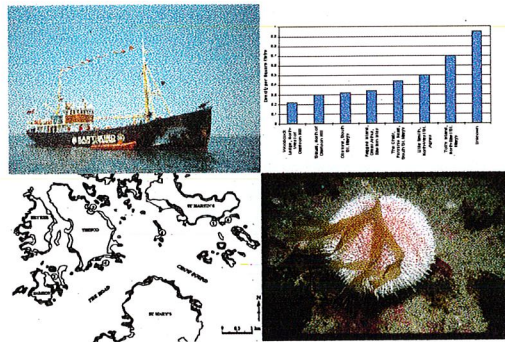


Coral Cay Conservation Sub-Aqua Club

Isles of Scilly 1995 Expedition Report



Prepared
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1. Abstract

Between June 10 and June 29, 1995 a team of 19 volunteers from the Coral Cay Conservation Sub-Aqua Club (CCC-SAC) undertook four key marine research projects work on behalf of the Isles of Scilly Marine Park Committee. This built on work started with the first Coral Cay expedition to the Isles of Scilly in 1992 which was continued in 1993 and 1994.

The science programme for the expedition during June 1995 was compiled by Robert Irving after discussions with Andrew Gibson (Director of the Isles of Scilly Environmental Trust) and Dr Paul Gilliland (Marine Protected Areas Officer, English Nature, Peterborough). Robert had undertaken work within the Isles of Scilly during a number of visits in the mid-1980's when he was employed by the Nature Conservancy Council's Marine Science Branch.

Firstly, it was considered appropriate that the monitoring of the sea grass *Zostera marina* beds, which had been undertaken by previous Coral Cay Conservation expeditions, should continue. Secondly, a survey of the populations of common sea urchins *Echinus esculentus* at various sites around the islands could be carried out. This would allow for direct comparisons to be made with a similar study undertaken in 1984 for the Nature Conservancy Council by Gill Bishop. Thirdly, records of sea bed types and sublittoral communities could be made at a number of sites using *SEASEARCH* recording techniques. Volunteers would be given initial training in these techniques by Robert Irving who has been co-ordinating a *SEASEARCH* project on behalf of the Marine Conservation Society off the Sussex coast in recent years. (Note that a full account of these dives will appear in the report for the CCC SAC 1996 expedition, when it is hoped further *SEASEARCH* dives will be undertaken).

A number of other projects were suggested as 'possibilities' and it was decided to concentrate on the main projects listed above and to give these others a low priority. As it turned out, either as a result of lack of time or due to unfavourable conditions, little if any work was done on these, as indicated below.

1. A re-assessment of the Penninis Head monitoring site, established a year earlier by CCC volunteers on the 1994 expedition, was attempted. However, the sub-surface marker buoys used to mark the 'permanent' depth transect could not be relocated, despite four divers taking the whole of their dives to search for them. It was assumed the fixings for the buoys had worked loose or that the buoys had become detached from the fixings.
2. Andrew Gibson had suggested that the expedition divers could help monitor the shore and subtidal movement of sediment in the Bar Point locality. A detailed study of this was undertaken by the CCC Expedition in 1992, under the guidance of Dr Robert Nunny, a professional coastal geomorphologist. The expertise of the 1995 expedition did not extend to undertaking a similar study, so the idea was dropped.

Unfortunately, as a result of delays in the publishing of expedition reports from 1993 and 1994 (which were not available in time for the 1995 expedition), accurate replication of data collection and analysis used for the monitoring of the sea grass beds was not possible.

2. Introduction

Lying 40 km south-west of Lands End, the Isles of Scilly are the most westerly land mass of Great Britain, comprising an archipelago of approximately 200 granite islands and rocks separated by a shallow sea. The five main islands - St. Mary's, St. Martin's, Bryher, Tresco and St. Agnes - are inhabited, and support farming, fishing and tourist industries.

The combination of physical environment and climate have dictated the very individual composition of the natural history of the Islands. Rare indigenous plants, as well as exotics characteristic of sub-tropical climates, thrive on the Islands. The almost complete absence of traffic and plentiful wind-break hedges and pines, provide ideal conditions for supporting one of Britain's most important areas for bird life.

The shallow, sheltered marine environment surrounding the Islands supports a variety of marine plant and animals that make up some of the most important marine communities to be found in Britain.

So different are the rocky shores of the western Islands that the scientific classification of shore-types had to be extended to include a special category for Scilly - the 'super-exposed'. Below the low-water mark, only those species that are able to withstand periodic inundations of the full force of the Atlantic are able to survive. On the more protected eastern seaboard by contrast, sheltered, deep-water habitats are home to colonies of various delicate species such as sea fans and branching sponges which often have southerly distributions.

At the opposite end of the scale of exposure to the battered western shores, the sea bed inside the archipelago is very sheltered. Sediments derived from the granite bedrock are carried by tides and waves into the sheltered inter-island basin and deposited there.

The relatively coarse local sediments settle rapidly and this, combined with the absence of river-born silts, leaves the water clean and clear. This encourages the growth of plants and algae which require clear waters through which adequate sunlight can pass for photosynthesis. These clear waters encourage the growth of extensive beds of eel-grass (*Zostera marina*) on sandy sediments and fast-growing kelp forests on harder substrata, and are home to some rare algal species.

Although deprived of the nutrient sources that are common to the inshore waters of mainland Britain, the waters around Scilly support a wealth of marine life, including numerous commercial species and an important colony of the Grey Seal (*Halichoerus grypus*).

More exotic visitors include the Basking Shark (*Cetorhinus maximus*), Pilot Whales (*Globicephala melaena*) and even the Killer Whale (*Orcinus orca*). The Common Dolphin (*Delphinus delphis*) and Common Porpoise (*Phocaena phocaena*) are both frequent visitors to the Islands. Records of passing Mediterranean-Atlantic 'vagrants' are not uncommon, and include the Sea Horse (*Hippocampus europaeus*), Trigger-Fish (*Ballistes capriscus*), Blue Marlin (*Makaira nigricans*) and various species of turtle. Not all such vagrants are welcome: the Japanese weed (*Sargassum muticum*) has now taken a firm hold in Scilly and may out-compete indigenous species for available space and sunlight for photosynthesis.

2.1 The Isles of Scilly Environmental Trust¹

The Isles of Scilly Environmental Trust was established in the mid-1980s for the sole purpose of "protecting the beautiful Isles of Scilly and preserving them undamaged and, as far as may be possible, unchanged for the enjoyment and appreciation of this and future generations". All the untenanted land of the Islands (including the uninhabited islands) and most of the Heritage Coast of Scilly has been leased to the Trust by the Duchy of Cornwall and the Trust is mandated to manage and conserve these areas.

¹ Source: "The Isles of Scilly: A Precious Heritage" - an Isles of Scilly Environmental Trust publication.

The archipelago of Scilly has been defined as that group of islands and rocks contained within the fifty metre depth contour (Figure 2.1). This entire area has been declared a Marine Park and has been placed under the management of the Isles of Scilly Marine Park Committee consisting of representatives of the IOS Environmental Trust, the Duchy of Cornwall, the Sea Fisheries Committee and English Nature. It aims to “conserve and protect the ecological, archaeological, historical and environmental heritage contained within the park’s boundaries and ensure its harmonious coexistence with traditional local activities to the mutual benefit of the marine environment, the local community and visitors to the islands”.

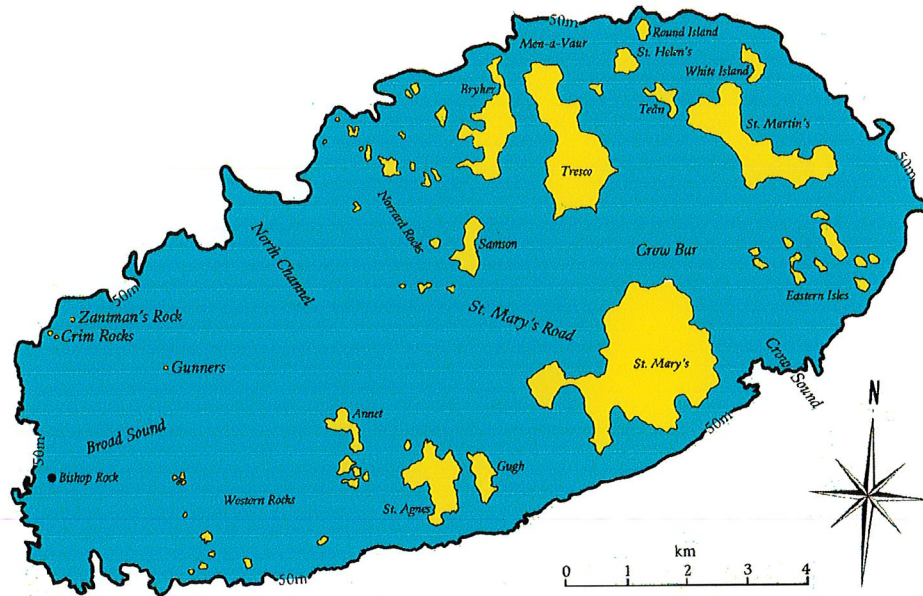


Figure 2.1 - Isles of Scilly Marine Park

The Trust also has an educational and scientific aim - “to control and co-ordinate opportunities and facilities for marine biological study and research, for the guidance, education and enjoyment of all those interested in the marine environment.”

Although Scilly has thus far escaped many anthropogenic disasters such as major oil spills or chemical pollution, an essential component of the Trust’s work is ensuring that the unique coastal resources of the Islands are protected from these potential dangers and the destruction that accompanies insensitive tourism and uncontrolled exploitation. The Trust has published a comprehensive Code of Conduct governing the management of the Marine Park and ensures that this is distributed to all users of the Island’s marine resources, including visiting tourists.

2.2 Coral Cay Conservation

Coral Cay is a UK-Based, non-profit organisation established in 1986. It has undertaken a series of surveys of the unique coastal marine resource associated with the Great Atlantic Barrier Reef of Belize¹, under a Memorandum of Understanding with the Belizian Government. The Reef has come under pressure with the increase of tourism and fishing in Belize.

In order to assist the Government of Belize with initiatives to protect its coastal resources, Coral Cay Conservation recruits teams of over 350 volunteer scientists and divers each year to participate in a systematic survey of the Reef. These volunteers are mainly from the UK and many of them have joined forces under the umbrella of the Coral Cay Conservation Sub-Aqua Club (a branch of the British Sub-Aqua Club) to continue to apply their underwater skill to conservation projects in Britain.

¹ Coral Cay Conservation is also participating in a number of projects in Southeast Asia.

3. The Expedition

CCC-SAC returned to the Isles of Scilly in 1995 for the forth year in succession. The expedition differed from previous years' in that operations were based on a ship, The Ocean Defender, owned and run by the charity EarthKind.

3.1 Expedition Team

Many of the team members have been volunteer divers sent out by Coral Cay Conservation to Belize in Central America. There they have received training in underwater survey techniques and marine identification while surveying the Barrier Reef. These divers along with other members of the team all volunteered to give up one or two weeks of their time, and to finance themselves, in order to take part in this expedition. The Expedition Team was as follows:

Albert Herring		P'ng Loke	
Andy Mell		Paul Wright	Expedition Leader (Phase 2)
Cath Downie		Peter Loader	
Gordon Mackenzie	Expedition Leader (Phase 1)	Phil Clarke	
Hsin Loke		Rob Mallett	
Ian Jones		Robert Irving	Science Officer
Jason Gibb		Sacha Dench	
Jeremy Williams		Toby Brown	
Julia Rigby		William White	
Kieth West			

The Expedition was financed with funds raised by contributions from the participating volunteers and by charitable donations. Office facilities were provided by The Generics Group of Cambridge and all aspects of expedition planning were co-ordinated by CCC-SAC volunteer divers.

Items of food were kindly donated by Kellogg's Company of Great Britain Limited. The Isles of Scilly Steamship Company generously supported the Expedition by arranging subsidised transportation for equipment and personnel and English Nature provided the expedition with the use of an additional boat (the Melza). The Duchy of Cornwall provided moorings in St. Mary's harbour and storage facilities.

The expedition accomplished its survey objectives within the schedule and within the allocated budget. Each member of the expedition carried out their tasks with enthusiasm and professionalism.

The success of the expedition was largely due to the help and support generously offered by the Duchy of Cornwall's office, Isles of Scilly Environmental Trust and English Nature, to whom we are extremely grateful. We are also indebted to the inhabitants of St. Mary's for their support, encouragement and patience, and for allowing us to share with them the natural beauty of their Isles.

It is hoped that the work presented in this report will contribute towards the continued collaboration between Coral Cay Conservation and the Isles of Scilly Environmental Trust.

4. Monitoring of *Zostera Marina* Sea Grass Beds

4.1 Introduction

Zostera marina (referred to as sea grass, eel grass or, locally, sedge) is the only sublittoral flowering plant found in the British Isles and grows in areas of shallow, wave-sheltered sands (Fowler & Pilley 1992). In the Isles of Scilly the plant grows in extensive beds on the low tide sand flats between the larger islands. These are the most extensive *Zostera marina* beds in south-west Britain and the most important in Britain as a whole in terms of their nature conservation interest, both because of their extent and the particularly rich fauna and flora, including many rarities, associated with the plants (Fowler & Pilley 1992).

Monitoring of the sea grass beds at English Island, SE St Martin's, and at Old Grimsby Harbour, E Tresco began in 1984 by the Nature Conservancy Council (NCC) and continued annually (usually in September) until 1988. There was a gap of two years in 1989 and 1990 when no monitoring was undertaken, with a limited study being carried out in 1991 (Fowler & Pilley 1992).

The monitoring programme undertaken by expedition members during June 1995 was designed to continue the investigations carried out during previous CCC-SAC expeditions in 1992 (Raines *et al.* 1993), 1993 (Cleator *et al.* 1996) and 1994 (Mackenzie *et al.* 1996). From 1984 to 1988 there was no sign of any infection of leaves of individual *Zostera marina* plants. However, during the years 1988 to 1991, the health of the sea grass beds had deteriorated, apparently due to the re-appearance of a parasitic slime mould of the genus *Labyrinthula* sp. (Fowler 1992). Infection of plants by this 'wasting disease', as it is known, during the 1930's and 1940's had caused widespread loss of sea grass plants from many areas (Den Hartog 1987), including the Isles of Scilly beds and other locations in the south-west.

The wasting disease initially manifests itself as small, discrete black lesions on the leaf surface which quickly spread, causing the leaf to die within a few weeks. After two or three seasons of constant leaf loss, the rhizomes will become discoloured and perish (Den Hartog 1989). No definite causative agent has been implemented in this most recent outbreak, though adverse environmental conditions (i.e. alterations in irradiance, temperature and current flow) have been suggested as possible causes (Cleator *et al.* 1996). It is thought that stress may cause a metabolic imbalance in the plant, reducing the production of complex organic compounds which are involved in preventing infection and epiphytism (the growth of other algae on the leaves).

Following on from similar studies which had been undertaken by previous CCC-SAC expeditions to the islands, the purpose of the studies in 1995 was:

- to repeat the counts of plants within a randomly-placed 0.25 m² quadrat, in order to obtain an overall average density of plants within a particular sea grass bed;
- to measure the total number of leaves per plant and the length of each individual leaf;
- to assess the level of infection of each leaf by the *Labyrinthula* slime mould;
- to assess the degree of epiphytic cover on each leaf, and to see if this could be related to measured infection levels.

4.2 Methods

A total of six sites were visited during the three weeks of the expedition. Samples had been collected from three of these sites in previous years (East Higher Town Bay, St Martin's; English Island, SE St Martin's; and Old Grimsby Harbour, E. Tresco). Full collection and measurements of plants were undertaken at these 'main' sites plus one other at East Samson. At the remaining two sites (E. Broad Ledge, S. Tresco; and S. Broad Ledge, S. Teen), less information was obtained as collecting was restricted due to time and tide restraints.

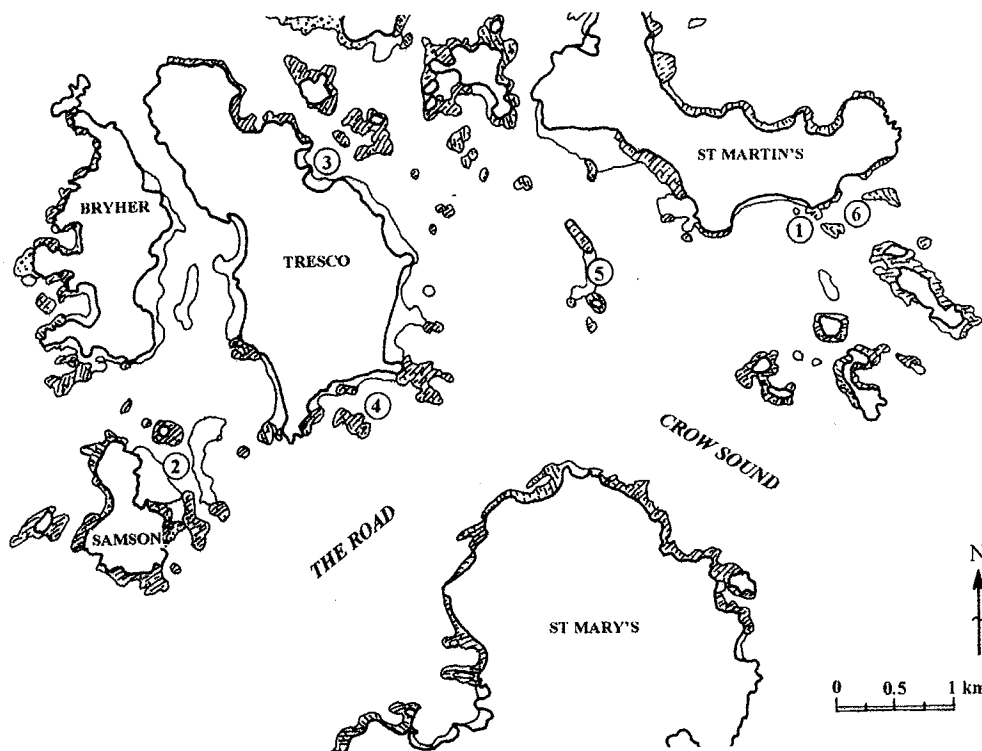


Figure 4.1 - Location of *Zostera* Sampling Sites

At each of the main collecting sites, a 0.25 m² (0.5 m x 0.5 m) quadrat made of 15 mm copper piping was placed on the sandy sea bed within the sea grass bed. The exact positioning of each quadrat (up to a maximum of 24 repeat quadrats were undertaken at each site) was determined by randomly-generated distances (0 to 30 m) and bearings (0° to 359°) from a shot-line located at a central datum point. Pairs of divers swam away from the shot unreeling a measuring tape until the indicated distance was reached. The quadrat was then placed with its left-hand side to the right of the tape. Each quadrat had been divided into quarters by two pieces of line tied to the mid-points of the frame. Using a diving knife or a pair of scissors, plants which lay within one quarter of the quadrat were cut at sea bed level and placed into a polythene collecting bag. It was found it took about an hour for a pair of divers to collect six bags of plant samples.

Once back on board the *Ocean Defender*, a number of determinants were then measured:

- Number of plants per sample;
- Number of leaves showing infection;
- Length of the longest leaf per plant;
- Leaf infection score (see Table 4.1)
- Epiphyte cover score (see Table 4.1)
- The number of flowering stems present

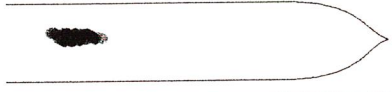
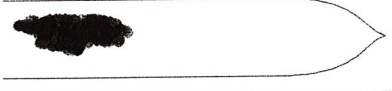
Score		Percentage	Diagrammatic representation of score
0	Uninfected	0%	
1	Some infection apparent	< 10%	
2	Up to half of leaf infected	10 - 50%	
3	Over half of leaf infected	50 - 80%	
4	Almost all of leaf infected	>80%	

Table 4.1 - Leaf infection and epiphyte cover scoring system

In addition to assessing the percentage infection of each leaf by the *Labyrinthula* slime mould, a measure of the level of epiphyte cover was also made. This used the same scoring system as set out in Table 4.1. Epiphyte cover was primarily of an unidentified fine filamentous brown algae.

4.3 Results and Discussion

Zostera marina plants were collected from six widely-spaced sites, as indicated Figure 4.1. Two of these sites (East Higher Town Bay [1]; and Old Grimsby Harbour [3]) were sampled in 1992, 1993 and 1994. In 1993, an additional site to the west of Chimney Rocks [6] was sampled. In 1995, it was decided to investigate a further three areas: East of Samson [2]; East of Broad Ledge, South of Tresco [4]; and South of Broad Ledge, South-East of Tean. Full summary forms for sites 1, 2, 3 & 4 are given as Appendices 2A-2D.

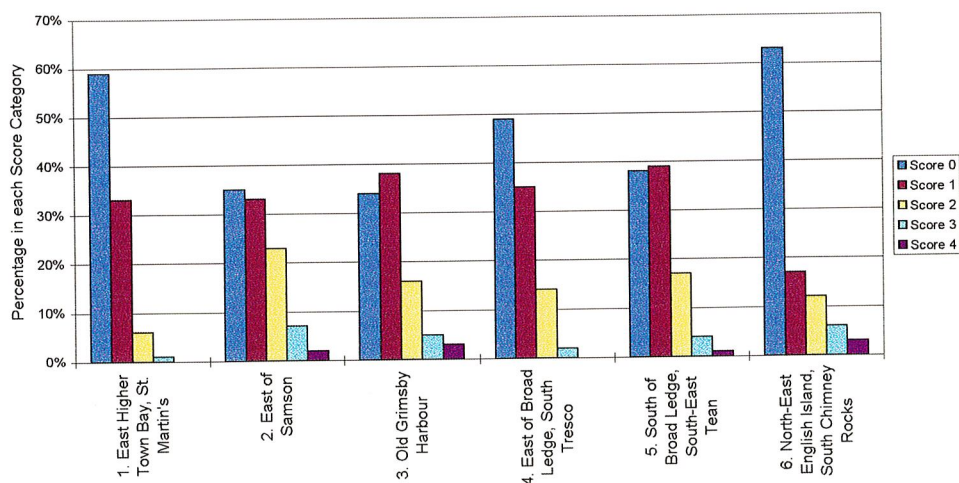


Figure 4.2 - Comparison of infection scores from the six sample sites

4.3.1 Levels of infection and epiphyte cover

Figure 4.2 and Figure 4.3 show the levels of slime mould infection and levels of epiphyte cover from samples taken from each of the six sites. In both cases, the extent of infection/epiphyte cover was estimated using the scoring system as set out in Table 1. The data from each site were averaged, with the charts showing the percentage of leaves collected from each site falling into each score category

(Series 1-5). The sample sizes (i.e. the total number of leaves examined) at each site are given in Table 4.2.

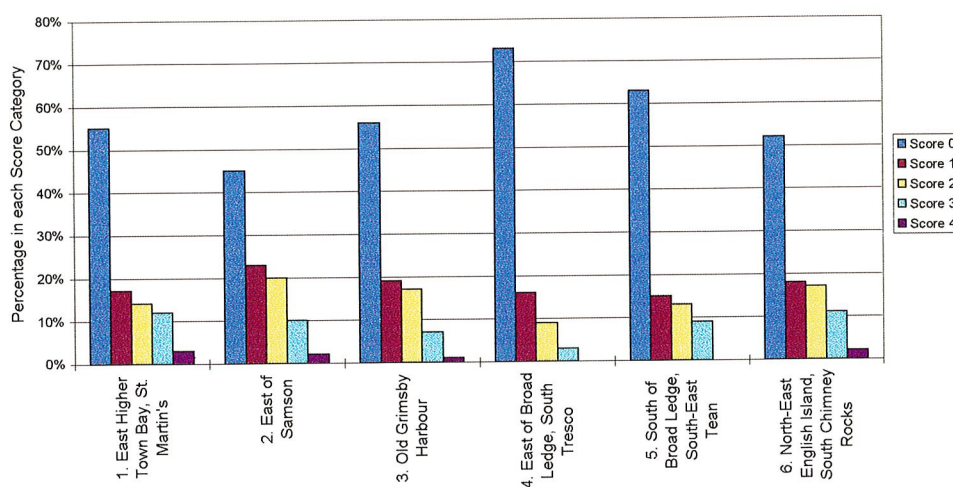


Figure 4.3 - Comparison of ephiphyte cover scores from the six sample sites

Site Number	Site Name	Total Number of leaves examined
1	East Higher Town Bay, St Martin's	1783
2	East of Samson	1456
3	Old Grimsby Harbour, E. Tresco	856
4	East of Broad Ledge, S. Tresco	840
5	South of Broad Ledge, SE Tean	667
6	NE English Island/S. Chimney Rocks	782

Table 4.2 - Sizes of *Zostera* leaf samples at each site.

4.3.2 Plant and leaf density; and plant length

Figure 4.4 gives an indication of the density of plants per $1/16 \text{ m}^2$ (i.e. a $1/4$ of the area of a quadrat) at each of the six sampling sites; Figure 4.5 shows leaf density; Figure 4.6 shows the plant length (measurements of the longest leaf taken for each plant); and Figure 4.7 shows the infection level of all leaves inspected per sample. Vertical bars on all figures represent 95% confidence limits. The data used are the average values for each sample - i.e. for each $1/16 \text{ m}^2$ of sea grass sampled.

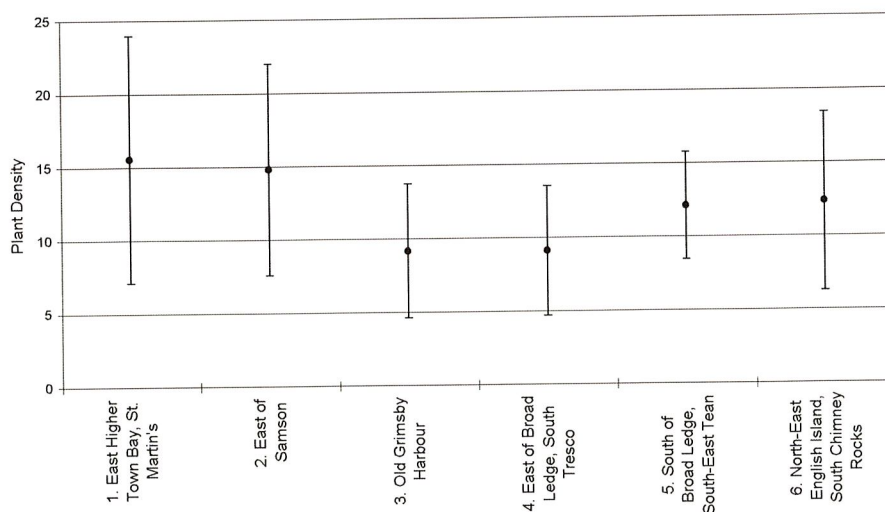


Figure 4.4 - Average density of plants within each $1/4$ quadrat sampled

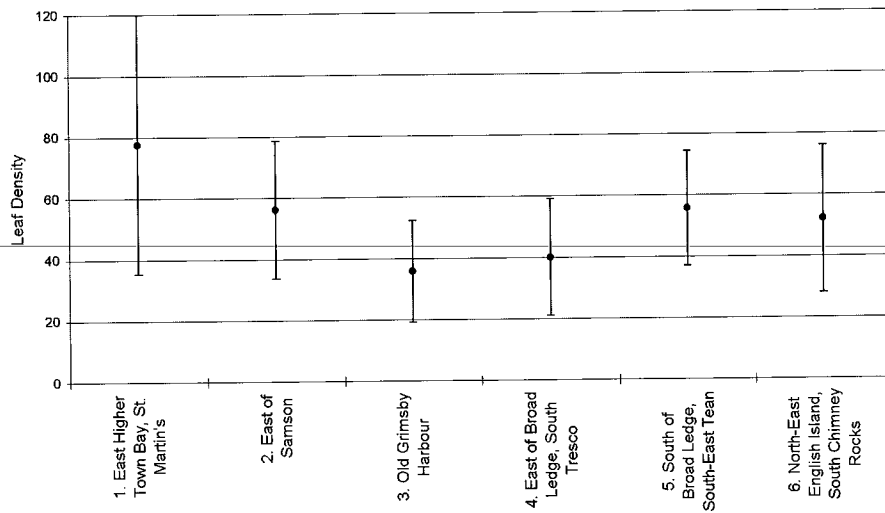


Figure 4.5 - Average leaf density within each $\frac{1}{4}$ quadrat sampled

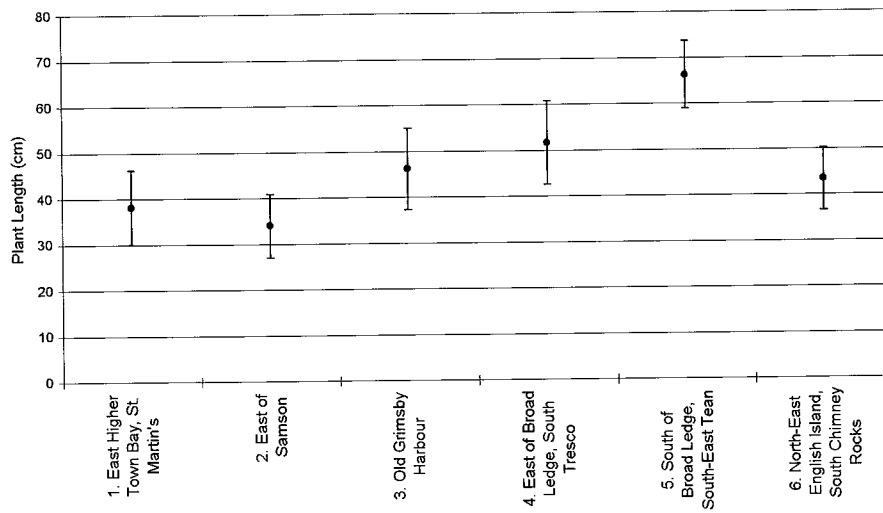


Figure 4.6 - Average plant length within each $\frac{1}{4}$ quadrat sampled

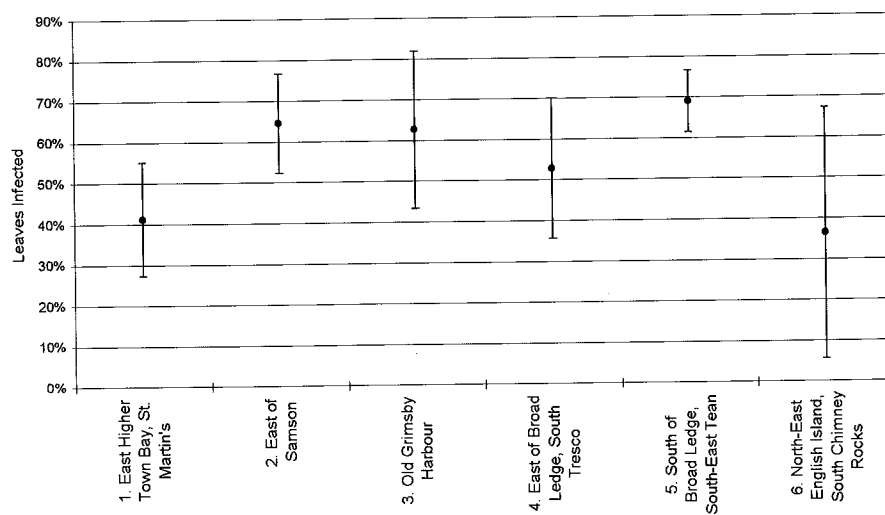


Figure 4.7 - Average leaf infection level within each $\frac{1}{4}$ quadrat sampled

MTB > Correlation 'plants' - '% infection'

Correlations (Pearson)

	PLANTS	LEAVES	LENGTH
LEAVES	0.932		
LENGTH	0.281	0.459	
% INF.	-0.050	-0.079	-0.248
LEAVES	0.577		
LENGTH	-0.024	0.349	
% INF.	-0.266	0.011	0.051
LEAVES	0.900		
LENGTH	-0.450	-0.385	
% INF.	0.118	-0.064	0.434

	PLANTS	LEAVES	LENGTH
LEAVES	0.875		
LENGTH	-0.076	0.123	
% INF.	-0.049	-0.229	-0.154
LEAVES	0.764		
LENGTH	0.030	0.027	
% INF.	-0.289	-0.615	0.222
LEAVES	0.984		
LENGTH	0.298	0.330	
% INF.	-0.004	0.023	-0.008

Table 4.3 - Correlation calculations for individual sites

Table 4.3 represents the correlation calculations for the individual sites: averages of plant length, number of leaves and percentage of leaves infected are compared.

The correlation coefficients for the combined data over all six sites are set out in Table 4.4. Also included is a calculation of (number of leaves) x (plant length) as a measure of total sea grass mass per unit area. As can be seen, there is a small negative correlation with infection, as one might expect.

	PLANTS	LEAVES	LENGTH	% INF.
LEAVES	0.839			
LENGTH	-0.177	-0.038		
% INF.	-0.093	-0.172	0.137	
BIOMASS	0.675	0.884	0.394	-0.118

Table 4.4 - Correlation coefficients for combined data over all six sites (Pearson)

As set out in Table 4.4, the more significant correlations are:-

- Leaves vs. plants (0.839) - clearly, the more plants there are in the sample, the more leaves there should be;
- Length vs. plants (-0.177) - the more dense patches of sea grass have shorter leaves;
- % infection vs. leaves (-0.172) - perhaps the slime mould reduces the vigour of the plant so that it produces fewer leaves?
- % infection vs. length (0.14) - the longer the leaf, the older it is, so presumably it is more likely to become infected.

Unfortunately, none of these numbers is dramatically large. The infection vs. leaf density correlation is visually apparent from Figure 4.5 and Figure 4.7, if one assumes that a higher infection level results in a lower leaf density and not vice-versa.

Finally, the question needs to be addresses as to whether the level of epiphyte cover has an influence on the extent of infection. Qualitatively, from Figure 4.2 and Figure 4.3, it appears to have (at most) a small effect. Here it is worth going back to the data for individual leaves in order to calculate the conditional probabilities of finding an infected leaf, given that it has epiphyte cover. A comparison with the probability of finding infection, given that there is no epiphyte cover, will indicate if the two are related. Since this task takes a long time, it is prudent just to look at the data from one randomly selected sheet from each site.

Site sheet	No. leaves 0/0	No. leaves x/0	No. leaves 0/x	No. leaves x/x
1.1	70	20	13	30
2.12	17	4	9	20
3.3	16	38	2	4
4.7	13	21	1	11
5.2	36	26	1	33
6.4	23	0	12	3

Table 4.5 - Probability values for infected and epiphyte-affected leaves

From these figures,

$$p(\text{Infected}|\text{GivenEpiphyte}) = \frac{[x / x]}{([0 / x] + [x / x])}$$

$$p(\text{Infected}|\text{GivenNoEpiphyte}) = \frac{[x / 0]}{([x / 0] + [0 / 0])}$$

Site sheet	p (infected given epiphyte)	p (infected given no epiphyte)
1.1	0.70	0.22
2.12	0.69	0.19
3.3	0.67	0.70
4.7	0.92	0.62
5.2	0.97	0.42
6.4	0.20	0.00

Table 4.6 - Probability values for infected leaves with and without epiphytic growth

Table 4.6 indicates that, in all but one case, the presence of the epiphyte dramatically increases the chance of a leaf becoming infected, though it may also indicate that an infected leaf is more likely to acquire epiphytic growth on it. However, this does not show through so clearly in the averaged results, so this conclusion may be premature. Further analysis of the data would be necessary to check the distinction remains so clear, but it would require additional experimentation to determine whether the infection acts as the true cause of increased epiphytic cover or *vice-versa*.

4.4 Conclusion

It would appear that epiphytic cover of leaves makes infection more likely (or *vice-versa*). The slime mould *may* cause the sea grass plants to lose their leaves, or produce fewer leaves. However, it is difficult to say for certain that the slime mould definitely reduces the amount of sea grass. The above figures should make year-to-year comparisons of slime mould and sea grass density possible. There appears to be no really clear difference in either sea grass density or mould density between sites - however, it may be that the expected differences would be small.

4.5 Acknowledgement

Robert Irving would like to acknowledge the help provided by Toby Brown (Somerville College, Oxford University), a member of the second phase of the expedition, in providing the statistical analysis which appears in this report.

5. Photography of Near Shore Sea grass Beds

Although not included with the original expedition plan, an opportunity arose while the team was in the islands to take a series of aerial photographs around the coasts of most of the major islands. By ensuring that the timing of the flight coincided with low water, the extent of the sea grass beds close to the shores was clearly apparent. The flight took place on Tuesday, 20th June 1995 at 17.40 hrs. (low water: 17.53 hrs.; tidal height: 1.5 m). Altitude was maintained at a fairly constant 500 feet. A total of 90 sequential exposures were taken, using 100 ASA colour print film.

5.1 Flight Path

Over St Mary's Harbour towards Tresco Flats between Bryher & Tresco. Round N end of Tresco and down east side and round southern end. Repeat. Across to Tean & then White Island. Along N coast of St Martin's and round east end. Along south of St Martin's. Across water between St Mary's and Tresco heading SW to south end of Samson. Up the west of Samson and around the north end/Puffin Island. Then south to St Agnes coming into the Cove between St Agnes and Gugh from the south (viewing the west coast of Gugh). North across St Mary's Road, then SE over St Mary's Harbour and Old Town Bay.

Duplicate numbered prints of the photographs taken have been made and presented to the Isles of Scilly Environmental Trust and to English Nature's Maritime Team (based in Peterborough). These photographs will be a valuable addition to the sets of aerial photographs of the islands already held by English Nature, which have been taken at irregular intervals since the 1970's. It is hoped that analysis of all of these sets using sophisticated GIS mapping tools will allow for greater accuracy in mapping the extent of the sea grass beds, and provide indications as to which areas are receding and which may be extending.

6. Counts of *Echinus Esculentus* Sea Urchins

6.1 Introduction and background

During the 1960's and 1970's, the common sea urchin *Echinus esculentus* was exploited from British waters for the value of its test (shell) in the curio trade. The trade has now diminished considerably, largely through the efforts of marine conservation organisations, though it is still possible to purchase urchin tests in shell shops today. A small scale fishery for these urchins existed in the Isles of Scilly in the early 1980's and has continued to the present day, albeit on a very limited basis. The urchins are collected by divers during the winter months from a handful of sites. During the winter of 1983/84, it was estimated that between 71,000 and 83,000 individuals were taken from three shallow sublittoral areas (Bishop 1985).

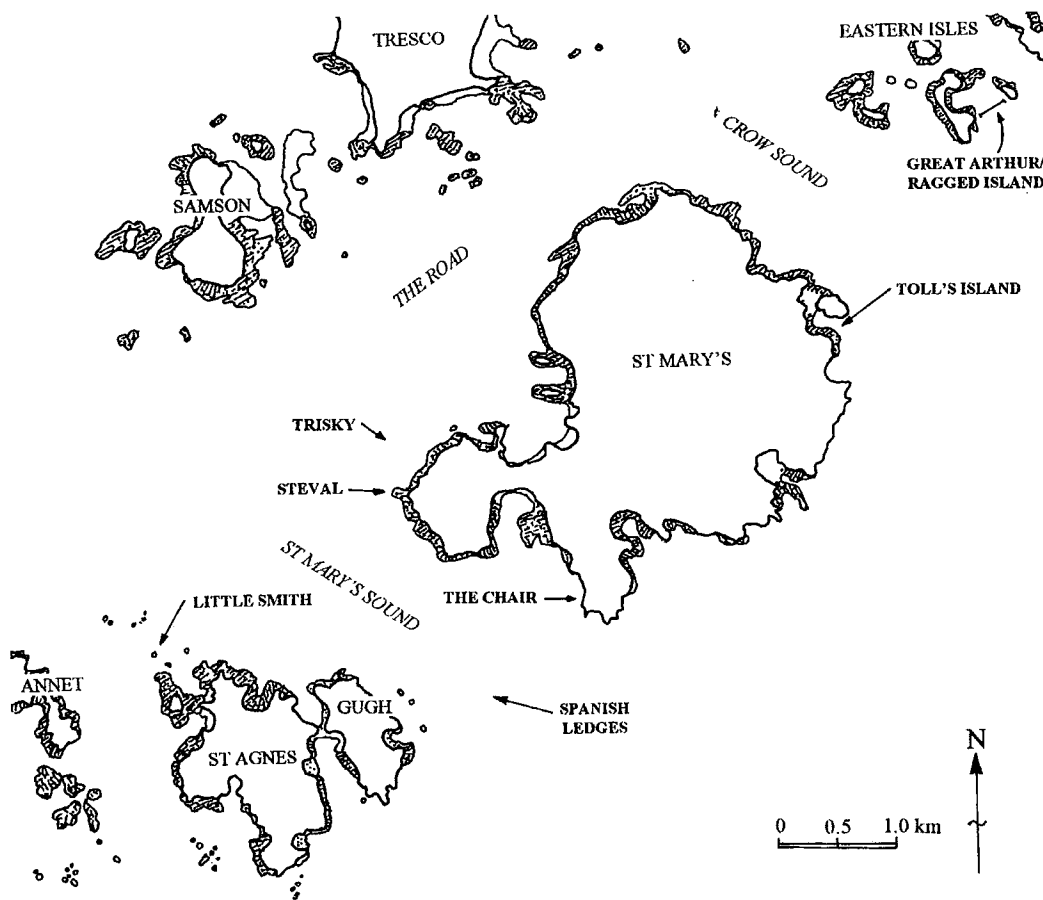


Figure 6.1 - Sea Urchin Survey Sites

The Nature Conservancy Council funded a study of urchin populations in the Isles of Scilly in 1984 (Bishop 1985), as it was suspected that such large landings would be having a considerable impact on the ecology of several sublittoral areas. Urchin populations in seven areas were sampled, three of which were categorised as fished (Spanish Ledges, St Mary's Sound; Tolls Island, NE St Mary's; & Steval, N of Garrison Hill); and four as unfished (Eastern Isles; Lethagus Rocks, SW St Agnes; Little Smith, NW St Agnes; & Penninis Point, S St Mary's). The findings of the 1984 study showed that "there was no evidence of differing population characteristics when comparing fished and unfished areas." (Bishop 1985).

It was thought appropriate that the CCC SAC 1995 expedition divers could repeat counts of urchins at several of the above sites in order to compare populations sizes, then and now. Andrew Gibson,

Director of the Isles of Scilly Environmental Trust, had also expressed his concern that urchins were still being taken within the Marine Park, a practice which he considered to be incompatible with the philosophy of the conservation area.

6.2 Methods

A shot line was set at the centre of a chosen site. Two pairs of divers then descended down the shot line, attached two measuring tapes to the shot itself and then swam on compass bearings in opposite directions, to 50 m distance or to 100 m distance, attempting to maintain a near-level depth profile. As one member of each pair paid out the measuring tape, the other would swim behind on one side of the line, holding out a 1 m long stick and counting the urchins which lay within that one metre wide band. A third diver (or the following pair) would measure *in situ* the diameters of the first thirty urchins that were encountered along the transect, using a roughly-calibrated pair of home-made measuring 'pincers'. These allowed diameters to be measured to the nearest 0.5 cm.

6.3 Results and Conclusions

Urchins were counted at seven different sites (Figure 6.1 and Figure 6.2), though urchin diameters were only measured at five of them (Figure 6.3). Comparison of the density of urchins at four sites with data from 1984 (Table 6.1), shows little variation. Both Tolls Island and Steval were categorised as being fished in the 1984 study, and the urchin density at both of these sites appears to have increased, possibly indicating a recovery in numbers. However, as there are so many unknown variables in this comparison which have not been taken into account, little weight can be given to this suggestion.

SITE	Density / m ² (as measured in 1984)	Density / m ² (as measured in 1995)
Great Arthur to Ragged Island	0.38	0.34
Tolls Island	0.32	0.70
Steval	0.22	0.30
Penninis Head	0.50	0.44

Table 6.1 - Comparison of urchin densities: 1984 to 1995

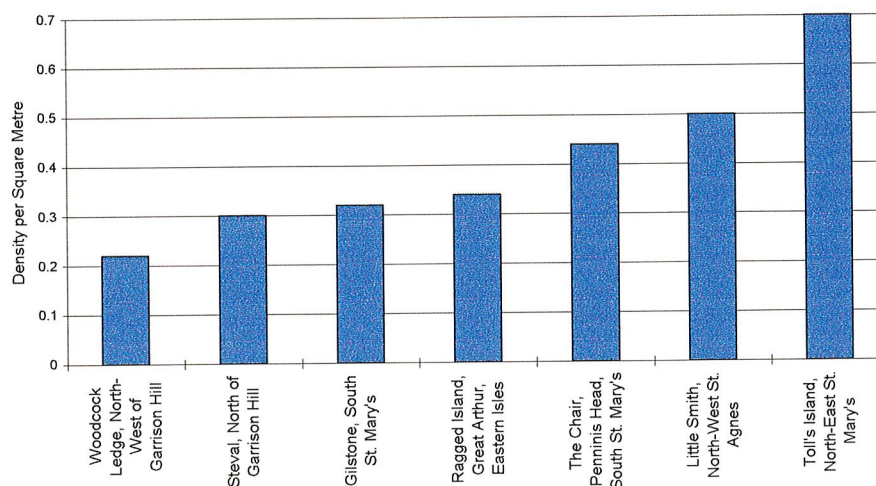


Figure 6.2 - Density of sea urchins (per m²) at seven sites within the Isles of Scilly¹

¹ Depths at which counts were made were not always noted.

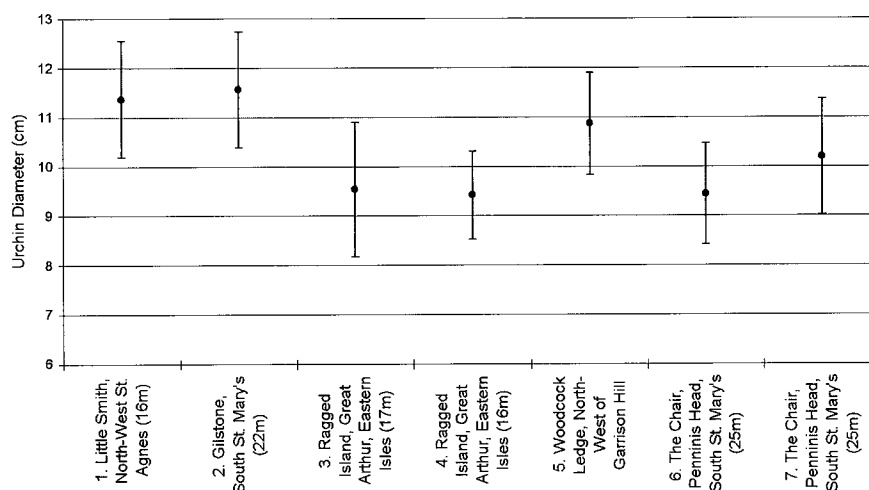


Figure 6.3 - Variation in urchin diameters between sites. (Bars represent 95% confidence limits)¹

Unfortunately, a number of incomplete recording forms has meant that further analysis of the data cannot be undertaken. It is thought that this study could be repeated (if necessary) by CCC SAC divers in the future, with closer attention being paid to data collection.

¹ Measurements took place at different depths which makes direct comparisons between sites difficult. Site 1: 16m; site 2: 22m; site 3: 17m; site 4: 16m; site 5: 15m; site 6: 25m; & site 7: 25m.

7. Wine Cove, St. Martin's, Refuse Disposal Site

7.1 Introduction

Until recently, the residents of the island of St Martin's had disposed of certain items of domestic refuse (mainly drinks cans, glass and other non-organic materials), over a low cliff into the intertidal area of Wine Cove on the north side of St Martin's. As part of the CCC Isles of Scilly expedition in 1993, a programme of study was undertaken to assess the extent and nature of contamination in adjacent sublittoral and intertidal areas.

By 1995, the disposal site was no longer being used. Indeed, we were informed by Andrew Gibson (Director, Isles of Scilly Environmental Trust) that it was planned to clear up the site in the autumn by loading the refuse items into a barge and removing them to a landfill site on the mainland. A preliminary assessment of the site was therefore agreed upon which would provide some indication of the extent below low water mark of refuse items in the vicinity of the tip.

On the 27th June, two pairs of divers were given the task of swimming along transit bearings of 160° (pair A) and 205° (pair B), either side of the tip, starting from a position approximately 150 m distant.

7.2 Findings

7.2.1 Pair A

Evidence of rubbish was only found within 15 m of the low water mark in very shallow water, perpendicular to the line of the shore. Items recorded included beer cans; a piece of corrugated steel sheeting; bits of plastic sheet; broken glass bottles, empty food tins, aerosol can, bicycle pump, plastic and rubber tubing, and various assorted bits of metal and plastic.

Marine life in this area was dominated by kelp attached to boulders and small bedrock outcrops, with sand patches in between. Edible crabs, starfish and pollack were seen.

7.2.2 Pair B

Very little evidence of rubbish approaching site from the north-east direction. Only one ring-pull can was found some 30 m from the edge of the tip. Otherwise, kelp cover was dense on boulders in the shallows, together with thongweed *Himanthalia elongata*. Animal life observed included topshells, snakelocks anemone, and a spiny starfish.

7.3 Assessment

It seems likely that any lightweight items of rubbish have been taken away from the area by water currents and wave action. Heavier items have remained on the seabed, but have not been distributed over a wide area. Those items which remain below low water mark are an eyesore (and possible hazard) to the diver, though few divers are likely to come to this locality to dive anyway.

8. Collection of Intertidal Invertebrates for NMR Spectroscopy

8.1 Preface

Besides taking part in expedition dives and projects, Jason Gibb¹ also took the opportunity of being in the Isles of Scilly to undertake his own research studies. A summary of his project is given below. At the time of preparing the expedition report (early 1996), the full results of his work are still to be determined.

8.2 Introduction

Of all marine pollutants, 'conservative wastes' (e.g. heavy metals, radioactivity and halogenated hydrocarbons) are of particular concern to humans as they are not subject to bacterial attack and are not dissipated (Clark 1992). They consequently not only build up in the marine environment but are concentrated above ambient levels in marine organisms. This is known as bioaccumulation.

The first logical step to assess such pollution would be to measure the quality of the water directly. However, the low concentrations found, even in highly contaminated areas, tend to necessitate the use of tedious and expensive analysis. An alternative is to use marine invertebrates as biological monitors, due to their ability to bioaccumulate substances. The high concentrations found in such organisms (often several hundred parts per million in the case of metals), allow for pollution analysis by relatively unsophisticated equipment, such as Atomic Absorption Spectroscopy. Furthermore, biomonitors indicate the amount of waste that is biologically available (Phillips and Segar 1986), and thus is of concern to humans. However, there is a considerable amount of pre-analysis sample preparation (and thus expense) associated with this technique of assessment.

In contrast to the above approaches, Nuclear Magnetic Resonance (NMR) Spectroscopy requires very little sample preparation. Additionally it allows non-destructive scanning of a wide range of low molecular weight metabolites, and is a well established tool in mammalian toxicological and clinical chemistry (Nicholson & Wilson 1989). In this study, the procedure will be used to analyse untreated extracts of selected pollution indicator species. This will not only produce novel metabolic profiles, but may be used in the investigation of pollution-induced metabolic stress. The use of NMR spectroscopy will allow for the effects of environmental pollutants to be investigated before they reach concentrations where the effects are lethal. This will involve the detection of unusual metabolites or unusual ratios of metabolites, known as 'biomarkers'.

8.3 Programme of research

A preliminary investigation was made into the suitability of a number of marine invertebrates for investigation. The common limpet *Patella vulgata* was found to be the most suitable for extraction of fluid due to the quantity of fluid that could be extracted, their abundance and their accessibility (as they are found on the shore). Fluid collection, a non-destructive technique, was achieved by entering a syringe needle into the coelomic cavity of the organism.

Samples were collected on both St Mary's and St Martin's.

a) St. Mary's

Samples were collected around a domestic sewage outfall on the south-east tip of Garrison Hill next to Wras Rock, at low tide. To determine the extent of any contamination effects of the outfall, samples were taken from sites 150 m and 250 m west and 300 m north of the sewage outfall.

¹ Department of Chemistry, Birkbeck College, University of London, Gordon House, 29 Gordon Square, London WC1H 0PP.

b) St. Martin's

Samples were collected on the shore adjacent to a domestic refuse dumping ground, Wine Cove, near the centre of the north coast. Again, to investigate the extent (if any) of contamination, samples were taken from another cove on the eastern side of Turfy Hill Point.

Where common mussels *Mytilus edulis* and topshells *Mondonta lineata* were found, samples of these were collected for whole body analysis.

8.4 Sample preparation and analysis

Individual organisms were either kept in filtered sea water for a period of depuration, or their gut contents were removed and individually frozen. The next step will be to make up tissue extracts of the whole bodies collected and analyse both these and the fluid samples. The frozen samples will then be homogenised in a 1:2 ratio (sample volume : solution volume) of ringer solution. The resulting homogenate will then be micro-centrifuged. The supernatant is then ultra-filtered with a molecular weight cut-off at 10,000 Daltons.

Samples will be made up to 700 µl using a minimum of 10% deuterated water. ¹H NMR analysis will then be carried out on the resulting solution on a JOEL GSX500, at the University of London.

The profiles of endogenous metabolites produced by NMR spectroscopy will then be qualitatively compared between sites and differences elucidated by Principal Component Analysis, a high-powered statistical technique. Results and conclusions will be published in the scientific journal *Toxicology & Ecotoxicology News*.

This work was supported by a grant from the Society of Environmental Toxicology and Chemistry.

9. Surveys of Sea Bed Habitats and Communities

'*SEASEARCH*' is a nationwide project designed to provide divers with a standard means of recording sea bed types and the dominant species they have associated with them. This initial description of sublittoral habitats and communities is known as a 'Phase 1' ecological survey. The project has been devised (and is run) by the Marine Conservation Society on behalf of the Marine Nature Conservation Review team of the Joint Nature Conservation Committee, the government agency responsible for nature conservation matters which span the geographical boundaries of the three country nature conservation agencies (English Nature, Scottish Natural Heritage and the Countryside Council for Wales).

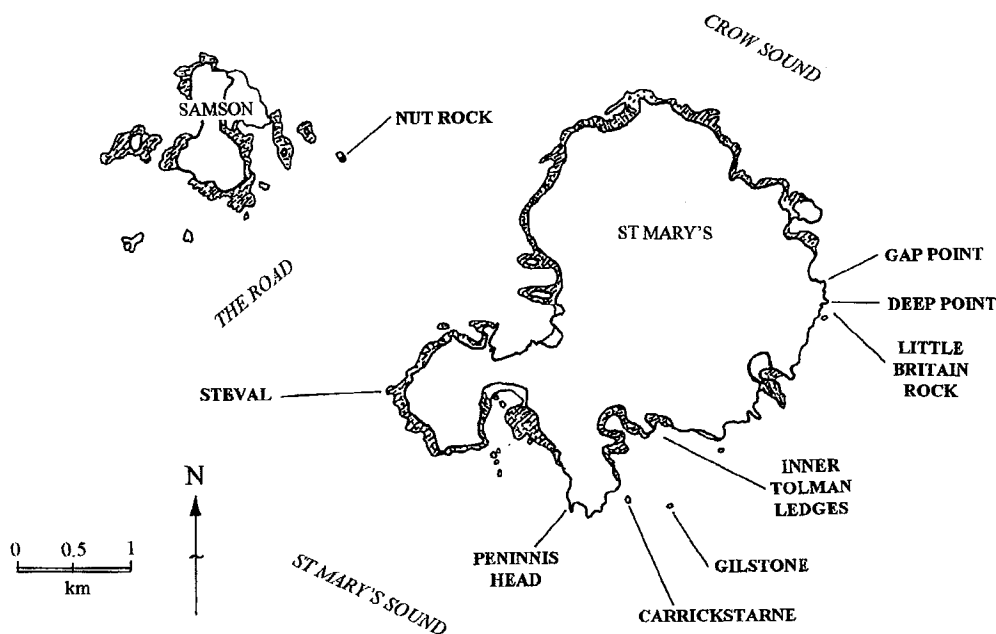


Figure 9.1 - Seasearch Dive Sites

There are two recording forms associated with *SEASEARCH*: one for the description of the dive itself (the dive recording form), and the other on which details of the dive site and any known human impacts which may affect the site can be recorded (the site recording form). As most of the impacts and potential impacts are already well documented for the islands, most effort was directed towards the completion of dive recording forms for each pair of divers.

Whilst many near-shore sublittoral areas around the islands have been investigated by survey divers, there are still a large number of sites from where no records have been made. It is hoped that over the next few years, CCC expeditions to the islands can make records from these lesser known areas, thereby adding to the overall information available on sea bed types present within the Marine Park.

SEASEARCH surveys during 1995 took place at sites which were accessible during slack water periods and which were also in the lee of the wind, at times when these conditions prevented sea grass or sea urchin surveys from taking place.

SEASEARCH records were completed from nine sites (see Figure 9.1 and Table 9.1) during the three weeks' duration of the expedition. Summary descriptions of these dives are given below. Abundance ratings for species (where recorded) follow the code letters: A: ABUNDANT; C: COMMON; F: FREQUENT; O: OCCASIONAL; R: RARE.

SITE NAME	No. of dives	Ref. Nos.
Peninnis Head, south St Mary's	7	96/01 - 96/07
Carrickstarne, east of Peninnis Head, south St Mary's	2	96/08 & 96/09
Gilstone, east of Peninnis Head, south St Mary's	3	96/10 - 96/12
Inner Tolman Ledges, north side of Old Town Bay, St Mary's	2	96/13 & 96/14
Little Britain Rock, east St Mary's	1	96/15
Gap Point & Deep Point, east St Mary's	2	96/16 & 96/17
Off Steval, west of the Garrison, St Mary's	1	96/18
Nut Rock, east of Samson	1	96/19

Table 9.1 - Sites at which SEASEARCH records of seabed and community types were made

9.1 Peninnis Head, South St. Mary's

Divers: Keith West & Gordon Mackenzie	Date: 14.6.95	Exact position (if noted): 49° 54.17' N 6° 18.33' W Off Inner Head, Peninnis Head	
Depth range (below chart datum): 9.6 - 26 m	Time: 12.00 - 12.30	Dive duration: 30 mins.	Ref. No.: 96/01
1. Habitat/community description: @ 9.6 - 13 m. Sloping boulder field, with some cobbles between boulders. Kelp forest becoming less dense below 11 m. sea urchin <i>Echinus esculentus</i> (C) anemone <i>Sagartia elegans</i> (R) jewel anemone <i>Corynactis viridis</i> (R)			
2. Habitat/community description: @ 13 - 20 m. Sloping boulder field. Algal cover decreasing from dense to sparse, as depth increases. <i>Halidrys siliquosa</i> becoming common at shallower depths. sea urchin <i>Echinus esculentus</i> (C) sea cucumber <i>Holothuria forskali</i> (C) spiny starfish <i>Marthasterias glacialis</i> (O) lightbulb sea squirt <i>Clavelina lepadiformis</i> (R) fan worms (indet.) (R)			
3. Habitat/community description: @ 20 - 26.2 m. Sloping boulder field (granite), with many crevices and some gullies between boulders. Dense covering of silty hydroid-bryozoan turf. Sparse red algae. sea urchin <i>Echinus esculentus</i> (C) sea cucumber <i>Holothuria forskali</i> (C) spiny starfish <i>Marthasterias glacialis</i> (O) Devonshire cup coral <i>Caryophyllia smithii</i> (R) jewel anemones <i>Corynactis viridis</i> (R) dead man's fingers <i>Alcyonium digitatum</i> (R)			

Divers: Rob Mallett & Will White	Date: 14.6.95	Exact position (if noted): Off Inner Head, Peninnis Head	
Depth range (below chart datum): 14.5 - 18.0 m	Time: 12.06 - 12.37	Dive duration: 31 mins.	Ref. No.: 96/02
1. Habitat/community description: @ 14.5 - 18.0 m. Large, smooth granite boulders with a mix of smaller boulders and large cobbles in between. All upward-facing surfaces with a covering of silt. Many gullies, ledges, crevices and fissures. Small patches of red algae (<2% cover). sea urchin <i>Echinus esculentus</i> (C) - 33 counted within area of visibility spiny starfish <i>Marthasterias glacialis</i> (C) common starfish <i>Asterias rubens</i> (R) jewel anemones <i>Corynactis viridis</i> (dense in patches on vertical surfaces) dead man's fingers <i>Alcyonium digitatum</i> (R @ 18 m, and even less @ 15 m) Devonshire cup corals <i>Caryophyllia smithii</i> (R) No sponges, sea squirts or bivalves observed. A few sea cucumbers <i>Aslia lefevrei</i> in crevices.			

Divers: Jason Gibb & Sacha Dench	Date: 14.6.95	Exact position (if noted): Off Inner Head, Peninnis Head	
Depth range (below chart datum): 12.5 - 18.5 m	Time: 12.49 - 13.24	Dive duration: 35 mins.	Ref. No.: 96/03
1. Habitat/community description: @ < 12.5 m depth. Large granite boulders, dominated by kelp <i>Laminaria hyperborea</i>, + encrusting red & green algae. Sea urchins			

<i>Echinus esculentus</i> common.
2. Habitat/community description: @ 12.5 - 17.5 m. Large granite boulders. Kelp park with some encrusting pink algae, red & green foliose algae. 50% bryozoan turf. Coarse clean sand in gaps between boulders. sea urchin <i>Echinus esculentus</i> (C) spiny starfish <i>Marthasterias glacialis</i> (C) jewel anemones <i>Corynactis viridis</i> (F) Devonshire cup corals <i>Caryophyllia smithii</i> (O) sea cucumber <i>Holothuria forskali</i> (O) lightbulb sea squirts <i>Clavelina lepadiformis</i> (O) dead man's fingers <i>Alcyonium digitatum</i> (F) pipefish (with full brood pouch)
3. Habitat/community description: @ 17.5 - 19.5 m. Small & large boulders with silt-filled gullies. Sparse red algae (no kelp), dense bryozoan turf. encrusting yellow sponge (indet.) burrowing cucumber ?<i>Thyone</i> sp. (R) jewel anemones <i>Corynactis viridis</i> (F) sea cucumber <i>Holothuria forskali</i> (O) 7-armed starfish <i>Luidia ciliaris</i> (R) velvet swimming crab <i>Necora puber</i> (O) cuckoo wrasse <i>Labrus mixtus</i> (O) ballan wrasse <i>Labrus bergylta</i> (O)

Divers: Ian Jones, Jeremy Williams & Robert Irving	Date: 14.6.95	Exact position (if noted): Peninnis Head 49° 54.22' N 6° 18.36' W	
Depth range (below chart datum): 15 - 20.8 m	Time: ?	Dive duration: 35 mins.	Ref. No.: 96/04
1. Habitat/community description: @ 12 - 14 m. Large granite boulders with cobbles inbetween with kelp <i>Laminaria hyperborea</i> forest, leading to bedrock/boulder slope. Sea urchins <i>Echinus esculentus</i> common. Other red and green algae in amongst kelp.			
2. Habitat/community description: @ 14 - 20 m. Granite bedrock forming gullies, with large boulders. Cobbles, pebbles and coarse sand inbetween. Kelp extended to 14 m; moderately sparse red & brown algae. <i>Halidrys siliqua</i> down to 17 m. Silty. sea urchins <i>Echinus esculentus</i> (A) Devonshire cup corals <i>Caryophyllia smithii</i> (C/A) sea cucumber <i>Holothuria forskali</i> (C) - approx. 10 per 1.5 m² spiny starfish <i>Marthasterias glacialis</i> (C) sponge <i>Hemimycale columella</i> (R) sponge <i>Cliona celata</i> (R) cowrie <i>Trivia arctica</i> (R) ballan wrasse <i>Labrus bergylta</i> (O) corkwing <i>Crenilabrus melops</i> (O) pollack <i>Pollachius pollachius</i> (O)			
3. Habitat/community description: @ 20 -21 m. Bedrock gullies with coarse sand (& some silt). Thin covering of silt on rocks. Brown algae: <i>Dictyota dichotoma</i> to 19 m and <i>Halidrys siliqua</i> to 17 m. Sparse red algae. <25% animal turf due to urchin grazing. sponges (indet.) (O) hydroids (indet.) (A) devonshire cup coral <i>Caryophyllia smithii</i> (C) jewel anemone <i>Corynactis viridis</i> (R) daisy anemone <i>Cereus pedunculatus</i> (R) - in sand dahlia anemone <i>Urticina felina</i> (R) - in sand zoanthid anemone <i>Isozoanthus sulcatus</i> (R) ('ginger tinies' - in sand) dead man's fingers <i>Alcyonium digitatum</i> (C) red sea fingers <i>Alcyonium glomeratum</i> (O) common starfish <i>Asterias rubescens</i> (O) spiny starfish <i>Marthasterias glacialis</i> (R) sea urchin <i>Echinus esculentus</i> (A) sea cucumber <i>Holothuria forskali</i> (C) lightbulb sea squirt <i>Clavelina lepadiformis</i> (O) goldsinny <i>Ctenolabrus rupestris</i> (O) cuckoo wrasse <i>Labrus mixtus</i> (O) - 'females' only			

Divers: P'ng Loke & Peter Loader	Date: 26.6.95	Exact position (if noted): between The Chair & Inner Head, Peninnis Head
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Depth range (below chart datum): 7.5 - 21.5 m	Time: 15.15 - 15.45	Dive duration: 30 mins.	Ref. No.: 96/05
<u>1. Habitat/community description:</u> @ 7.5 m. Tip of bedrock pinnacle. 50% kelp cover (<i>Laminaria hyperborea</i>) & 70% animal turf. No dead man's fingers.			
<u>2. Habitat/community description:</u> @ 12.5 m. Middle part of large bedrock pinnacle. 10% cover of kelp, 50% cover of foliose algae (7 or 8 species) & 10-25% cover of animals. Surfaces quite silty. jewel anemones <i>Corynactis viridis</i> - about 30/0.1 m² dead man's fingers <i>Alcyonium digitatum</i> sea urchin <i>Echinus esculentus</i> hydroids & bryozoans (indet.) ballan wrasse <i>Labrus bergylta</i>			
<u>3. Habitat/community description:</u> @ 23.5 m. V. large granite boulders, 3-6 m in diameter., sitting in silty sand. Surfaces quite silty; seaweeds - sparse. Not much animal turf - providing about 10% cover of the sea bed. axinellid sponge <i>Axinella</i> sp. Devonshire cup coral <i>Caryophyllia smithii</i> (C) - about 10/0.1 m² dead man's fingers <i>Alcyonium digitatum</i> sea urchin <i>Echinus esculentus</i> (C) sea squirts (indet.) sea cucumber <i>Holothuria forskali</i> burrowing cucumbers (indet.) spiny starfish <i>Marthasterias glacialis</i> pollack <i>Pollachius pollachius</i> wrasse (indet.)			

Divers: Cath Downie & Andy Mell	Date: 26.6.95	Exact position (if noted): 20 m west 30 m north of The Chair, Peninnis Head.	
Depth range (below chart datum): 19 - 25 m	Time: 15.30 - 16.00	Dive duration: 30 mins.	Ref. No.: 96/06
<u>1. Habitat/community description:</u> @ 19 m. Granite bedrock with large boulders. Moderately dense cover of hydroid-bryozoan turf all over rock. sponge <i>Polymastia mamillaris</i> (O) - up to 10 cm in diameter. sponge <i>Axinella polypoides</i> (O) - between 10-20 cm in height dead man's fingers <i>Alcyonium digitatum</i> (from 25 - 19m) red sea fingers <i>Alcyonium glomeratum</i> (@ 25 m) jewel anemones <i>Corynactis viridis</i> (@ 25 m) (O) Devonshire cup coral <i>Caryophyllia smithii</i> (C) edible crab <i>Cancer pagurus</i> (R) sea slug <i>Polycera faeroensis</i> (O) sea urchin <i>Echinus esculentus</i> (F) spiny starfish <i>Marthasterias glacialis</i> (C) sea cucumber <i>Holothuria forskali</i> (O)			
<u>2. Habitat/community description:</u> @ 23-25 m. Flat sea bed of fine sand with shell fragments. burrowing anemone <i>Cerianthus lloydi</i> (C) sea cucumber <i>Holothuria forskali</i>			

Divers: Phil Clarke & Hsin Loke	Date: 26.6.95	Exact position (if noted): Peninnis Head	
Depth range (below chart datum): 17.5 - 14.5m	Time: 15.30 - 16.00	Dive duration: 28 mins.	Ref. No.: 96/07
<u>1. Habitat/community description:</u> @ 14.5 m. Large boulders, gradually decreasing in size as one progresses up gradual slope. Boulders covered in animal turf, with crustose coralline algae in patches. Kelp park started at 14.5 m. yellow boring sponge <i>Cliona celata</i> dead man's fingers <i>Alcyonium digitatum</i> sea urchins <i>Echinus esculentus</i> (F) spiny starfish <i>Marthasterias glacialis</i> (F) sea cucumber <i>Holothuria forskali</i> cuckoo wrasse <i>Labrus mixtus</i> - both females & males ballan wrasse <i>Labrus bergylta</i>			
<u>2. Habitat/community description:</u> @ 17.5 m. Flat sandy sea bed, with some rippling. burrowing anemone <i>Cerianthus lloydi</i>			

9.2 Carrickstarne, East of Penninis Head, South St. Mary's

Divers: Ian Jones & Phil Clarke	Date: 20.6.95	Exact position (if noted): central southern side of Carrickstame	
Depth range (below chart datum): ? m	Time: ?	Dive duration: ? mins.	Ref. No.: 96/08
1. Habitat/community description: @ 8-14 m (below sea level). Granite bedrock with large crevices and caverns. Kelp forest/park, down to 14 m. Surge apparent down to 15 m. kelp <i>Laminaria hyperborea</i> yellow boring sponge <i>Cliona celata</i> dead man's fingers <i>Alcyonium digitatum</i> (O) red sea fingers <i>Alcyonium glomeratum</i> (R) jewel anemone <i>Corynactis viridis</i> (A/C) sea urchin <i>Echinus esculentus</i> (R/O) ballan wrasse <i>Labrus bergylta</i> pollack <i>Pollachius pollachius</i>			
2. Habitat/community description: @ 14 - 18m (below sea level). Vertical cliff face with crevices. Cliff covered in bryozoan turf, cup corals and jewel anemones. Devonshire cup coral <i>Caryophyllia smithii</i> jewel anemones <i>Corynactis viridis</i> velvet swimming crab <i>Necora puber</i> squat lobster (indet.) orange bryozoan colonies (indet.) - <i>Cellepora</i> ? burrowing sea cucumber (indet.)			
3. Habitat/community description: @ 18 - 19 m (below sea level). Large granite boulders with smaller boulders inbetween, with covering of silty bryozoan turf. Sparse red algae on tops of some boulders. jewel anemones <i>Corynactis viridis</i> (A/C) dead man's fingers <i>Alcyonium digitatum</i> (R) - small colonies only squat lobster (indet.) spiny starfish <i>Marthasterias glacialis</i> (O) common starfish <i>Asterias rubens</i> (R) sea cucumber <i>Holothuria forskali</i> (O) cuckoo wrasse <i>Labrus mixtus</i> (C) ballan wrasse <i>Labrus bergylta</i> (C) whiting <i>Merlangius merlangus</i> (R)			

Divers: Cath Downie & Peter Loader	Date: 20.6.95	Exact position (if noted): east corner of Carrickstame 49° 54.22' N 6° 17.88' W	
Depth range (below chart datum): 9.5 - 16.5 m	Time: 11.15 - 11.47	Dive duration: 32 mins.	Ref. No.: 96/09
1. Habitat/community description: @ 14.5 - 16.5 m. Large granite boulders at the foot of a near-vertical bedrock cliff wall. Thin layer of silt on surfaces with animal turf. sea oak <i>Halidrys siliqua</i> kelp <i>Laminaria digitata</i> kelp <i>Laminaria hyperborea</i> sugar kelp <i>Laminaria saccharina</i> sponge <i>Oscarella lobularis</i> sponge <i>Suberites domuncula</i> anemone <i>Sagartia elegans</i> zoanthid anemone <i>Epizoanthus couchi</i> Devonshire cup coral <i>Caryophyllia smithii</i> jewel anemones <i>Corynactis viridis</i> (A/C) spiny starfish <i>Marthasterias glacialis</i> sea urchin <i>Echinus esculentus</i> (C) - approx. 1/m² sea cucumber <i>Holothuria forskali</i> burrowing sea cucumber (indet.)			

9.3 Gilstone, East Penninis Head, South East St. Mary's

Divers: Cath Downie & Julia Rigby	Date: 27.6.95	Exact position (if noted): 49° 54.22' N 6° 17.76' W NE side/slope of Gilstone itself	
Depth range (below chart datum): 27 - 7 m	Time: 18.00 - 18.30	Dive duration: 30 mins.	Ref. No.: 96/10
1. Habitat/community description: @ 27 - 7 m. Steep to vertical granite bedrock overhangs and fissures. Very dense cover of hydroid turf, with individual hydroids and anemones. Deepest depth of red algae = 24 m. kelp <i>Laminaria hyperborea</i> - sparse on ledges at 15 m; dominant from 9 m upwards.			

sponge *Polymastia boletiforme* (C - up to 15 m)
sponge *Suberites coarctatus* (C - up to 15 m)
axinellid sponge *Axinella polypoides* (O - up to 15 m)
yellow boring sponge *Cliona celata* (C - up to 10 m)
hydroids (indet.) (C - 25-15 m especially on ledges)
plumose anemone *Metridium senile* - (A - on vertical surfaces, though absent in areas where *Corynactis* dominated)
jewel anemone *Corynactis viridis* (A - at all depths, 22-7 m, forming a dense carpet)
Devonshire cup coral *Caryophyllia smithii* (O)
anemone *Sagartia elegans* (O - @ 13 m; more common above 10 m)
dead man's fingers *Alcyonium digitatum* (C - up to 10 m)
red sea fingers *Alcyonium glomeratum* (O - up to 10 m)
sea slug *Polycera faeroensis* (R) - one individual seen at 11 m
bryozoan *Pentapora foliacea* (O - 25 m & above)
7-armed starfish *Luidia ciliaris* (O)
ballan wrasse *Labrus bergylta* (C)
common dogfish *Scyliorhinus canicula* (R)

Divers: Hsin Loke & Toby Brown	Date: 27.6.95	Exact position (if noted): on south side of Gilstone itself	
Depth range (below chart datum): 16.5 - 12.5 m	Time: ?	Dive duration: 24 mins.	Ref. No.: 96/11
1. Habitat/community description: @ 12.5 m. Ledge/top of cliff. Covered with kelp <i>Laminaria hyperborea</i> & <i>L. digitata</i> , with several sea urchins <i>Echinus esculentus</i> . Rock below kelp canopy covered by red algae & animal turf. jewel anemone <i>Corynactis viridis</i> yellow boring sponge <i>Cliona celata</i>			
2. Habitat/community description: @ 16.5 - 11.5 m. Vertical wall, covered with orange & white plumose anemones & jewel anemones. Ledge at 16.5 m was covered with 'turf' and sparse red algae. yellow boring sponge <i>Cliona celata</i> hydroids (indet.) sea fan <i>Eunicella verrucosa</i> (R) anemone <i>Sagartia elegans</i> (F) plumose anemone <i>Metridium senile</i> (C) jewel anemone <i>Corynactis viridis</i> (C) spiny starfish <i>Marthasterias glacialis</i> sea cucumber <i>Holothuria forskali</i> cuckoo wrasse <i>Labrus mixtus</i> (males & females)			

Divers: Ian Jones & Phil Clarke	Date: 28.6.95	Exact position (if noted): Gilstone rock	
Depth range (below chart datum): ? m	Time: ?	Dive duration: ? mins.	Ref. No.: 96/12
1. Habitat/community description: @ 32 - 12 m (below sea level). Near-vertical granite rock face with occasional ledges. No seaweeds below 30 m (bsl). Deepest kelp plants @ 20 m (bsl) with kelp park beginning above 17 m (bsl). kelp <i>Laminaria hyperborea</i> boring sponges (indet.) hydroid <i>Nemertesia ramosa</i> Devonshire cup coral <i>Caryophyllia smithii</i> jewel anemone <i>Corynactis viridis</i> dead man's fingers <i>Alcyonium digitatum</i> fan worm ? <i>Sabella pavonia</i> common starfish <i>Asterias rubens</i> sea urchin <i>Echinus esculentus</i> sea squirt <i>Stolonica socialis</i>			
2. Habitat/community description: @ 35 m (below sea level). Sand (not surveyed).			

9.4 Inner Tolman Ledges, North Side of Old Town Bay, South East St. Mary's

Divers: Sacha Dench & Jeremy Williams	Date: 18.6.95	Exact position (if noted): Inner Tolman Ledges, Old Town Bay	
Depth range (below chart datum): 5.2 - 13.2 m	Time: 11.30 - 12.01	Dive duration: 31 mins.	Ref. No.: 96/13
1. Habitat/community description: @ 6.2 - 9.2 m. Large granite boulders with crevices. Gradual slope of 30°. Kelp dominant (40% cover) forming canopy, 30% red &			

brown algae, & 20% encrusting calcareous pink algae. NB: pieces of wreckage found at all depths.

kelp *Laminaria hyperborea*
kelp *Sacchoriza polyschides*
orange sponge (indet.) (R)
jewel anemone *Corynactis viridis*
Devonshire cup coral *Caryophyllia smithii*
dead man's fingers *Alcyonium digitatum* - small colonies only
topshell *Calliostoma zizyphinum* (F) - on kelp
common starfish *Asterias rubens* (R)
sea urchin *Echinus esculentus* (R)
sea cucumber *Holothuria forskali* (R)
lightbulb sea squirts *Clavelina lepadiformis*

2. Habitat/community description:

@ 9.2 - 10.2 m. Small to large boulders, with small fissures & crevices inbetween. Inclination of slope ~20°. Silty bryozoan turf providing 25 % cover.

kelp *Laminaria* sp. (C)
mixed red & brown algae
topshell *Calliostoma zizyphinum*
sea urchins *Echinus esculentus*

3. Habitat/community description:

@ 12.2 - 13.2 m. Small to large boulders with cobbles, pebbles & gravel inbetween. Flat bottom, very silty.

kelp (indet.) (R)
sea oak *Halidrys siliqua*
encrusting pink algae
Devonshire cup coral *Caryophyllia smithii* - in crevices
sea anemones (indet.)
common starfish *Asterias rubens*
sea urchin *Echinus esculentus*
sea cucumber *Holothuria forskali*
ballan wrasse *Labrus bergylta*

Divers: Ian Jones & Paul Wright	Date: 18.6.95	Exact position (if noted): Inner Tolman Ledges, Old Town Bay	
Depth range (below chart datum): ? m	Time: ?	Dive duration: ? mins.	Ref. No.: 96/14
1. Habitat/community description: @ 10 - 14 m (below sea level). Large granite boulders with kelp forest cover. sea lettuce <i>Ulva lactuca</i> (R) - deepest depth at 13.5 m (bsl) jewel anemone <i>Corynactis viridis</i> (R) Devonshire cup coral <i>Caryophyllia smithii</i> (R) squat lobster (indet.) (O) - in crevices topshell <i>Calliostoma zizyphinum</i> (O)			
2. Habitat/community description: @ 15 m (below sea level). Bits of wreckage + large & medium-sized boulders with kelp park. Occasional patches of coarse sand. Various red algae amongst kelp. Silty bryozoan turf on rock surfaces.			
3. Habitat/community description: @ 16 - 18 m (below sea level). Large boulders, with small caves formed between them. Deepest limit of kelp @ 15.8 m (bsl). Moderately dense cover by foliose algae. jewel anemone <i>Corynactis viridis</i> (C) Devonshire cup coral <i>Caryophyllia smithii</i> (C) spiny starfish <i>Marthasterias glacialis</i> (O) sea urchin <i>Echinus esculentus</i> (C) sea cucumber <i>Holothuria forskali</i> (C) goldsinny <i>Ctenolabrus rupestris</i> (C) cuckoo wrasse <i>Labrus mixtus</i> (O) whiting <i>Merlangius merlangus</i> (R)			

9.5 Little Britain Rock, East St. Mary's

Divers: Cath Downie & Julia Rigby	Date: 28.6.95	Exact position (if noted): east side of Little Britain Rock	
Depth range (below chart datum): 26.9 - 18.8m	Time: 11.30 - 12.00	Dive duration: 30 mins.	Ref. No.: 96/15
1. Habitat/community description: @ 18.8 - 26.9 m. Moderate to steeply sloping granite bedrock. Some gullies with coarse sand with shell fragments. kelp <i>Laminaria hyperborea</i> (sparse cover at 21 m, increasing upwards) Hydroid/bryozoan turf (dense @ 27-20 m) axinellid sponge <i>Axinella polypoides</i> (F - 25-20 m)			

sponge *Suberites carnosus* (O - 25-21m)
sponge *Polymastia boletiforme* (C - 27-20m)
sponge *Polymastia mamillaris* (O - 26-20 m, on horizontal surfaces)
hydroid *Tubularia indivisa* (C - on horizontal surfaces above 20 m)
anemone *Sagartia elegans* (C @ 25 - 20 m)
burrowing anemone *Cerianthus lloydii* (O - in sand gullies)
Devonshire cup coral *Caryophyllia smithii* (O @ 27-23 m; F above 23 m)
jewel anemone *Corynactis viridis* (C - especially above 23 m)
dead man's fingers *Alcyonium digitatum* (F - 27-20 m)
red sea fingers *Alcyonium glomeratum* (O up to 24 m)
sea fan *Eunicella verrucosa* (R - one individual at 25 m)
sea urchin *Echinus esculentus* (C at all depths)
spiny starfish *Marthasterias glacialis* (C at all depths)
7-armed starfish *Luidia ciliaris* (C at all depths)
sea cucumber *Holothuria forskali* (F at all depths)
golfsinny *Ctenolabrus rupestris* (O)
ballan wrasse *Labrus bergylta* (C)
cuckoo wrasse *Labrus mixtus* (R - one male seen)
scorpionfish (indet.) (R)

9.6 Gap Point - Deep Point, East St. Mary's

Divers: Will White & Gordon Mackenzie	Date: 18.6.95	Exact position (if noted): Directly off Deep Point	
Depth range (below chart datum): m	Time: ?	Dive duration: ? mins.	Ref. No.: 96/16
1. Habitat/community description: @ 16-19 m (below sea level). Large boulders with increased density of kelp. Moderately silty with hydroid-bryozoan turf. anemones (indet.) (F) dead man's fingers <i>Alcyonium digitatum</i> (F)			
2. Habitat/community description: @ 19-25 m (below sea level). Similar sea bed type, though some kelp apparent & increasing amounts of red brown seaweeds (up to 30% cover). sea fan <i>Eunicella verrucosa</i> - one individual seen ~ 30 cm across sea cucumbers (indet.) in fissures ballan wrasse <i>Labrus bergylta</i> (R)			
3. Habitat/community description: @ 25-30 m (below sea level). Granite bedrock forming a series of dips, with cliffs and gullies. Rock surfaces covered in silt. Site has been used in the past for disposal of old vehicles, and some wreckage was noted during the dive. red seaweeds (indet.) - sparse boring sponges (indet.) (O) Devonshire cup coral <i>Caryophyllia smithii</i> (C) dead man's fingers <i>Alcyonium digitatum</i> (C) red sea fingers <i>Alcyonium glomeratum</i> (F) velvet swimming crab <i>Necora puber</i> (O) 7-armed starfish <i>Luidia ciliaris</i> (O) burrowing sea cucumbers (indet.) (F) colonial sea squirt (indet.) (O)			

Divers: Jason Gibb & Robert Irving	Date: 18.6.95	Exact position (if noted): off Gap Point	
Depth range (below chart datum): m	Time: ?	Dive duration: ? mins.	Ref. No.: 96/17
1. Habitat/community description: @ < 20 m (below sea level). Granite bedrock forming small cliffs & gullies, with much silt. sugar kelp <i>Laminaria saccharina</i> - deepest depth recorded @ 21 m (bsl) mixed red & green algae (indet.) encrusting coralline algae (C) sea oak <i>Halidrys siliqua</i> (O) dead man's fingers <i>Alcyonium digitatum</i> (O) red sea fingers <i>Alcyonium glomeratum</i> (O) sea slug <i>Diaphorodoris luteocincta</i> (R) 7-armed starfish <i>Luidia ciliaris</i> (O) sea urchin <i>Echinus esculentus</i> (F) sea cucumber <i>Holothuria forskali</i> (F) cuckoo wrasse <i>Labrus mixtus</i> (O) ballan wrasse <i>Labrus bergylta</i> (O)			
2. Habitat/community description: @ 20-25 m (below sea level). Undulating silt-covered granite bedrock, dominated by hydroid-bryozoan turf. Occasional red & brown			

algae. Otherwise similar to Habitat 3.
spiny starfish <i>Marthasterias glacialis</i> (C) sea urchin <i>Echinus esculentus</i> (C)
3. Habitat/community description: @ 25-30 m (below sea level). Granite bedrock forming small cliff & gullies, with occasional horizontal platforms. Very silty, with bryozoan turf dominating. Sparse red algae. axinellid sponge <i>Axinella polypoides</i> (C - up to 25 cm high) sponge <i>Suberites ?domuncula</i> (C) Devonshire cup coral <i>Caryophyllia smithii</i> (C) dead man's fingers <i>Alcyonium digitatum</i> (O) red sea fingers <i>Alcyonium glomeratum</i> (O) sea slug <i>Diaphorodoris luteocincta</i> (R) 7-armed starfish <i>Luidia ciliata</i> (O) sea cucumber <i>Holothuria forskali</i> (O) ballan wrasse <i>Labrus bergylta</i> (O)

9.7 Off Steval, West of the Garrison, St. Mary's

Divers: Robert Irving & Jeremy Williams	Date: 18.6.95	Exact position (if noted): NW side of Steval	
Depth range (below chart datum): 10.9 - 12.2m	Time: 17.10 - 17.48	Dive duration: 38 mins.	Ref. No.: 96/18
1. Habitat/community description: @ 10.9 - 12.2 m. Level seabed, with large & small granite boulders, and cobbles & pebbles inbetween. Occasional patches of just cobbles and pebbles with gravel. Kelp (mostly <i>Laminaria hyperborea</i> but also some <i>Laminaria ochroleuca</i>) providing 30% of cover; red algae 25%; pink encrusting algae 15%; green algae 5%; leaving 25% of sea bed uncovered by seaweeds. No fish seen. small orange encrusting sponge (indet.) (R) Devonshire cup coral <i>Caryophyllia smithii</i> (R) snakelocks anemone <i>Anemonia viridis</i> (R) burrowing anemone <i>Cerianthus lloydii</i> (R) sandmason worm <i>Lanice conchilega</i> (R) velvet swimming crab <i>Necora puber</i> (R) common starfish <i>Asterias rubens</i> (R) sea urchin <i>Echinus esculentus</i> (O) - almost all of a large size sea cucumber <i>Holothuria forskali</i> (R) burrowing sea cucumbers (indet.) (R) colonial sea squirts (indet.) (R)			

9.8 Nut Rock, East of Samson

Divers: Ian Jones & Gordon Mackenzie	Date: 15.6.95	Exact position (if noted): Off the south side of Nut Rock	
Depth range (below chart datum): m	Time: ?	Dive duration: ? mins.	Ref. No.: 96/19
1. Habitat/community description: @ ? m. Depths not recorded, though all of dive < 7 m below sea level. "Towards top of rock outcrop there is bladderwrack moving down into very dense kelp forest, covering all available bedrock. Very dense understorey of various red & brown weeds, with some sea lettuce. Several large ballan wrasse observed. Little silt noted from kelp bed, indicating medium/high energy of site. At edge of bedrock, about 15 m away from the drying part of the rock, is coarse sand with fragmented sea grass growths.			

CONSPICUOUS SPECIES	SITES							
	Pen'nis Head	Carri- kstame	Gil- stone	Inner Tolm'n Ledges	Little Britain Rock	Gap & Deep Pts.	Off Steval	Nut Rock
	1	2	3	4	5	6	7	8
ALGAE								
kelp <i>Laminaria digitata</i>		✓						
kelp <i>Laminaria hyperborea</i>	✓	✓	✓	✓	✓	✓	✓	✓
sugar kelp <i>Laminaria saccharina</i>		✓				✓		
kelp <i>Laminaria ochroleuca</i>							✓	
kelp <i>Sacchoriza polyschides</i>				✓				
sea oak <i>Halidrys siliqua</i>	✓	✓		✓		✓		
<i>Dictyota dichotoma</i>	✓							
encrusting pink algae				✓		✓		
sea lettuce <i>Ulva lactuca</i>				✓				✓
PORIFERA								
<i>Suberites domuncula</i>		✓				✓		
<i>Suberites carnosus</i>			✓		✓			
<i>Hemimyscale columella</i>	✓							
<i>Cliona celata</i>	✓	✓	✓					
<i>Axinella</i> sp.	✓							
<i>Axinella polypoides</i>	✓		✓		✓	✓		
<i>Polymastia mamillaris</i>	✓				✓			
<i>Polymastia boletiforme</i>			✓		✓			
<i>Oscularella lobularis</i>		✓						
sponge (indet.)	✓			✓		✓	✓	
CNIDARIA								
hydroids (indet.)	✓		✓					
hydroid <i>Nemertesia ramosa</i>			✓					
hydroid <i>Tubularia indivisa</i>					✓			
zoanthid anemone <i>Isozoanthus sulcatus</i>	✓							
zoanthid anemone <i>Epizoanthus couchi</i>		✓						
sea fan <i>Eunicella verrucosa</i>			✓		✓	✓		
Devonshire cup coral <i>Caryophyllia smithii</i>	✓	✓	✓	✓	✓	✓	✓	
jewel anemone <i>Corynactis viridis</i>	✓	✓		✓	✓			
plumose anemone <i>Metridium senile</i>			✓					
anemone <i>Sagartia elegans</i>	✓	✓	✓		✓			
daisy anemone <i>Cereus pedunculatus</i>	✓							
dahlia anemone <i>Urticina felina</i>	✓							
snakelocks anemone <i>Anemonia viridis</i>							✓	
burrowing anemone <i>Cerianthus lloydii</i>	✓				✓		✓	
dead man's fingers <i>Alcyonium digitatum</i>	✓	✓	✓	✓	✓	✓		
red sea fingers <i>Alcyonium glomeratum</i>	✓	✓	✓		✓	✓		
POLYCHAETA								
Fan worm ? <i>Sabella pavonina</i>			✓					
sandmason worm <i>Lanice conchilega</i>							✓	
CRUSTACEA								
velvet swimming crab <i>Necora puber</i>	✓	✓				✓	✓	
edible crab <i>Cancer pagurus</i>	✓							
squat lobster (indet.)		✓		✓				
MOLLUSCS								
topshell <i>Calliostoma zizyphinum</i>				✓				
cowrie <i>Trivia arctica</i>	✓							
sea slug <i>Polycera faeronensis</i>	✓		✓					
sea slug <i>Diaphorodoris luteocincta</i>						✓		
BRYOZOA								
bryozoa (indet.)	✓	✓						
<i>Pentapora foliacea</i>			✓					
ECHINODERMS								
common starfish <i>Asterias rubescens</i>		✓	✓	✓			✓	
spiny starfish <i>Marthasterias glacialis</i>	✓	✓	✓		✓	✓		
7-armed starfish <i>Luidia ciliaris</i>	✓		✓		✓	✓		

CONSPICUOUS SPECIES	SITES							
	Pen'nis Head	Carrie- kstame	Gil- stone	Inner Tolm'n Ledges	Little Britain Rock	Gap & Deep Pts.	Off Steval	Nut Rock
	1	2	3	4	5	6	7	8
sea urchin <i>Echinus esculentus</i>	✓	✓	✓	✓	✓	✓	✓	
sea cucumber <i>Holothuria forskali</i>	✓	✓	✓	✓	✓	✓	✓	
burrowing cucumber ? <i>Thyone</i> sp.	✓							
burrowing cucumber ? <i>Aslia lefevrei</i>	✓							
burrowing cucumber (indet.)	✓	✓				✓	✓	
ASCIDIACEA								
lightbulb sea squirt <i>Clavelina lepadiformis</i>	✓			✓				
sea squirt <i>Stolonica socialis</i>			✓					
colonial sea squirt (indet.)						✓	✓	
FISH								
common dogfish <i>Scyliorhinus canicula</i>			✓					
goldsinny <i>Ctenolabrus rupestris</i>	✓			✓	✓			
cuckoo wrasse <i>Labrus mixtus</i>	✓	✓	✓	✓	✓	✓		
corkwing <i>Crenilabrus melops</i>	✓							
ballan wrasse <i>Labrus bergylta</i>	✓	✓	✓	✓	✓	✓		✓
pollack <i>Pollachius pollachius</i>	✓	✓						
whiting <i>Merlangius merlangus</i>		✓		✓				
pipefish (indet.)	✓							
scorpionfish (indet.)					✓			

Table 9.2 - Conspicuous species noted by recorders from each site

10. Appendices

10.1 Budget

The following summarises the income and expenditure of the report. The remaining balance of £408 will be used for the production of the report and other administration expenses.

Income (Fees and Donations)	£6,310.00	
Accommodation		£1,070.00
Air		£81.00
Boat		£114.00
Ferry		£752.00
Food		£1,086.99
Miscellaneous		£181.68
Petrol		£1,056.25
Science		£1,560.00
Total	£6,390.00	£5,981.92
Balance		408.08

10.2 Diary

Glossary

CCC Coral Cay Conservation
OD Ocean Defender

RIB Rigid-hull Inflatable Boat
SMB Surface Marker Buoy

Friday, 9th June

Four volunteers, Gordon, Will, Jason and Sacha met at Penzance in the Dolphin pub in the evening before the main trip.

Saturday, 10th June LW: 09.20 1.2 m HW: 15.20 4.9 m
Weather:

Meet the rest of the team (Rob, Keith, Jeremy & Ian) on the pier at 8.30 a.m. and load up gear into a container marked for Coral Cay use. The traffic at the entrance to the quay is much less than in previous years since it's still term time. The *Scillonian III* sails at 9.15 and takes two and a half hours to reach the Islands. Arrive at St. Mary's Harbour just after lunch and are picked up by the *Ocean Defender* at the quayside once the *Scillonian* departs. Fortunately this was at high water (15:20). Unfortunately, we find that the *OD* needs a pilot to come into harbour and for all movements within the archipelago, which is likely to restrict our use of her as an on-site support vessel as the pilotage fee is quite high. Meet the officers and crew on board and get to know the layout of the ship.

Sunday, 11th June LW: 10.13 0.9 m HW: 16.11 5.3 m
Weather: Fair

First wave was delayed by engine problems on the *OD*'s RIB, but eventually we got going after lunch. Everyone had safe and enjoyable dives on the wreck of the *Lady Charlotte* near Peninnis Head, at the southern end of St Mary's. Supper is on the early side at 6.30. The quality of the meal, prepared by ex-Dorchester Hotel chef Kier, is excellent. We're told that all meals on board the *OD* are vegetarian - and all the cleaning fluids have to be environmentally friendly.

Monday, 12th June LW: 11.03 0.6m HW: 16.59 5.6 m
Weather: Fine

Morning spent trying to sort out and purchase fuel supplies for the RIB. Attempted to re-locate the permanent marker at Peninnis Head but didn't see it. Visibility was poor by local standards and the

afternoon session was spoilt by adverse currents. Availability of the RIB meant just one dive for each diver. Robert arrives on the Scillonian at 12.30 and he and Gordon call in at Andrew Gibson's office in Hugh Town to discuss the expedition's work programme. After supper, all of the team plus a number of the *OD* crew go ashore for a slideshow given by local diver Mark Groves, returning to the ship at 11.45.

Tuesday, 13th June LW: 11.49 0.5 m HW: 17.44 5.8 m
Weather: Wind NE3/4 Sunny, clear skies with thin high cloud. Cool breeze.

After breakfast, Gordon & Robert explain the methodology of the sea grass survey work to the group. Will is taken into St Mary's Harbour in order to accompany Cyril Nicholas in the English Nature launch *Melza* out to St Martin's. The *OD* RIB sets off with four first wave divers to St Martin's, meeting up with the *Melza* at the eastern end of Higher Town Bay, about one hour before LW. The first batch of 12 quadrats was undertaken in knee-depth water, either on foot or using snorkels, followed by a lunch break when the RIB returned to the *OD*. The tide turned surprisingly quickly and soon the second batch of quadrats was being completed in an awkward 2.5 m of water and a strong east-flowing current. However, all were completed successfully and the *Melza* returned to the *OD* with all 9 divers. In the meantime, Martin of the *OD* crew had managed to overhaul Andrew Gibson's RIB and we're hoping to use this prior to the arrival of the CCC RIB on Friday. After a short tea break, the team start the task of measuring all the sea grass samples, which continues after supper until 8.00 pm.

Wednesday, 14th June LW: 12.45 0.4 m HW: 18.38 6.0 m
Weather: Wind NW3 Sunny with clear skies

From 8.45 until 10.15, Robert runs through the MCS Seasearch project, explaining the categories mentioned in the "promptsheet" and the lay-out of the recording forms, followed by a number of slides indicating habitat types together with some common and some less common species. The theory is then put into practice with a dive at Inner Peninnis Head, using both the *OD* Tornado RIB and Andrew Gibson's Humber RIB to ferry us there. Recording forms are filled in after lunch back on board the *OD*. Paul Fenner, a freelance journalist writing an article about the *OD* for Diver magazine, joins the ship early afternoon. It's decided to have an initial stab at the sea urchin transect study as a second dive for everyone at Toll's Island off the NE corner of St Mary's, where we're hoping for relatively slack water. Though the first pairs in achieve this, the second pairs have to contend with a gradually increasing current. However, the task is completed successfully, with numbers of sea urchins being counted along a 1 m wide 50 m long strip. Return for supper at 8.00, when a small school (6 or 7 individuals) of Risso's dolphins are spied off the port stern quarter. Everyone drops everything to watch them and the two RIBs and a surf-ski head off to get a closer look. Most of the team are run to the shore for a couple of hours before the pubs close.

Thursday, 15th June HW: 07.11 5.6 m LW: 13.39 0.4 m
Weather: Fine & sunny. Light winds from the NW. Spring tide.

Today is being given over to PR. An interviewer and cameraman from the BBC (Plymouth) and one from TV South West arrive on helicopters and are collected from the quay at 11.00. They have both picked up on the press release which Earthkind issued a couple of days ago, and have both decided to run the piece on the same day at the same time on their local (south-west) early evening news programme. The TVSW man acts as both interviewer and cameraman and simply stays on board the *OD*. The BBC couple want some shots of divers surveying the sea grass beds so are taken over to the shallow flats off Samson. Robert gives interviews to both, explaining the sea grass project and the concern about the reappearance of the wasting disease. Both crews depart at 13.45. The plan is then to make the most of the flat calm conditions and catch low water slack at Trenemene out on the Western Rocks. However, both RIBs then have engine problems and the plan is aborted. Avidly watch both BBC & ITV between 6-7 pm and manage to catch both "soundbites" which are shown within a minute of each other. Supper at 7.00 is followed by groups going ashore. Return to *OD* 11.45.

Friday, 16th June HW: 08.10 5.6 m LW: 14.31 0.5 m
Weather: Cloudy. Light breeze from the W which picks up to SW force 5 by evening. Spring Tide

Up at 07.00 to attempt to catch high water slack round the east side of St Mary's at Deep Point from 8.30 - 9.30, but the Humber RIB's engines are out of action (blocked fuel lines) and the Tornado RIB, we find, is only performing at half speed. With the likelihood of strong currents today if slack is missed, Robert considers the situation too precarious for diving and the team once again spend the morning twiddling their thumbs. However, Gordon, who stayed in Hugh Town last night, meets with the Duchy's Land Agent Jeremy, and explains to him how the expedition is getting on. A call comes through from Andrew Gibson that he'd like *OD*'s help in erecting some "Keep Off" signs to be put up on Great Ganilly in order to protect some sea bird chicks. Two of the crew set off in the Tornado RIB to do this, but one hour later we hear their RIB has been left high and dry on the island by the falling tide (oops!). They have to wait five hours before she's afloat again. The team stranded on board the *OD* all sit round in the "state room" with pocket calculators working out totals and averages on the sea grass recording forms. The *Scillonian* arrives about midday bringing with her Steve Westwood (& his girlfriend Vicky) who are joining *OD* for a week to study seals; and departs later with Paul Fenner. Gordon oversees the arrival of the CCC RIB off the *Scillonian*, but has problems getting one of her twin 40 hp engines into forward gear, so is unable to bring her out to the *OD* until about 17.30. In the meantime, the *OD*'s engineer Martin, who's spent most of the morning bobbing up and down in the Humber RIB alongside the *OD* whilst trying to fix her outboards, takes her in to the quay to fix her there. We see no more of him until the evening. Once Gordon brings the CCC RIB out to the *OD*, we're able to take two waves of divers out to the sea grass beds off the NE of Samson to take some more samples (18.00 - 20.00). In the early evening there's a pilot gig race (6 rowers per boat) which passes close to where the *OD* is anchored.

Saturday, 17th June HW: 09.04 5.3 m LW: 15.21 0.7 m
Weather: Overcast. Wind: SW6. Swell from W/SW

The poor weather leads to diving being cancelled for this morning, it being too dangerous to load equipment into a RIB alongside the *OD*. However, the time is put to good use by measuring the sea grass samples collected yesterday evening and carrying out further statistical analysis on the results of the St Martin's Higher Town Bay samples. Gordon stays on dry land and meets Paul Wright, expedition leader for Phase 2, off the *Scillonian* (*OD* crew members Martin, Jo and Ally leave on her for a few days on the mainland). Jason and Sacha are taken to St Martin's over the low tide period for Jason to collect some intertidal invertebrates from the vicinity of the Wine Cove tip site. Jeremy & Ian and Keith & Robert dive at the NE Samson sea grass site (with Rob boathandling) to collect the remaining samples from there. At 7.30 all of the CCC team plus several of the *OD* crew go ashore for a meal at the Bishop & Rock pub. Gordon, Robert, Will and Paul stay at the flat, leaving the CCC RIB on a mooring overnight.

Sunday, 18th June HW: 09.58 5.1 m LW: 16.10 1.0 m
Weather: Starts off overcast but by lunchtime there are clear skies and sunshine. Wind light from SW. Swell from SW though little sea.

The CCC RIB drives out to the *OD* by 08.15. Load on gear for first wave of divers who go round to Gap Point/Deep Point area. The underwater visibility has dropped considerably (2-3 m) after yesterday's strong winds. We manage to catch slack water at the site (which approximates to a period one & a half hours before L&HW), but by the time the second wave head out from the *OD* (which is now alongside at the quay, St Mary's Harbour) the tide is beginning to run. So they dive in the lee of the SW-wards running current on Inner Tolman Ledges, out from Old Town Bay. The task for the morning is Seasearch recording at these sites. During non-diving periods, the remainder of the sea grass samples from yesterday are measured. Everything comes to a stop in the early afternoon as today England are playing New Zealand in the Rugby World Cup semi-final (and getting trounced) so all gather round the TV on board. Jason does some more mollusc collecting around the Garrison over the low water period while 3 pairs plus a coxswain (Rob) undertake a sea urchin transect off Steval, a rock off the west side of the Garrison. Visitors have been looking around the *OD* during the day whilst she's been tied up alongside the quay. She's due to return to her anchorage tomorrow morning before the *Scillonian* comes in. The team go ashore after supper for a last night drink or two at the Bishop & Wolf.

Monday, 19th June HW: 10.51 4.8 m LW: 16.59 1.3 m
Weather: Overcast. Wind force 3 SW backing E during the day.

Gordon, Paul & Robert return from the flat to the *OD* at 07.30 and supervise the offloading of dive gear and personal luggage. The *OD* leaves the quay at 08.00. The four pairs diving from Jim Heslin's hardboat, which comes alongside soon after, then load their gear onto it. Motor out to the SW side of St Agnes and dive on the wreck of the *Plympton* which went down in 1909. Dive about an hour and a half before HW and there's still a current running which makes the dive slightly less enjoyable. The second dive is at Menawethan, Eastern Isles, where everyone has an amazing time with the seals under water - biting fins, prodding cameras and performing acrobatics - the seals appeared to have fun as well. Return to St Mary's Harbour to meet up with the new arrivals off the *Scillonian*. Ferry their dive gear out to the *OD* aboard Jim's boat, leaving the departing team on the quayside. Cyril Nicholas helps to ferry out people aboard *Melza* a little later on. The new team sort out their gear on board the *OD*, are introduced to the crew and have a quiet afternoon. Robert explains the science programme before supper at 18.30. Go ashore after supper for Mark Groves' lecture at 20.30.

Tuesday, 20th June

HW: 11.49 4.6 m

LW: 17.53 1.5 m

Weather: Low mist/fog until mid-morning, lifting at midday with the afternoon clear and sunny.

Wind: NW3.

The five staying in the flat overnight (Robert, Cath, Julia, Bert & Andy) get to the quay for 08.15 to be ferried over to the *OD* by Paul who'd stayed on the boat last night. The team get their own dive gear together prior to the first wave of six leaving for a dive at 10.30 on the Carrickstarne, a rock just east of Peninnis Head, using the CCC RIB. Besides a general shake-down dive, one of each pair undertakes a Seasearch description of the site. Return to the *OD* and the second wave departs after 45 mins. of 'sorting things out'. Still catch slack at Peninnis Head but Julia and Bert have problems in getting down. Return to *OD* for a late lunch at 14.00. Plan to do sea grass collecting at Old Grimsby Harbour on the east side of Tresco at 16.00-18.30, in two waves. Mark Groves offers the use of his RIB to help with this. At the site, the sea grass beds appear severely depleted since last year, so quadrat collection of samples is undertaken from the densest areas only. In the meantime, to coincide with low water, Robert takes a flight in a small aircraft in order to take some aerial photos of the sea grass beds around the islands. The weather is ideal for this and the pilot flies at 500 feet. Brian, the *OD* skipper and an ex-pilot himself, comes along for the ride and to help change film in cameras (two and a half print films taken). The divers return for a late supper at 19.30, while Brian and Robert are stranded ashore because the Tornado RIB has now broken down. Eventually they are picked up and taken out to the *OD*. The six staying in the flat then come ashore at about 21.00.

Wednesday, 21st June

HW: 12.49 4.4 m

LW: 18.54 1.7 m

Weather: Overcast until midday, with clearing skies in the afternoon. Wind: NE3.

The team ashore are collected from the quay at 08.15 and taken out to the *OD*, with the exception of Bert who stays in HughTown to buy some provisions, takes the aerial films in to be processed and acquires a wet suit jacket on loan from Mark Groves. Robert gives instruction to the others on the technique of measuring the sea grass collected yesterday and five pairs then measure the samples from 18 or so bags. Today's dive plan is to undertake a sea urchin transect at the Eastern Isles, between Great Arthur and Ragged Island. Cyril Nicholas arrives with the *Melza* at 11.00 and takes one group of 5 divers. The CCC RIB does a 'fuel run' in to St Mary's Harbour and then takes the second group of 5 divers out to the Eastern Isles at 12.00. Two prototype urchin measuring callipers have been made up by Al on board the *OD* and these prove to do the task adequately. The group return at 14.30 having completed the task almost completely - unfortunately the last pair fail to finish their urchin measuring and leave down the tape attached to the shot line. This leads to another pair of divers (Toby & Ian) returning to the site later in the afternoon in order to complete the task. During the afternoon, Robert checks through the aerial photographs and labels them all with Cyril Nicholas' help. He then gives the group a talk/slideshow about the recording techniques of the Seasearch project. Supper is at 19.15. It's been decided to hold a summer solstice(?) party on board this evening, so there's a booze run to shore and another after supper to pick up bedding from the flat, so that all who wish to stay on board tonight can do so. Cyril Nicholas and his daughter Diane join in the fun too.

Thursday, 22nd June

LW: 07.28 1.7 m

HW: 13.44 4.3 m

Weather: Clear sky, sunshine. Wind NE3/4 decreasing to 2 by early evening.

The plan today is to undertake a sea urchin count on Trisky, south of Woodcock Ledge to the NW of the Garrison, St Mary's. With slack being two hours after high water in St Mary's Sound to the south, we are hoping there won't be too much tide if we dive this site half an hour *before* high water. Cyril Nicholas comes out to the OD at 11.45 and, after an early lunch, the first wave of six divers are ferried over to the site at 12.45 aboard *Melza*. Ian accompanies Steve Westcott this morning observing seals on the Norrad Rocks and so doesn't dive, Robert catches up on entering data into his computer and Paul boat-handles the second wave of divers aboard the CCC RIB. This means that five pairs carry out the urchin counts. We decide that only one dive can be undertaken today as high & low water times fall at awkward times. This will allow a chance for an early night tonight prior to an early start in the morning. Steve Westcott gives a talk to the crew of the OD about his grey seals' study, but unfortunately this coincides with the dive so our group don't hear it. He departs on the Scillonian with Vicky later this afternoon. Paul and Will fix the GPS and radio onto the CCC RIB before supper at 18.30. Eight of the team go ashore at 20.00, with six staying on at the flat overnight. Robert shows the aerial photographs to the pilot and then meets up with Mark Groves to discuss the current level of sea urchin fishing.

Friday, 23rd June

LW: 08.31 1.7 m HW: 14.36 4.4 m

Weather: Fine, sunny. Wind N2.

The shore team are collected at 08.00 and are brought out to the OD. The intention today is to carry out another sea urchin transect at Spanish Ledges in St Mary's Sound. Slack here is two hours after LW, so the first wave of six set off at 09.45. They return some 75 minutes later with the news that they only found 3 urchins within an area of 400 m². It's therefore decided that the second wave of five divers should reposition the shot before beginning the urchin measuring. However, by this time (11.45), the tide is beginning to run so they have some difficulty lifting the shot line, the two measuring tapes and the two SMBs which are all connected together. Lunch at 13.30. A group of six divers then head off to east of Broad Ledge, S. Tresco, to do some more sea grass collecting, followed by a second wave of four divers. The only upset here is that a quadrat frame is accidentally left behind on the sea bed. Supper at 18.30, followed by one and a half hours of sea grass measuring while cylinders are being compressed. The next failure to afflict us then happens: a bolt holding the exhaust manifold to the engine of the compressor shears off as a result of the vibration and the compressor has to be shut down. Paul is hopeful the bolt can be drilled out tomorrow... A party go ashore at 20.45.

Saturday, 24th June

LW: 09.28 1.5 m HW: 15.23 4.7 m

Weather: Fine to start with but becomes overcast in the afternoon. Wind NE4 decreasing to 3 later.

The 07.45 pick-up RIB arrives at the quay half an hour late to collect the shore party. The intention is to dive the wall at Trenemene at the southern end of the Western Rocks, as a "fun" dive this morning, followed by a free afternoon. The sea is reasonably calm though there's a stiff NE breeze. Slack we are told is half an hour after LW. Nine divers and two boat handlers depart OD at 09.15 and arrive on site at 09.45. There's still a current creating a choppy sea on the eastern side of Trenemene when we get there, so we wait a further 15 minutes before entering the water. The current is still present though it does not create too much difficulty. A spectacular vertical wall is encountered which drops to 40+ m. All have an enjoyable dive despite the chop on the surface making boat re-entry difficult. Return to the OD for lunch at 12.30. Six of our group go ashore after lunch and catch a launch over to Tresco, while the others stay on board and watch the Rugby World Cup Final on TV with the crew (well done South Africa). Paul has little joy trying to drill out the sheared bolt from the compressor, so we arrange for Jim Heslin to fill our bottles overnight. The good news is that the GPS is now working on the CCC RIB. Half the group go out for an evening meal at the Bishop & Wolf, while the others eat on board and then do their own thing (which includes a visit to the only disco in Hugh Town, situated underneath the butchers!). Late to bed for most.

Sunday, 25th June

LW: 10.14 1.4 m HW: 16.05 4.8 m

Weather: Overcast to start with, brightening up during the day. Wind NE4/5.

Manage to get everybody up at 09.00 and get the first wave of six divers off in the Humber RIB to Peninnis Head by 10.15. The plan is to carry out a sea urchin transect/depth profile off the Chair in the lee on the west side of the headland. A shot line is dropped in 30 m depth at the sediment/bedrock interface. Two groups of three then descend down the shot and lay out the two measuring tapes on bearings of 60° and 80° respectively. Two of each group record the number of urchins a metre either side of the tape, gradually ascending to 10 m depth at a distance of 90 m along the tape. The CCC RIB (with Paul as cox) then puts down a pair of divers on each SMB line/tape and they measure urchins and reel in the tapes as far as they can within the limit of their dive time. The shot line and the two partially-wound tapes are then recovered from the surface. Lunch back on board *OD* (which is still alongside the quay) at 13.00-14.00. We are unable (and unwilling due to the expense) of filling the diving cylinders twice per day, so the sea grass dives this afternoon are only for those who have enough air left. The CCC RIB takes 4 divers to do a sea grass survey in the Broad Ledge area between Tresco and St Martin's, which, from the aerial photographs, has been shown to have dense beds. Unfortunately, the current is too strong for the divers to stay on station and the attempt is abandoned. The Humber RIB takes two snorkellers and attempts to confirm the presence of sea grass in the same area. This is partially successful, the difficulty being identifying the sea grass at high water (depth of about 6 m). The two boats return to the *OD*. Several of the group (Will, Bert & Robert) are now suffering from colds and coughs which brings the number of active divers down to ten. Paul arranges for Jim Heslin to fill 13 cylinders again this evening. Cyril Nicholas calls by and discusses a plan for tomorrow. Some of the group go ashore but most seem to be feeling quite tired and either talk on deck or watch TV.

Monday, 26th June

LW: 10.54 1.2 m HW: 16.42 5.1 m

Weather: Fine though cool. Wind NE4/5.

The *OD* leaves the quay at 07.45 with the pilot on board for the ten minute journey out to our anchoring position in St Mary's Road. Bert stays ashore in order to acquire some threading tools and bolts to (hopefully) fix the compressor. The intention is to get up to St Martin's today to survey the English Island sea grass bed and to look at Wine Cove on the north side of the island. However, the NE wind thwarts our plan and we change to collecting some further samples of sea grass from Old Grimsby Harbour and to doing some more Seasearch dives on Peninnis Head. So Cyril Nicholas takes four divers aboard *Melza* to Old Grimsby Harbour at 14.00. The CCC RIB sets off with six divers half an hour later, set the task of describing the shelving granite rock sea bed between the Outer and Inner Heads at Peninnis Point. Cath collects a sample of the alga growing at the deepest depth here, for pressing. Bert reports that he's managed to fix the exhaust manifold back onto the compressor but then gets a lift ashore leaving someone else to actually start it up! Robert remains on board and types out a short article about the expedition for the next issue of the 'Scilly' magazine, which is submitted together with one written by Martin about Earthkind and the *Ocean Defender*. After a reviving cup of tea, a start is made on measuring the sea grass. Supper at 19.00 is followed by most aboard going ashore, either for a shower and a drink or for kite flying on Garrison Hill.

Tuesday, 27th June

LW: 11.28 1.1 m HW: 17.16 5.2 m

Weather: Fine & sunny. Wind NE4/5 though moderating to 2 by early afternoon.

The team ashore are met on the quay at 09.00, together with Liz Cook who was a member of last year's CCC expedition. She asks to spend the day with us. Paul stays ashore and manages to visit a number of people to sort out arrangements for our departure, e.g. taking the CCC RIB out of the water onto its trailer and loading it aboard the *Scillonian*; arranging for a shipping container for our gear; and seeing the Harbour Master to inform him of these arrangements. Cyril Nicholas comes out to the *OD* at 10.30 and by 11.15 the *Melza* (with 6 divers) and the CCC RIB (with 4 divers) are off to St Martin's. Those on board *Melza* do the final sea grass collecting from the English Island/Chimney Rocks site, while the other 4 head round to Wine Cove and search the near-shore area for signs of refuse from the cliff rubbish tip. Both of these tasks were accomplished successfully, though there was no sign of the permanent marker (granite block) to the NE of English Island. Back to the *OD* for lunch and measuring the sea grass samples. The Gilstone, east of Peninnis Head is chosen as a second dive site, to coincide with high water. The dive is to be part 'fun'/part work, with Seasearch survey forms to complete, sea urchins to be measured and those with cameras to take pictures. A number of

mishaps mar the dive for some: Bert's HP hose blows just as he's kitting up; Ian can't clear his ears as he's descending so he and Andy have to terminate their dive after just five minutes; Phil gets a vertigo attack under water which makes him feel most peculiar; and P'ng manages to lose his underwater camera during the dive, but fortunately it floats and we pick it up on the surface later. Return to *OD* for a late supper at 19.30, followed by a form filling session. Some of the shore party then end up at the Mermaid pub where a blues band is playing, getting to bed at about midnight.

Wednesday, 28th June

LW: 12.01 1.1 m HW: 17.50 5.3m

Weather: Fine and sunny. Wind NE/E 2/4/2.

The shore party is picked up at 08.30 and Will is left with Cyril Nicholas to help him clear out his shed (Will's cold is still keeping him 'off games', as is Robert's; other non-divers today include Bert, Hsin and Paul). So the 8 that remain have a dive either on the Gilstone (for those who didn't manage it yesterday) or off Little Britain Rock on the east side of St Mary's [slight northwards-running current half an hour before LW]. Return to *OD* for lunch at 12.30. Toby, Hsin and P'ng pack up their gear ready for their departure on the *Scillonian* at 16.00. Bert fills the tanks used this morning ready for a second shallow dive by six of the team this afternoon at Little Smith, off the NW of St Agnes, for sea urchin counts/measuring. This goes fairly well though there's a slight current which hampers laying the measuring tape in a straight line. Return to *OD*. Finish cleaning out Andrew Gibson's RIB prior to returning it to him, together with the CCC RIB which is winched out onto its trailer at Porth Mellon beach by a range rover by prior arrangement. The 4 involved with this operation are then collected from the quay by the *OD* RIB and brought back out to the *OD* for supper at 19.30. Final form-filling ensues before two runs ashore at 20.30 and 21.00. Meet up with Cyril Nicholas in the Bishop & Wolf for a farewell drink. Paul joins a group of guitar-strumming Irish yachtsmen and impresses with his blues renditions. All late to bed about midnight.

Thursday, 29th June

HW: 06.16 5.1 m LW: 12.39 1.0 m

Weather: Fine and sunny. Wind E 4/5

Jezz and Adam arrive at the quay for an 08.30 pick-up, but those in the flat were expecting a 09.30 pick-up. So the confusion continues... Robert pays a call on Andrew Gibson at his office to thank him (and the Environmental Trust) for his assistance over the past three weeks. Back on board, a late breakfast is followed by everyone packing up personal and diving gear. We watch a video, lent to us by Cyril Nicholas, of the CCC sea grass project in the IOS as filmed by IBM in 1993. This is followed by another of a 999 rescue of a yacht in Porth Cressa by the St Mary's lifeboat. After lunch, the *OD* RIB is filled with the diving cylinders and weightbelts for the first run in to the quay. By now the wind has picked up to force 5 and a bumpy ride in is experienced. On the successive runs (three in all) luggage is wrapped up in bin liners to avoid getting too wet. Those staying in the flat then finish packing there and tidy up. Paul extracts the boat on its trailer from the Duchy boatshed and leaves it on the quay ready for loading onto the *Scillonian*. There's then time for an hour's souvenir hunting prior to boarding the ship which sails at 16.30. We wave goodbye to Cyril on the quay and manage a 'Mexican wave' from the top deck to those on board the *OD* anchored about half a mile away. We arrive at Penzance at 19.10 and are met by Jon Ridley who's driven down from London in order to tow the RIB back. Offload luggage from the container and

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