to Occasional. While Henricia was only found at rocky sites where it feeds on sponges, Marthasterias was also observed on the maerl bed (site 4) reflecting it's wider habitat range. One specimen at La Noire (site 2) was observed feeding on Mytilus.

The species of Asterina is probably A. gibbosa. It can tolerate lowered salinity, however, although the sites were located in the Baie de Morlaix, the mouth of a large estuary, all specimens were found at depths ranging from 19-26.5m. below chart datum.

Echinaster sepositus, regarded as a Mediterranean species was noticeable in the Baie de Morlaix being recorded at 5 sites but not appearing to occur on the south west coast of England. Specimens ranged from small to large in size and at varied depths. One individual was observed feeding on Cliona celata at Astan (site 5).



Echinaster sepositus. Les Trepieds (site 8). R.L. Manuel.

5.11.3 Ophiuroidea

A number of different species of brittle-star were recorded. Each species however, was only found at a few sites and in low numbers/abundance. Ophiothrix fragilis occurred in cracks and crevices at Astan (site 5) on a vertical rock face at 25 m below chart datum and in the rocks by the maerl bed (site 4). One record was made of Ophiura texturata (?) on the maerl bed (site 4). This N.E. Atlantic and Mediterranean species generally occurs on mud and sand and so may explain its location and the reason for its absence elsewhere.

5.11.4. Echinoidea

Echinus esculentus was observed at most sites, at a range of depths, as Rare to Occasional and so may be reaching its southern limits.

5.11.5. Holothurioidea

The most common sea-cucumber and echinoderm was Aslia lefevrei which occurred at nearly all sites in crevices from Rare to Abundant. Pawsonia saxicola was recorded from Les Trepieds (site 8) and La Tortue (site 9) as Frequent and Common respectively. It was felt by the recorder of this species that many may have been recorded as Aslia. Therefore perhaps the records for the two species should be taken together as an Aslia/Pawsonia aggregate. Holothuria forskali was also occasionally found at most sites.

5.12. Chordata

5.12.1. Ascidiacea. A total of 21 species of sea squirts were recorded, plus 4 further uncertain species. Comments of interest taken from the recording sheets follow.

Aplidium punctum. A few recorded on large shell fragments at La Noire (site 2). Found both on kelp stipes, and in deeper water (20-22m) at Les Trepieds (site 8). Recorded as common at La Tortue (site 9) in large patches about 20cms. across.

Ascidia conchilega. Only one specimen seen, in a crevice at Astan (site 5), with the characteristic 8 blotches on the oral siphon.

Ascidia mentula. Recorded in crevices S. of Le Cordonnier (site 4), and at La Tortue (site 9), those at the latter site being large.

Botryllus schlosseri. Together with Stolonica socialis, the most common and frequently recorded ascidian. Found growing on rock, around hydroids, and on Eunicella. The commonest colour variety was a bright citrus yellow, large patches forming a characteristic component of the sublittoral scenery. Other colours encountered were orange and olive.

Ciona intestinalis. Several specimens found only S. of Le Cordonnier (site 4). A few were on the carapace of a specimen of Pisa tetradon, a couple were in a shell on the maerl, and a few more were seen on rock. Probably more common than these records suggest (see Levi, 1955), perhaps being confined to cryptic

habitats.

Clavelina lepadiformis. Surprisingly uncommon. When encountered, colonies would typically possess only one or two zooids.

Diazona violacea. Only found at the open, deeper water sites, Astan (site 5) and Les Trepieds (site 8). At Astan, colonies on vertical rock faces were noted as being flattened, with a few to many zooids; those on horizontal rock surfaces were more erect and bulbous, upto 20cms.across, with many zooids.

Didemnum maculosum. Recorded as common on kelp stipes at La Tortue (site 9).

Distomus variolosus. Found in large patches S.of Le Cordonnier (site 4) and at La Tortue (site 9). Characteristically sheeting across rocks, kelp holdfasts and up the stipes. Also found on other animate substrata such as the base of the exposed tube of Sabella spallanzani.

Molgula sp. Found S. of Le Cordonnier (site 4) covered in maerl, and in patches of shell gravel at Les Trepieds (site 8) and at La Tortue (site 9).

Morchellium argus. Large clumps were reported from Le Corbeau (site 3) and La Tortue (site 9). Recorded growing on Eunicella at Astan (site 5).

Polycarpa rustica. At the three sites where this species was recorded (S of Le Cordonnier, site 4, Les Trepieds, site 8, and La Tortue, site 9), it tended to form a significant component of the sessile rock fauna in local areas. When partially contracted, its square shaped siphons were quite characteristic.

Polysyncraton lacazei. Although this species was not ecologically important, its uniform deep red colour gave it a most distinctive appearance. It was encountered in modest numbers at four sites. According to Levi, 1955, it is very common in the Roscoff area, although apparantly unknown on the English side of the Channel.



Polysyncraton lacazei. Le Paradis (site 1) C.Lumb.

Pycnoclavella aurilucens. Sometimes found covering large areas, on both animate and inanimate substrates.

Stolonica socialis. Together with Botryllus schlosseri, the most common and frequently recorded species. A very characteristic component of the underwater scenery. Curiously, the sponge feeding Cadlina laevis was reported 'feeding' on it at Astan (site 5).

Sydnium elegans. Colonies were recorded in attractive groups from La Tortue (site 9), somewhat unusual as colonies typically occur singly.

Sydnium turbinatum. S. of Le Cordonnier (site 4), this species was recorded as frequent, with maerl being its substrate.

Styela clava. Both the records from Le Corbeau (site 3) and La Tortue (site 9) were of single specimens. Although not recorded in Levi, 1955, this introduced species inhabits similar silty and sheltered locations on the English side of the Channel, and could be expected to occur in larger numbers in the Bay of Morlaix.

Trididemnum cereum. This was only recorded at Astan (site 5), where it was covering large patches of some Eunicella colonies.

Taking into account the difficulties of in situ identification of some species, the ascidian fauna in the Bay of Morlaix appears reasonably rich. Perhaps only three species were not encountered that might have been expected- Diplosoma listerianum and Ascidiella aspersa (both cited in Levi, 1955), and Phallusia mammillata (not in Levi, 1955). This latter species extends from the extreme south of the British Isles to the Mediterranean, but is apparently very patchily distributed within its range. The only site where it is known to occur commonly in Britain is Portland Harbour. This silty and sheltered environment shares similarities with the Bay of Morlaix, which in turn is presumably similar to rias in N.W. Spain, where the species also occurs (Picton, 1985).

5.12.2. Gnathostomata. A total of 17 positively identified fish species were observed, with perhaps half a dozen more identified to family only. The remarks that follow are based on comments of interest from the recording sheets.

Conger eels, Conger conger, were recorded at 4 sites - at La Corbeaux (site 3) in an old pipe at 28m; the one specimen seen at Astan (site 5) was noted as 'very large'; of the 4 seen at Basse Brien (site 6), two were seen swimming freely in a crevice on the cliff, and another in a hole with large prawns and Leopard Spotted Gobies (Thorogobius ephippiatus). A large (10cm) specimen of the latter was also noted under a crawfish at Les Trepieds (site 8), perhaps suggesting that an association with larger animals is purposeful. Only two other goby (Gobiidae) species were recorded - the Sand Goby (Pomatoschistus minutus) at three sites, and the Two-spotted Goby (Gobiusculus flavescens) at six sites, swimming low over the substrate at La Noire (site 2), and shoaling over kelp at Astan (site 5), La Tortue (site 9), and probably adopting this characteristic habitat at the other sites too.

Cling-fishes (Gobiesocidae) were observed only at S. of Le Cordonnier (site 4), where two species were differentiated. According to Le Gall, 1956, all four northern European cling

fishes are common in the region.

Cod Fishes (Gadidae). Gadoids were seen at six sites, frequently as shoals of small fish which were difficult to identify in the field. Shoals of Bib (Trisopterus luscus) were seen only at Astan (site 5). Although Bib are fairly easy to identify in the field, the closely related Poor Cod, (T.minutus) is more difficult, and was only recorded with certainty from Astan (site 5), and doubtfully from Les Trepieds (site 8), where they were shoaling around rocky outcrops (Poor Cod in British waters tend to live under ledges near the seabed). Where unidentified, the gadoids were recorded as 'silver with yellow streak' (Le Paradis, site 1), 'a shoal of a dozen or so, feeding' (Les Trepieds, site 8), and 'many shoals around cliffs in lower infralittoral/ upper circalittoral at 18m' (La Tortue, site 9). Although populations of small gadoids are seen by divers in the English Channel Coast, they frequently turn out to be pollack (Pollachius pollachius), a surprising absence from our records from the Bay of Morlaix.

A few juvenile Dory's (Zeus faber) were seen and photographed on the night dive at Roscoff ferry port (site 7).

Wrasses (Labridae). Both the Ballan (Labrus bergylta) and the Cuckoo (L.mixtus) wrasses were recorded at seven sites. At sites 1,5,6,and 8 the 'large' size of the Ballan wrasse was particularly noted. At Astan (site 5), several such specimens were seen around, and below the kelp limit. At Basse Brien (site 6), they were seen living territorially in gullies and under boulders, from below the kelp line to 30m. Cuckoo wrasse of various sizes were recorded, 'females' being commoner than 'males'. Surprisingly, the Corkwing wrasse (Crenilabrus melops) was recorded by only one pair of divers at one site (La.Tortue, site 9), although Le Gall, 1956 records it as very common in Zostera beds and rocky areas. Goldsinny wrasse (Ctenolabrus rupestris) were recorded at seven sites, some observed at La Tortue (site 9) as small as 5cms. At Basse Brien (site 6) and Les Trepieds (site 8) many territorial populations were noted, several of much greater numbers of individuals than in British waters. By contrast, the Rock Cook (Centrolabrus exoletus) was observed in small territorial shoals at Basse Brien (site 6), but only recorded at two other sites (8 and 9). It appears to be much less frequent over its range of distribution than the similar Goldsinny.

The ubiquitous Tompot Blenny (Parablennius gattorugine) was the only blenny (Blenniidae) recorded, at seven sites. It occupied its typical rock crevice habitats, and at Le Corbeau (site 3) many were seen sitting outside boulder crevices at 15-20m, retreating on being approached.

Sandeels (Ammodytidae). Two shoals were seen at Les Trepieds (site 8), one being very large, spanning a depth range of 4m between 22-26m. The species involved was probably Ammodytes tobianus.

The fish fauna of the Bay of Morlaix is apparantly no different from many S.W .Britain sites. Taking into account the habitats dived, most of the species encountered could have been predicted. Although some of the sites visited had sediment substrates, no sediment dwelling flatfish (Rajidae, Scophthalmidae, Bothidae, Pleuronectidae or Soleidae) were encountered, although the

Topknot (Zeugopterus punctatus), which occurs on rocks, was found. Other species not found that might have been expected are the Long-spined Sea Scorpion (Taurulus bubalis), Grey Mulletts (Mugilidae), and definite sightings of Pollack (Pollachius pollachius).

Appendix 1Habitat Types By Depth Zone

<u>Habitats</u>	Site No.	1	2	3	4	5	6	7	8	9.
<u>Upper Infralittoral</u>										
Bedrock -upwards facing		*	*	-						*
Bedrock -upwards facing (wave exposed)		*				-	*		*	
Bedrock -vertical			*							*
Bedrock -vertical (wave exposed)						-	*		*	
Bedrock-upwards facing (exposed to tidal streams)							*		*	
Bedrock outcrops / sand					*			*		
Maerl / coarse shell gravel					*					
Muddy shell sand / gravel								*		
Kelp Stipes		-	-	-		-	*	-	-	-
<u>Lower Infralittoral</u>										
Bedrock -upwards facing		*	*	-						*
Bedrock -upwards facing & wave exposed						*	*		*	
Bedrock -vertical		*	*							*
Bedrock -vertical & wave exposed						*	*		*	
Bedrock -upwards facing & exposed to strong tidal streams							*		*	
Boulders		*								
Boulders -exposed to moderate tidal streams									*	*
Shell Gravel			*						*	
<u>Upper Circalittoral</u>										
Bedrock -upwards facing		*		*						*
Bedrock -upwards facing & wave exposed						*	*			
Bedrock -upwards facing & exposed to tidal streams				*			*			*
Bedrock -vertical facing		*		*						*
Bedrock -vertical facing & wave exposed						*	*			
Boulders -		*								
Boulders -exposed to moderate tidal streams				*		*	*			
<u>Lower Circalittoral</u>										
Bedrock -upwards facing		*		*						*
Bedrock -upwards facing (& wave exposed)						*				
Bedrock -vertical facing		*		*		*				
Boulders -exposed to moderate tidal streams				*		*				*
Caves						*				*

	Site No.								
	1	2	3	4	5	6	7	8	9
<u>Kallymenia reniformis</u>	P	P		O	O	F		O	O
<u>'Lithothamnia'</u>	C	C		F		A		F	F
<u>Lithothamnion coralloides</u>	R			A					R
<u>Lomentaria clavellata</u>	P			O					O
<u>Membranoptera alata</u>						P			
<u>Meredithia microphylla</u>	F				O	F		O	O
<u>Myriogramme sp.</u>					P			O	O
<u>Nitophyllum punctatum</u>									P
<u>Palmaria palmata</u>						O			O
<u>Peyssonnelia dubyi</u>	F			P?					
<u>Peyssonnelia harveyana</u>				P					
<u>Peyssonnelia immersa</u>				P					
<u>Phycodrys rubens</u>	F					C		C	C
<u>Phyllophora crispa</u>	F	O				F		F	F
<u>Phyllophora pseudoceranoidea</u>	P					P			
<u>Phyllophora traillii</u>									P
<u>Phymatolithon calcareum</u>				F					
<u>Phymatolithon polymorphum</u>	P			P				O	O
<u>Plocamium cartilagineum</u>	O	O				O		O	C
<u>Polyneura gmelinii</u>									O
<u>Polyneura hilliae</u>		P	P	P?					F
<u>Polysiphonia spp.</u>	P			P					F
<u>Porphyra spp.</u>				P					
<u>Porphyropsis coccinea</u>	P			F					
<u>Pterosiphonia parasitica</u>	P				O				O
<u>Rhododiscus pulcherrimus</u>				P					
<u>Rhodomela confervoides</u>	P								
<u>Rhodophyllis divaricata</u>	P								
<u>Rhodophyta indet 1</u>	P								
<u>Rhodophyta indet. (dark encr)</u>	C	F		C		O		O	O
<u>Rhodymenia delicatula</u>									O
<u>Rhodymenia holmesii</u>	O				C	F		O	F
<u>Rhodymenia pseudopalmata</u>	O		P		P	O		O	F
<u>Rhodymenia pseudopalmata</u> <u>on L. hyperborea</u>	C	C			C	C		C	C
<u>Rhodymenia pseudopalmata (spiky)</u>	P	P		O	C	O		O	P
<u>Schottera nicaeensis</u>	F	P				F		O	F
<u>Schmitzia neopolitana</u>				F					
<u>Scinaea sp.</u>	P	P		F					
<u>Scinaea forcillata</u>		P		F					
<u>Scinaea turgida</u>				F					P
<u>Spermothamnion repens</u>				P					
<u>Stenogramme interrupta</u>									O
CHRYSOPHYTA									
<u>Bacillariophyceae indet.</u>				P					
PHAEOPHYTA									
<u>Aglaozonia parvula</u>	O			O				O	O
<u>Arthrocladia villosa</u>				O					
<u>Asperococcus sp.</u>				O					R
<u>Carpomitra costata</u>				O					
<u>Cladostephus sp.</u>	O								
<u>Desmarestia dresnayi</u>				O					

	Site No.								
	1	2	3	4	5	6	7	8	9
<u>Desmarestia ligulata</u>				O					
<u>Desmarestia viridis</u>									P
<u>Dictyopteris membranacea</u>	O	O		F	F	R		O	O
<u>Dictyota dichotoma</u>	C	F		A	C	O		F	F
<u>Halidrys siliquosa</u>	O						F		?
<u>Halopteris filicina</u>	F	F		F	F	O		F	F
<u>Laminaria ochroleuca</u>	F	O			A	P		C	C
<u>Laminaria hyperborea</u>	F	P			A	A		F	C
<u>Laminaria saccharina</u>				F			F		O
<u>Phaeophyta indet.1.</u>				O					
<u>Phaeophyta indet.2.</u>									
<u>Phaeophyta indet.3.</u>	O								O
<u>Saccorhiza polyschides</u>									O
<u>Sargassum muticum</u>	O		R			F	F	F	
<u>Sporochnus pedunculatus</u>	P			O					
<u>Taonia atomaria</u>	P			F					
CHLOROPHYTA									
<u>Bryopsis plumosa</u>	P	R							O
<u>Cladophora spp.</u>	P								
<u>Enteromorpha spp.</u>	O			O					R
<u>Ulva sp.</u>	F			O			F		F

Appendix 3
Flora listed with Substrate Type

RHODOPHYTA	Bedrock			
	Crevices	Overhangs	Steep/vertical	Gentle slope / horizontal
<u>Acrosorium uncinatum</u>				✓
<u>Acrosorium reptans</u>				✓
<u>Ahnfeltia plicata</u>				
<u>Antithamnion plumulata</u>				✓
<u>Antithamnion cruciatum</u>				
<u>Antithamnion spirographidis</u>				
<u>Apoglossum ruscifolium</u>				✓
<u>Audouinella sp.</u>				
<u>Bonnemaisonia asparagoides</u>	✓			✓
<u>Brongniartella byssoides</u>				✓
<u>Calliblepharis ciliata</u>				
<u>Calliblepharis jubata</u>				✓
<u>Callithamnion spp.</u>				✓
<u>Callophyllis laciniata</u>				
<u>Ceramium rubrum (agg)</u>				
<u>Ceramium sp.</u>				
<u>Chondria dasyphylla</u>				
<u>Chondrus crispus</u>				
<u>Compsothamnion thuyoides</u>			✓	✓
<u>Corallina sp.</u>				
<u>Cordylecladia erecta</u>				
<u>Cruoria rosea</u>				
<u>Cryptopleurax ramosa</u>			✓	✓
<u>Delessaria sanguinea</u>				✓
<u>Dilsea carnosa</u>				✓
<u>Drachiella spectabilis</u>				
<u>Gastroclonium ovatum</u>				
<u>Gelidiella calcicola</u>				
<u>Gelidium latifolium</u>				
<u>Gracilaria verrucosa</u>				
<u>Gracilaria foliifera</u>				
<u>Grateloupia filicina</u>				
<u>Griffithsia corallinoides</u>				
<u>Griffithsia devoniensis</u>				✓
<u>Griffithsia flosculosa</u>				
<u>Gymnogongrus crenulatus</u>				
<u>Gymnogongrus devoniensis</u>				
<u>Gymnogongrus griffithsiae</u>				
<u>Halarachnion ligulatum</u>				✓
<u>Halurus equisetifolius</u>				✓
<u>Helminthocladia sp.</u>				
<u>Heterosiphonia plumosa</u>				
<u>Hildenbrandia sp.</u>				
<u>Hypoglossum woodwardii</u>			✓	
<u>Kallmenia reniformis</u>			✓	
<u>'Lithothamnion'</u>		✓	✓	
<u>Lithothamnion corallioides</u>				
<u>Lomentaria clavellosa</u>				
<u>Membranoptera alata</u>				

Adjacent Sediments	Cobbles		Shells		Maerl	Shell Gravel	Other Algae	
	Boulders		Pebbles			L.hyperborea	Not noted	
	✓	✓	✓				✓	
			✓				✓	
✓			✓					✓
								✓
✓				✓	?			✓
			✓					
		✓	✓	✓				✓
	✓						✓	
✓			✓					✓
			✓					✓
			✓					✓
			✓					✓
			✓				✓	
			✓				✓?	
✓			✓					✓
		✓	✓		✓			✓
✓			✓					✓
✓			✓	✓				✓
✓			✓	✓				✓
✓			✓	✓				✓
✓			✓	✓				✓
✓			✓	✓	✓			✓
✓			✓	✓				✓
✓	✓	✓	✓					✓
✓			✓			✓		
✓			✓				✓	

RHODOPHYTA	Crevices	Overhangs	Steep / Vertical	Gentle Horiz.
<u>Meredithia microphylla</u>		✓	✓	
<u>Myriogramme bonnemaisonii</u>				
<u>Nitophyllum punctatum</u>				
<u>Palmaria palmata</u>				✓
<u>Peyssonnelia dubyi</u>				
<u>Peyssonnelia harveyana</u>				
<u>Peyssonnelia immersa</u>				
<u>Phycodrys rubens</u>				✓
<u>Phyllophora crispa</u>	✓		✓	✓
<u>Phyllophora pseudoceranoides</u>				
<u>Phyllophora traillii</u>			✓	
<u>Phymatolithon calcareum</u>				
<u>Phymatolithon polymorphum</u>				
<u>Plocamium cartilagineum</u>				✓
<u>Polyneura gmelinii</u>				
<u>Polyneura hilliae</u>				✓
<u>Polysiphonia spp.</u>				
<u>Porphyra spp.</u>				
<u>Porphyropsis coccinea</u>				
<u>Pterosiphonia parasitica</u>				
<u>Rhododiscus pulcherrimus</u>				
<u>Rhodomela confervoides</u>				
<u>Rhodophyllis divaricata</u>				
<u>Rhodophyta indet.3.</u>				
<u>Rhodophyta indet.(dark encr)</u>				✓
<u>Rhodymenia delicatula</u>		✓	✓	
<u>Rhodymenia holmesii</u>			✓	✓
<u>Rhodymenia pseudopalmata</u>			✓	✓
<u>Rhodymenia pseudopalmata</u> (spiky)				
<u>Schottera nicaeensis</u>		✓	✓	
<u>Schmitzia neapolitana</u>				
<u>Scinaea sp.</u>				
<u>Scinaea forcellata</u>				
<u>Scinaea turgida</u>				
<u>Spermothamnion repens</u>				
<u>Stenogramme interrupta</u>				✓
CHRYSOPHYTA				
<u>Bacillariophyceae indet.</u>				
PHAEOPHYTA				
<u>Aglaozonia parvula</u>				
<u>Arthrocladia villosa</u>				
<u>Asperococcus sp.</u>				
<u>Carpomitra costata</u>				
<u>Cladostephus spongiosus</u>				
<u>Desmarestia dresnayi</u>				
<u>Desmarestia ligulata</u>				
<u>Desmarestia viridis</u>				
<u>Dictyopteris membranacea</u>				✓
<u>Dictyota dichotoma</u>			✓	✓
<u>Halidrys siliquosa</u>				✓

Adjacent Sediments	Cobbles		Shells	Shell Gravel		Other Algae	
	Boulders	Pebbles		Maerl	L.hyperborea	Not	Noted
							✓
		✓	✓		✓		✓
		✓	✓				
			✓				
			✓			✓	
✓							✓
	✓	✓			✓		
	✓	✓	✓	✓			
			✓				✓
✓				✓			✓
	✓			?	✓		✓
							✓
	✓	✓	✓	✓	✓	✓	
		✓	✓				
						✓	
							✓
✓			✓		?		
					✓		
			✓	✓			
✓			✓	✓			
			?				
			✓	?	?		
	✓		✓				
			✓				✓
✓	✓	✓	✓	✓		✓	

PHAEOPHYTA	Crevices	Overhangs	Steep Vert.	Gentle Horiz.
<u>Halopteris filicina</u>				✓
<u>Laminaria ochroleuca</u>			✓	✓
<u>Laminaria hyperborea</u>			✓	✓
<u>Laminaria saccharina</u>				
<u>Phaeophyta indet.1.</u>				
<u>Phaeophyta indet.2.</u>				
<u>Phaeophyta indet.3.</u>				
<u>Saccorhiza polyschides</u>				✓
<u>Sargassum muticum</u>				
<u>Sporochnus</u>				
<u>Taonia atomaria</u>				
CHLOROPHYTA				
<u>Bryopsis plumosa</u>				
<u>Cladophora spp.</u>				
<u>Enteromorpha spp.</u>				
<u>Ulva sp.</u>				

Adjacent Sediments	Cobbles		Shells	Shell gravel		Other Algae	Not Noted
	Boulders	Pebbles	Maerl	L.hyperborea			
		✓					
	✓						
	✓	✓					✓
							✓
		✓	✓				✓
		✓	✓				✓
		✓	✓				✓
			✓	✓			✓
✓		✓	✓			✓	✓

APPENDIX 4
Fauna Lists

Species name	Site no.	1	2	3	4	5	6	7	8	9
PORIFERA										
<u>Adreus fascicularis</u>		R								
<u>Amphilectus fucorum</u>			C	F		O	F			C
<u>Antho involvens</u>						O	R			
<u>Axinella damicornis</u>			R	R		R	C		F	O
<u>Axinella flustra</u>						R	C			
<u>Axinella polypoides</u>						R	F			
<u>Ciocalypta penicillus</u>		R	O							O
<u>Clathrina coriacea</u>			O							
<u>Cliona celata</u>		C	O	O	R	O	F		C	O
<u>Dercitus bucklandi</u>		R				R	R			O
<u>Dysidea fragilis</u>		C	C	O	R	R	F		O	F
<u>Halichondria panicea</u>		R	F							R
<u>Haliclona cinerea</u>				F	R					F
<u>Haliclona fistulosa</u>		R		O		O				R
<u>Haliclona oculata</u>										R
<u>Haliclona simulans</u>		F	C	C	F	R	O			C
<u>Haliclona viscosa</u>		O	F			O	O	F		O
<u>Hemimycale columella</u>		O	O	O		O	F		O	O
<u>Homaxinella subdola</u>						R				R
<u>Hymeniacion perleve</u>			F	R						O
<u>Iophon sp.</u>				R		R				
<u>Iophonopsis nigricans</u>						R	R		R	
<u>Leuconia nivea</u>			O		R		R			
<u>Leucosolenia botryoides</u>		O	O				O			O
<u>Myxilla incrustans</u>			O	O		R	C			
<u>Pachymatisma johnstonia</u>		O	O	O		F	F		O	O
<u>Polymastia boletiformis</u>		O	O	F		O	R		R	R
<u>Polymastia mamillaris</u>		O	F	F	R				R	R
<u>Raspailia hispida</u>		R	O	O		R				
<u>Raspailia ramosa</u>		O	R	O		O	O		R	F
<u>Stelligera rigida</u>		R	R	O		O	R		R	R
<u>Stelligera stuposa</u>			O	O		O	O			O
<u>Stelletta grubii</u>						R				
<u>Suberites carnosus</u>		R								
<u>Suberites domuncula</u>		R			R					R
<u>Sycandra utriculus?</u>										R
<u>Tethya aurantium</u>		C	C	F	F	F	C		R	R
<u>Thymosia guernei</u>							R			
<u>Ulosa digitata</u>			O	F						O
Encrusting orange thin-channelled sponge		C	F	F						F
Encrusting red sponge										F
Encrusting yellow sponge		O	F	F						R
Encrusting thick orange sponge					R					
Encrusting white sponge				O						

Species Name	Site No.	1	2	3	4	5	6	7	8	9
		COELENTERATA-HYDROZOA								
<u>Aglaeophaenia</u> sp.			F		C				O	
<u>Amphisbaetia operculata</u>			F							
<u>Corymorpha nutans</u>								R		
<u>Halecium</u> sp.		R	O	R		F	O			R
<u>Hydractinia echinata</u>					O			R		
<u>Hydrallmania falcata</u>			O	O	R					
<u>Nemertesia antennina</u>		R	F	C						O
<u>Sertularella polyzonias</u>				O		C			F	O
<u>Sertularia</u> sp.				O					F	R
COELENTERATA- ANTHOZOA										
<u>Actinothoe sphyrodeta</u>		O	O	O	R	R	R		C	O
<u>Adamsia carciniopados</u>					R					
<u>Alcyonium digitatum</u>		O	O			R			O	O
<u>Alcyonium glomeratum</u>		O	O			F	F		F	O
<u>Anemonia viridis</u>		R				R		F	R	O
<u>Aureliana heterocera</u>			R							
<u>Balanophyllia regia</u>			R							
<u>Calliactis parasitica</u>		R	O		O					
<u>Caryophyllia smithii</u>		O	O	R		O	O		R	R
<u>Cereus pedunculatus</u>		R	R		R			R		
<u>Cerianthid</u> sp. 'Dorothy'		O	O				R		R	C
<u>Cerianthus lloydii</u>			R					R		
<u>Corynactis viridis</u>		O	O	R		C	A		O	O
<u>Epizoanthus couchii</u>		C	O	O		O	O		O	O
<u>Eunicella verrucosa</u>		F	A	O		C	C		F	O
<u>Hormathia coronata</u>		R								
<u>Isozoanthus sulcatus</u>						R			R	R
<u>Leptopsammia pruvoti</u>						O				
<u>Mesacmaea mitchellii</u>			O							
<u>Parazoanthus anguicomis</u>						O				
<u>Parazoanthus axinellae</u>		R				O	R		R	
<u>Sagartia</u> spp.		O			R			R	R	R
<u>Sarcodictyon roseum</u>				R						
<u>Urticina felina</u>		R	R							
PLATYHELMINTHES-TURBELLARIA										
<u>Prostheceraeus vittatus</u>					R					R
NEMERTEA										
<u>Tubulanus annulatus</u>					R					
ANNELIDA-POLYCHAETA										
<u>Bispira volutacornis</u>		O	R	O		O	O			O
<u>Branchiomma vesiculosum</u>			O		O				O	O
<u>Lanice conchilega</u>					O				O	F
<u>Pomatoceros triqueter</u>									P	
<u>Pseudosabella variabilis</u>		C	O			C				O
<u>Sabella pavonina</u>		R	F		R					
<u>Sabella spallanzani</u>			R	R	R	R	R	R	R	O
<u>Salmacina dysteri</u>		F	O	O	O	O	O	O	O	F
<u>Serpula vermicularis</u>					R	R				
<u>Spirorbinidae</u> indet.		P		O	P					P

Species Name	Site No.	1	2	3	4	5	6	7	8	9
CRUSTACEA-CIRRIPIEDIA										
<u>Balanus balanus</u> ?				O			O			
<u>Balanus crenatus</u>			O			P	C		C	F
CRUSTACEA-DECAPODA										
<u>Cancer pagurus</u>		R		R		R	R		R	R
<u>Galathea strigosa</u>		R			R					R
<u>Homarus gammarus</u>		R		R		R	R			
<u>Hyas</u> sp.			R							R
<u>Inachus dorsettensis</u>		R								R
<u>Inachus phalangium</u>										R
<u>Liocarcinus puber</u>		R		R			R	R		O
<u>Maja squinado</u>		R	R	R		R				
Paguridae indet.		R	R		R					
<u>Palinurus elephas</u>							R		R	
<u>Pisa tetraodon</u>					R					F
CHELICERATA-PYCNOGONIDA										
Pycnogonidae indet.					R				R	
MOLLUSCA										
<u>Acanthodoris pilosa</u>		R	R							
<u>Acmaea</u> sp.					O					
<u>Anomia</u> sp.		R							O	O
<u>Antiopella cristata</u>			O						O	R
<u>Aplysia punctata</u>		R	O		C	R			R	
<u>Buccinum undatum</u>					R					
<u>Cadlina laevis</u>		R	R			O			R	
<u>Calliostoma zizyphinum</u>		F	F	O	F	O	F		F	F
<u>Calyptraea chinensis</u>			O		C	O				R
<u>Cantharidus clelandi</u>					O					
<u>Crimora papillata</u>		R				R				
<u>Doto</u> sp.			R							
<u>Doto fragilis</u>			R							
<u>Ensis</u> sp.					C					
<u>Gibbula cineraria</u>		F	O		O	O	O		O	F
<u>Gibbula magus</u>			F		O					
<u>Goniodoris emarginata</u>									R	
<u>Haliotis tuberculata</u>										R
<u>Lepidochiton cinereus</u>					O					
<u>Lutraria lutraria</u>					F					
<u>Mytilus edulis</u>		F	C							
<u>Nassarius</u> sp.		C		O	O	O			O	O
<u>Nassarius incrassatus</u>		O	R		O	R			O	
<u>Nassarius reticulatus</u>		O			O	R				
<u>Natica alderi</u>					O	R				
<u>Natica montagui</u>					R					
<u>Ocenebra erinacea</u>						R			R	O
<u>Onchidoris luteocincta</u>									R	
<u>Onchidoris pilosa</u>		R								
<u>Ostrea edulis</u>				R		R				
<u>Patina pellucida</u>										R
<u>Pecten maximus</u>		O	C	C	O					O

Species Name	Site No.	1	2	3	4	5	6	7	8	9
<u>Sepia</u> sp.				R	R					
<u>Tritonalia aciculata</u>							R			
<u>Tritonia odhneri</u>		R	O	O		O				
<u>Trivia arctica</u>		O			R	F			R	R
<u>Venus</u> sp.										
BRYOZOA										
<u>Alcyonidium diaphanum</u>		C	C	F	O	O	O	O	F	C
<u>Bugula plumosa</u>			O	O					O	F
<u>Bugula turbinata</u>									O	R
<u>Bugula</u> sp.			O				O			
<u>Cellaria</u> sp.		O				F	F		C	O
<u>Chartella papyracea</u>		C	C	C		F	C		C	O
Crisiidae			O			C			O	
<u>Membranipora membranacea</u>		O	O	C		O	O		O	O
<u>Omalosecosa ramulosa</u>		O	F	R		F	F		O	O
<u>Pentapora foliacea</u>		C	F	O		O	F		F	O
<u>Scrupocellaria reptans?</u>		O		O					R	
<u>Securiflustra securifrons ?</u>							C			
BRACHIOPODA										
<u>Terebratulina retusa</u>						F			R	
ECHINODERMATA										
<u>Antedon bifida</u>						R				
<u>Aslia lefevrei</u>		C	C	O	R		O		A	F
<u>Asterias rubens</u>							R			
<u>Asterina</u> sp.						R			R	
<u>Echinaster sepositus</u>		R	O			O			O	R
<u>Echinus esculentus</u>			R	R		O	O		O	O
<u>Henricia oculata</u>		R	R			O	R		O	O
<u>Holothuria forskali</u>		O	O			O	R		R	O
<u>Marthasterias glacialis</u>		R	R		R	O	R		O	R
<u>Neopentadactyla mixta?</u>			C							
<u>Ophiactis balli?</u>		C	R							
<u>Ophiopholis aculeata</u>		O							O	
<u>Ophiothrix fragilis</u>					R	R				
<u>Ophiura albida</u>		R	C		R	O				
<u>Ophiura texturata?</u>					O					
<u>Pawsonia saxicola</u>									F	C
<u>Psammechinus miliaris</u>		R								
<u>Thyone roscovita</u>		R	O							
CHORDATA-ASCIDIACEA										
<u>Aplidium densum?</u>		C								
<u>Aplidium punctum</u>		F	O	O	O	O	O		F	C
<u>Ascidia conchilega</u>						R				
<u>Ascidia mentula</u>		O	O	R	R					O
<u>Ascidia virginea</u>		F	O		R	R			R	R
<u>Ascidiella scabra</u>		O	O	F		F	O		F	F
<u>Botryllus schlosseri</u>		C	C	O	O	F	F		F	C
<u>Ciona intestinalis</u>					R					
<u>Clavelina lepadiformis</u>			R		O	O				

Species Name	Site No.	1	2	3	4	5	6	7	8	9
<u>Corella parallelogramma</u>		R	R							
<u>Diazona violacea</u>						C			O	
<u>Didemnum maculosum</u>		F	O		R					C
<u>Diplosoma spongiforme?</u>										R
<u>Distomus variolosus</u>			O		C					A
<u>Lissoclinum sp.</u>		O							O	F
<u>Molgula sp.</u>					O				O	F
<u>Morchellium argus</u>		O		F	R	R			O	F
<u>Polycarpa rustica</u>					F				F	A
<u>Polysyncraton lacazei</u>		O	O	O		O				
<u>Pycnoclavella aurilucens</u>		F	C	A	R	O				O
<u>Stolonica socialis</u>		A	O	C	C	C	C		C	F
<u>Sydnium elegans</u>		C	F		R	O				O
<u>Sydnium turbinatum</u>		O			F	O	O			
<u>Styela clava</u>				R						R
<u>Trididemnum cereum</u>						O				
CHORDATA- GNATHOSTOMATA										
Ammodytidae									F	
<u>Callionymus lyra</u>					C					F
<u>Centrolabrus exoletus</u>							F		O	R
<u>Conger conger</u>				O		R	O			O
<u>Crenilabrus melops</u>										O
<u>Ctenolabrus rupestris</u>		C	O	C		C	C		F	C
Gadidae		C	C	F					F	C
Gobiesocidae					F					
<u>Gobiusculus flavescens</u>		F	F	F	F	F				F
<u>Labrus bergylta</u>		C	R	F		F	F		O	O
<u>Labrus mixtus</u>		C	O	F		F	F		F	F
<u>Parablennius gattorugine</u>		R	R	F		O	O		F	O
<u>Pomatochistus minutus</u>					F				O	O
<u>Scyliorhinus canicula</u>				F	R					
Syngnathidae				R						
<u>Syngnathus acus</u>							R			
<u>Thorogobius ephippiatus</u>		F	R	O		O	O		R	C
<u>Trisopterus luscus</u>						F				
<u>Trisopterus minutus</u>						O			F	
<u>Zeugopterus punctatus</u>										R
<u>Zeus faber</u>								O		

Appendix 5
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