
Coral Cay Conservation Sub-Aqua Club

Isles of Scilly 1998 Expedition Report

Prepared by
Kevan Cook
Adel Enderson
Tom Reid

Supported by



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Abstract

A total of 18 people took part in the Coral Cay Conservation Sub-Aqua Club 1998 Expedition to the Isles of Scilly during the two week period 1-15 August 1998. During this time the volunteer divers carried out four main projects:

1. *Zostera* monitoring dives at four sites surveyed in previous expeditions and an additional site at the Great Ganilly
2. 41 Seasearch dives
3. a sediment profile survey of Bar Point, St. Mary's
4. a litter survey on 11 beaches in the archipelago.

It was found that *Zostera* plant densities follow a similar pattern from that seen in previous years although this was slightly greater at Old Grimsby Harbour, the site with the lowest density, and less at Higher Town Bay, St. Martin's, the site with the greatest plant density. Infection by the parasitic slime mould *Labyrinthula* was greater at all sites than in 1997 but not as high as that seen in earlier years. The pattern of plant size distribution at the four sites previously sampled was similar to that recorded in previous years. However, plants at the new site, Great Ganilly, appear to have a greater average length.

Seasearch dives were carried out at eight sites around the archipelago, concentrating on areas previously unsurveyed. The data show similar habitats to those recorded in previous years. However, an additional biotope, Mixed Horizontal Sediments, is described for the first time. The data were also used to ground-truth an Ambios remote sensing survey carried out in the Isles of Scilly in September / October 1998.

A survey of the sub-tidal sediment distribution around Bar Point, Saint Mary's, Isles of Scilly was conducted as a repetition of work done by CCC-SAC in 1992, (R.Nunny, 1992). The aim was to ascertain if the processes of erosion, transport and deposition of sands around the point had significantly changed over 5 years. In 1992 the practice of licensed aggregate extraction from the beach was identified as accelerating the natural migration of the Point to the East. Given the absence of a significant offshore source for re-supply extraction has since ceased.

It was found that sand transport is potentially active in the western area, being dependent upon supply of sand from the West. Active transport was observed in the North around Crow Bar with deposition of finer sands in the East. This study confirmed the trends identified in 1992 and thus supports the conclusion that aggregate extraction is not a sustainable practice in the area.

The beach litter surveys revealed that plastics, including some small pieces of the video film from the wreck of the *Cita*, dominated the litter on beaches. The beaches with the heaviest litter cover were those popular with tourists, particularly those around Hugh Town, St. Mary's despite the presence of litter bins.

1 Introduction

Lying 40km 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, Treco and St Agnes - are inhabited, and support farming, fishing and tourist industries.

The combination of the physical environment and the climate has dictated the very individual composition of the natural history of the Islands. Rare indigenous plants, as well as exotics characteristic of subtropical climates, thrive on the Islands. The almost complete absence of traffic and plentiful windbreak 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 plants 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 that require clear waters through which adequate sunlight can pass for photosynthesis. These clear waters encourage the growth of extensive beds of sea 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, though rarely seen 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* sp.), Trigger-Fish (*Ballistes capriscus*), Blue Marlin (*Makaira nigricans*) and various species of turtle. Not all such vagrants are welcome: the Jap weed (*Sargassum muticum*) has now taken a firm hold in Scilly and may out-compete indigenous species for available space and sunlight for photosynthesis.

The Isles of Scilly Environmental Trust

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.

The archipelago of Scilly has been defined as that group of islands and rocks contained within the fifty-metre depth contour (Figure 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 Isles of Scilly 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"*.

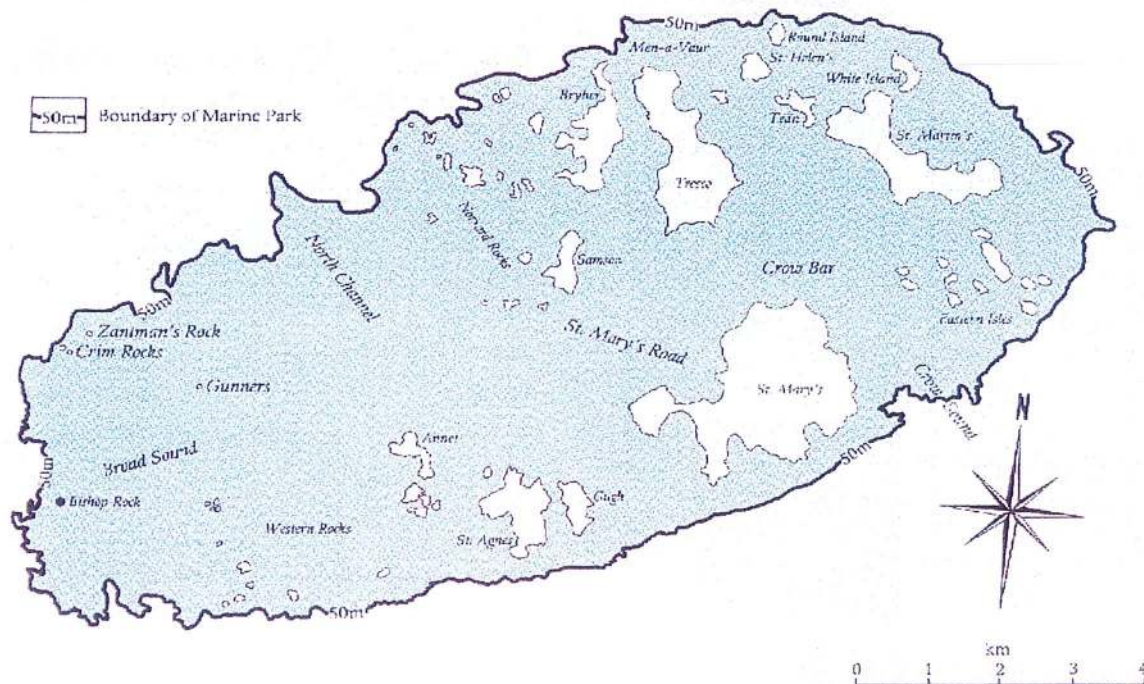


Figure 1 *The Isles of Scilly Marine Park*

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.

Coral Cay Conservation Expeditions

Coral Cay Conservation (CCC) is a UK-based non-profit organisation with an associated charitable trust (CCC Trust: Charity Number 1025534). Each year CCC recruits hundreds of volunteers to undertake coastal zone surveys on behalf of government organisations, and is financed almost exclusively by voluntary donations from participating volunteers. CCC has offices in the UK, US, Honduras, Australia, Indonesia and the Philippines.

CCC began as a small group of diving enthusiasts who in 1986, decided to mount an expedition to undertake baseline surveys of the Belize barrier reef. Using basic techniques, the expedition team surveyed three sites and reported their results to the Belize Fisheries Department. These sites were resurveyed by a second CCC expedition in 1987. Since then, over 1,000 volunteers have joined CCC expeditions to Belize, Indonesia and the Philippines. Some of these have set up a special branch of the British Sub-Aqua Club, CCC-SAC.

The Expedition

1998 was the seventh consecutive year in which members of the CCC-SAC have visited the Isles of Scilly. The 1998 expedition lasted two weeks and, due to the fact that most members of the team were either experienced Scillies volunteers or were there for both weeks of the expedition, a considerable amount of work was achieved.

As in the previous two years, accommodation was in the Mundesley Boarding House, which provides very comfortable and well-equipped facilities for a working group. Sadly, as the Duke of Edinburgh Award scheme require the Schoolhouse for the whole summer in 1999 it will not be available to CCC-SAC.

The Duchy of Cornwall boathouse on Porth Mellon beach had been emptied of the tires that the Cita Salvage Company had stored there the previous year and so it was once again available as a diving locker.

During the 1998 expedition the CCC-SAC volunteers had five main objectives. These were:

- Repeat surveys of the *Zostera* beds surveyed previous years and to investigate another possible *Zostera* bed identified by a RoxAnn survey carried out for English Nature in 1997.
- Investigate the spread of *Sargassum muticum* through out the islands.
- To carry out a repeat sediment survey of Bar Point in order to assess the effect of aggregate removal.
- Carry out Seasearch dives in various sites to map the physical and biological parameters and use this data to ground-truth the RoxAnn survey carried in 1997.
- To conduct litter surveys around the Isles.

Management of the Expedition

In 1998 Kevan Cook, Adel Enderson and Tom Reid planned and led various aspects of the expedition. Alice Lewthwaite, prior to starting work in America, and Leanne Giles provided assistance by helping to arrange transport and co-ordinate volunteer recruitment.

Once again, during the course of the expedition the Diving Officer Kevan Cook oversaw all aspects of the diving and ensured that the highest standards of safety were known and adhered to. This was achieved by publication of the CCC-SAC Diving Rules, an abridged version of which was issued to each volunteer prior to the expedition.

Kevan Cook, in addition to his role as Diving Officer, was the expedition Science Officer, maintaining the high standards set by his predecessor Rob Irving.

The other CCC-SAC volunteer divers carried out all other activities associated with the expedition.

Expedition Team

The 1998 expedition team was composed of a number of experienced Isles of Scilly Expedition volunteers, supported by new members. Many of the team members were volunteer divers who had been sent out by CCC Expeditions to Belize. There they received training in underwater survey techniques and marine identification skills.

Expedition Members

Adel Enderson	Julia Rigby
Andrew Austwick	Kevan Cook
Chris Ashelby	Leanne Giles
Claudia Eckardt	Tim Bartley
Craig Thorn	Tom Reid
Geoff Shaxton	Gordon Mackenzie
Heather Sales	Roger Covey
John Whittaker	Tim Hill
John Davis	Sion Sales

Expedition Finance

The expedition was financed by a grant from English Nature with the balance of funds raised by contributions from the participating volunteers. Assistance from the Isles of Scilly Steamship Company, in the form of subsidised transportation for equipment and personnel, also helped the expedition to achieve its objectives.

2 *Zostera marina* Monitoring

Introduction

Seagrass beds were identified under Agenda 21 as being of vital importance and worthy of preservation. They are ecosystems of high productivity and are found in sheltered shallow marine conditions. They are also environmentally susceptible to natural and human related activities, such as climatic changes, sea level rise, dredging and fill activities, sedimentation, sewage discharge and shoreline development. *Zostera marina* is an important species both ecologically and economically because it provides critical habitat for a range of invertebrates and fish, it protects coastlines from erosion, it causes increased sedimentation leading to enhanced recycling of nutrients and improves water clarity (IGC, 1996).

Species Conservation

The south west regional Biodiversity Action Plan identifies all three of the *Zostera* species (*Z. marina*, *Z. augustifolia* and *Z. noltii*) as being nationally scarce (occurring in between 16-100, 10 km squares in the UK).

Identified in the report are current factors affecting the habitat:

1. A lack of ecological information including:
distribution and extent, community diversity and abundance, reproductive strategies, population dynamics/interactions, population stability and susceptibility to natural and human influence.
2. Anchoring and mooring issues.
3. The potential spread of the non-native brown algae *Sargassum muticum*
4. Coastal development including coastal protection and beach cleaning.
5. Shellfish collection and bait digging.
6. Dredging and dumping issues.
7. Water quality (pollution/eutrophication).

The UK Seagrass Beds Costed Habitat Action Plan proposes to:

- Maintain extent and distribution of seagrass beds in UK waters.
- Assess feasibility of restoration of damaged or degraded seagrass beds.
- Until surveys assess the extent of the seagrass resource, it will not be possible to assess whether restoration is necessary, or to specify a final target. An interim target of 1,000 ha has been costed.

The South-West biodiversity objectives and proposed targets are:

OBJECTIVE 1 TARGET: by 2002

Increase knowledge of the distribution, extent and quality of *Zostera* beds in the South-West.

OBJECTIVE 2 TARGET **by 1997 *ongoing

Identify and quantify natural* and human factors** affecting seagrass beds in the South-West

OBJECTIVE 3 TARGET ongoing
Seek to halt any decline in *Zostera* populations in the South-West resulting from human impacts.

OBJECTIVE 4 TARGET ongoing
Seek to increase the current size of the *Zostera* resource in the South-West.

OBJECTIVE 5 TARGET ongoing
Raise the profile and increase public awareness of seagrass beds and their associated species.

Species Description

Zostera marina is a marine angiosperm and the only marine flowering plant found in UK waters. The flowering plants appear markedly different from the non-flowering ones in that they have extended stems containing the flowers growing from the rhizomes with small leaves branching off the main stem. The leaves of the plants die back at the end of each summer / autumn and then regrow in the spring with the rhizomes, the root system, remaining in place. However, although *Zostera* can reproduce both sexually and vegetatively, Grassle and Grassle (1978) suggest that due to the vigorous rhizomatic growth of this and other seagrasses, and their wide distributions and ecological success, vegetative reproduction generally prevails. Flowering stems have been noted on several *Zostera* plants within the beds surveyed, however it is not known whether any of the resulting seeds are viable.

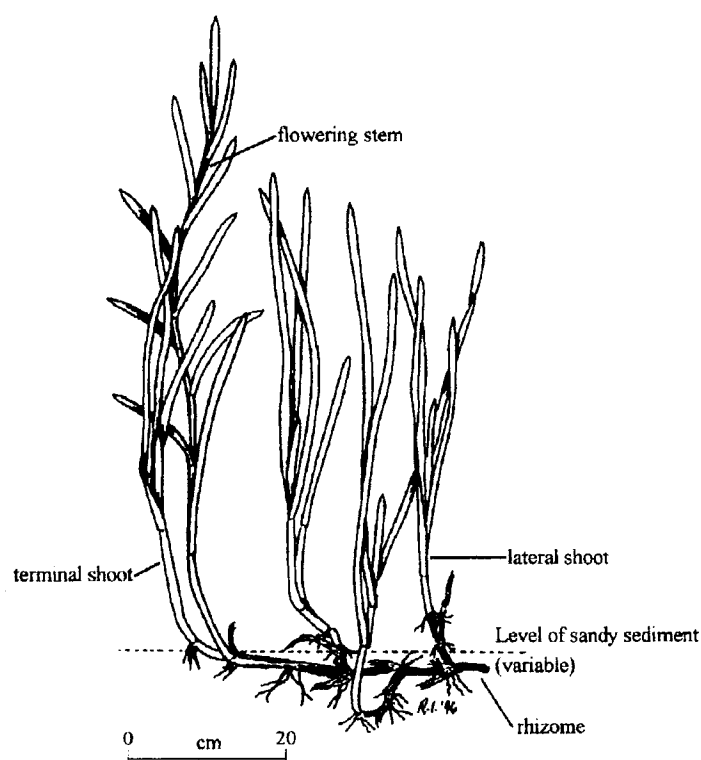


Figure 2 *Zostera marina*

The distribution of *Zostera* along the south coast extends from the beds in the Scilly Isles eastwards along the channel as far as Studland Bay in Dorset in full marine but sheltered conditions in sand or mud substrates. However, it can also be found in some brackish lagoons such as the Fleet in Dorset.

Annual surveys of the *Zostera* beds around the Scilly Isles were begun in 1984 by the Nature Conservancy Council and were continued until 1988. Following a gap of two years, 1988 and 1989, when no studies were carried out, a further limited survey was done in 1991 (Fowler & Pilley, 1992). Since then volunteers from Coral Cay Conservation Sub-Aqua Club have carried out surveys every year from 1992 to 1998 (Raines *et al.*, 1993; Cleator *et al.*, 1996; Mackenzie & Rickards, 1996; Irving *et al.* 1996, Irving and Mackenzie, 1997 and Irving *et al.*, 1998). The initial surveys were only carried out at two sites, English Island, East Higher Town Bay, St. Martin's and at Old Grimsby Harbour on the east side of Tresco. Since then additional sites at East Broad Ledge, St Martin's and West Broad Ledge, Tresco have been added and, following the investigation of a site identified by aerial survey carried out in September 1996, a further *Zostera* bed was surveyed at Great Ganilly in the Eastern Isles.

In addition to the initial concerns relating to the population and concentration of the plants within the beds it was noted in the surveys of the beds between 1988 and 1991 that the plants were infected with the parasitic slime mould of the genus *Labyrinthula* sp. more commonly known as wasting disease. The infection of the *Zostera* plants with *Labyrinthula* caused widespread loss in many areas during the 1930s and 1940s including the Isles of Scilly and various other beds in the south-west (den Hartog, 1987). The surveys carried out by the Nature Conservancy Council during the years 1984 to 1988 reported no incidences of *Labyrinthula* within the beds surveyed (Fowler & Pilley, 1992). Although no formal surveys of the beds were carried out in the years 1989 and 1990, Fowler (1992) reported that during the years 1988 to 1991, the health of the beds had shown a marked deterioration. The cause of this was attributed to *Labyrinthula* and this was later confirmed by the Coral Cay Conservation Sub-Aqua Club expedition to the Islands in 1992 (Raines *et al.*, 1993).

It is unclear what caused the reoccurrence of the infection in the beds in the Isles of Scillies although Cleator *et al.* (1996) suggested a worsening in environmental conditions i.e. changed water temperature, water flow and sedimentation or even changes in irradiance. Whatever the cause it was thought, however, that the increase in occurrence of *Labyrinthula* was due to metabolic stress making the individual *Zostera* plants more susceptible to infection by reducing the amount of organic compounds involved in the resistance of disease and the growth of epiphytes on the leaves.

The disease first becomes apparent with the appearance of small black spots on the leaves. These then spread along the length of the leaf until the leaf can become so infected that photosynthesis is no longer possible and the leaf dies. If the infection is not severe the plant will remain viable and continue to grow. However, should the infection continue for a number of years the leaf loss may cause the rhizomes to also become infected and cause the plant to die (den Hartog, 1989). This die-back has yet to be confirmed in the beds around the Isles of Scilly.

Zostera Sampling

The surveys carried out during the 1998 expedition followed on from those undertaken in earlier years and the aims were:

- To assess the plant density of different beds by surveying randomly selected samples.
- To count the number of leaves per plant and measure the maximum leaf length.
- To assess the amount of *Labyrinthula* infection within the beds.
- To assess the amount of epiphytic cover on each plant.

Locations

Five locations were surveyed during the 1998 expedition, four of which continued the work of previous years and the fifth, off Great Ganilly in the Eastern Isles was added for comparison and record.

Site	Central Position Lat. / Long.	Date:
English Island, St. Martins	49° 55.028 N 006° 18.534 W	11 th August
West Broad Ledges, St. Martin's	49° 57.522 N 006° 18.167 W	7 th August
Broad Ledges off Tresco	49° 56.460 N 006° 19.280 W	4 th August
Old Grimsby Harbour, Tresco	49° 57.600 N 006° 19.750 W	3 rd August
Great Ganilly, Eastern Isles	49° 57.014 N 006° 15.756 W	10 th August

Method

At each site a central line was lowered to the sea floor to act as a datum from which all bearings and distances were measured. The position of this line was chosen by eye to be approximately central in the bed to be surveyed. Pairs of divers were then sent to take samples from points at randomly selected distances, between 0 and 30m, and bearings, between 0° and 359°, from the central line using a 0.25m² quadrat made from 15mm copper tubing, 0.5m by 0.5m in dimension.

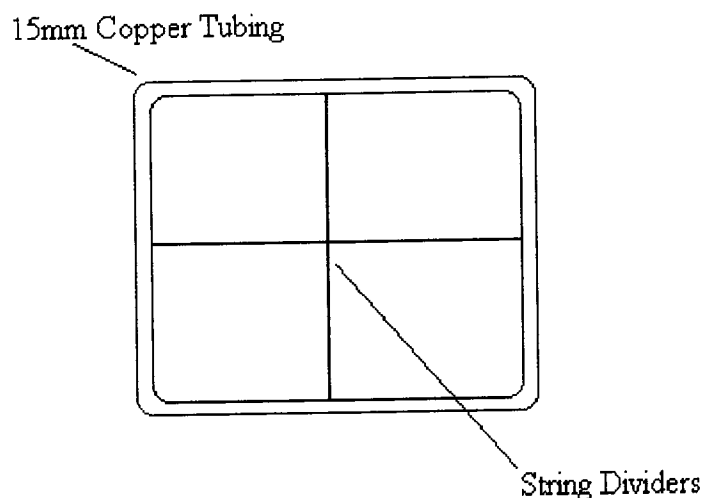


Figure 3 A Quadrat

The bearing was measured using a standard diver's compass and the distance from the central line was measured using a marked tape. The quadrat was placed to the left of the line at the indicated distance such that the bottom right hand corner was against the tape at the indicated distance with the right hand edge of the quadrat along the tape. All the plants within the bottom right hand quarter were then cut above the rhizomes and stored in a plastic bag for later analysis. Care was taken to ensure that only the plants with their rhizomes directly under the quarter square were taken by ensuring that all leaves were traced to their base.

During the 1997 survey two methods were used to estimate the density of plant cover:

- **Method A:** where an empty quadrat was encountered the divers were instructed to continue swimming until a patch of *Zostera* was reached at which point a sample was taken.
- **Method B:** where an empty quadrat was recorded as such and no further attempt was made to find patches of *Zostera*.

During the 1998 survey, Method B was used in order to give a more accurate estimate of plant density.

Score	Amount of Infection	Percentage of Infection	Diagrammatic Representation of Infection
0	Uninfected	0%	
1	Some infection apparent	<10%	
2	As much as half the leaf infected	10 - 50%	
3	Over half the leaf infected	50 - 80%	
4	Almost all the leaf infected	>80%	

Table 1 *Zostera Leaf Infection Scoring System*

Data Analysis

For each sample bag, the following variables were recorded:

- Bearing and distance at which sample was taken
- Number of plants per bag
- Maximum plant length
- Amount of *Labyrinthula* infection
- Number of leaves showing infection
- Amount of Epiphytic cover
- Number of leaves showing cover
- Number of flowering plants

The data for infection and epiphyte cover was recorded using the score system shown in Table 1. The data were initially recorded on a preformatted sheet and then loaded into an Excel spreadsheet for further analysis where the following was calculated:

- The density of plants per 0.0625m²
- The proportion of infected leaves expressed as a percentage of the total number of leaves together with a mean infection and epiphyte cover score.
- One-way Analysis of Variance (ANOVA) on maximum leaf length and percentage of infected leaves between the different sites surveyed to examine if any significant difference (with a 95% confidence level) exists between the five sites.
- Correlation matrix of the variables listed above to investigate the existence of any relationship between these variables.
- Frequency analysis of longest leaf length to investigate the population structure at the five sites.

Results

The sampling of the five sites took place during the period 4th August to 11th August, 1998 from the boats *Hellbent* and *Melza*. A summary of the results from these surveys appears in Table 2.

	Old Grimsby Harbour, Tresco	Broad Ledge, Tresco	Broad Ledge, St. Martins	Higher Town Bay, St. Martins	Great Ganilly, Eastern Isles
Total Number of Quadrats	25	25	25	25	25
Total Number of Plants	183	105	184	352	207
Total Number of Leaves	701	435	798	1506	920
Mean Leaves Infected	57%	76%	61%	67%	65%
Mean Infection Score	0.87	0.94	0.71	0.81	0.71
Mean Epiphyte Score	1.41	0.29	1.05	1.74	0.96
Mean Plant Length (m)	0.29	0.47	0.62	0.50	0.86
Standard Deviation	11.43	19.50	22.10	15.91	30.23
Mean Plant Density (per 0.0625m ²)	7.32	4.20	7.36	14.08	8.28

Table 2 Summary of *Zostera* analysis, 1998 survey

Leaf Infection

Comparison of 1998 percentage leaf infection data for Old Grimsby Harbour and Higher Town Bay, St. Martins with data from previous years shows a marked increase in the amount of *Labyrinthula* infection from the previous year. The plants at Old Grimsby Harbour show the same amount as recorded in 1994 but less than in 1996, 1995 or 1993. The plants at Higher Town Bay show higher levels of infection than in any year recorded with the exception of 1994.

	Old Grimsby Harbour, Tresco	Higher Town Bay, St. Martins
August-98	57%	67%
August-97	43%	37%
July-96	69%	64%
June-95	63%	42%
August-94	57%	79%
July-93	59%	65%

Table 3 Percentage Leaf Infection at Old Grimsby Harbour and Higher Town Bay, St. Martin's 1993 - 1998.

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	2.757411	4	0.689352	16.06365	9.149E-13	2.380602
Within Groups	44.02958	1026	0.042913			
Total	46.78699	1030				

Table 4 ANOV - Percentage Leaf Infection - All sites

From Table 4, the one-way analysis of variance for the null hypothesis that 'there is no significant difference in the amount of leaf infection between sites' shows that this null hypothesis must be rejected as the calculated F value of 16.06 is greater than the F-Critical value of 2.61. This indicates that there is a significant difference.

Plant Size Distribution and Plant Density

The plant size distribution, measured as the length of the longest leaf, is illustrated in Figure 4.

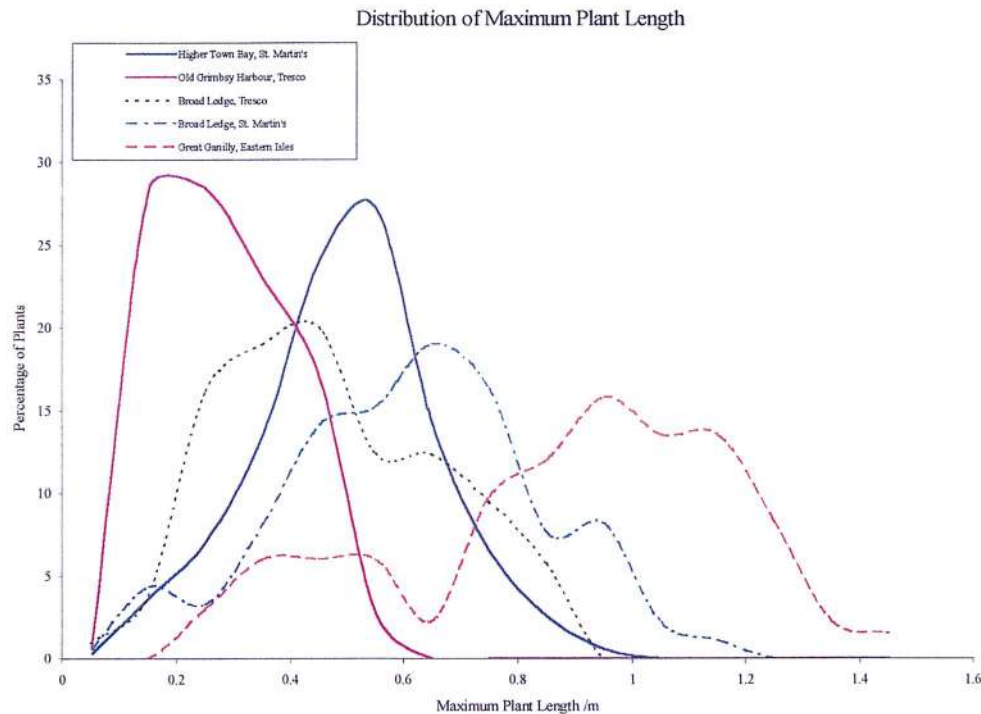


Figure 4 *Zostera* Plant Size Distribution at Different Sites

This shows that, as seen in 1997, the distribution of maximum plant length at each site is very different to that at the other sites. The distributions for Old Grimsby Harbour, Tresco and Higher Town Bay, St. Martin's and Broad Ledge St. Tresco have a near normal distribution although the distribution for Broad Ledge, Tresco is close to being bi-modal. The distributions for Broad Ledge, St. Martin's and Great Ganilly, Eastern Isles appear to be bi-modal with the later being skewed towards the longer leaf length. The distributions for Old Grimsby Harbour, Tresco and Broad Ledge, Tresco show a skew towards shorter leaf lengths.

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	340798.1	4	85199.53	203.3899	1.9E-128	2.380602
Within Groups	429788.7	1026	418.8974			
Total	770586.8	1030				

Table 5 ANOV - Maximum Plant Length

From Table 5, the Null Hypothesis that 'no significant difference existed between the leaf length from plants at the five sites' is not supported with the F value of 203.34 being larger than the F-Critical value of 2.38 supporting the evidence above that the distributions are markedly different. The plant densities recorded at the four sites surveyed in the 1997 expedition showed a similar mean plant density. Higher Town Bay, St. Martin's again had the greatest plant density although less than last year. The site with the lowest density was again Old Grimsby Harbour, Tresco but was slightly higher than the previous year.

Correlation of variables recorded

Table 6 shows the results of correlation of variables for the five sites.

Variable	% Infected	Plant Length	Infection	Epiphyte Cover
Higher Town Bay, St. Martins				
% Infected	1.00			
Plant Length	0.17	1.00		
Infection	0.82	0.23	1.00	
Epiphyte Cover	0.33	0.39	0.36	1.00
Old Grimsby Harbour, Tresco				
% Infected	1.00			
Plant Length	0.41	1.00		
Infection	0.55	0.38	1.00	
Epiphyte Cover	0.66	0.48	0.35	1.00
Broad Ledge, Tresco				
% Infected	1.00			
Plant Length	0.36	1.00		
Infection	0.73	0.34	1.00	
Epiphyte Cover	0.01	-0.31	-0.20	1.00
Broad Ledge, St. Martin's				
% Infected	1.00			
Plant Length	0.27	1.00		
Infection	0.83	0.18	1.00	
Epiphyte Cover	0.34	0.40	0.35	1.00
Great Ganilly, Eastern Isles				
% Infected	1.00			
Plant Length	-0.16	1.00		
Infection	0.85	-0.09	1.00	
Epiphyte Cover	0.32	-0.05	0.33	1.00

Strong Positive Correlation

Table 6 Correlation of *Zostera* Variables at Different Sites

As recorded in the analysis for the 1997 survey, the strongest correlation is seen between Percentage Leaf Infection and Mean Infection Score (Irving *et al.*, 1997). However, the correlation for the variables recorded at Old Grimsby Harbour at 0.55 can only be described as 'modest correlation' where the other five sites show 'strong correlation' (Fowler and Cohen, 1994). In addition to these, the data for Old Grimsby Harbour also show 'modest correlation' between Percentage Leaf Infection and Mean Epiphyte cover and also between Plant Length and Mean Epiphyte Cover.

Discussion and Future Work

Population Size Structure

The results given here again indicate the plant populations at the five sites have a different size structure despite being within the same general area. In addition to continued monitoring of the sites in the Isles of Scilly investigation of the environmental variables at these sites would be valuable to determine the optimum conditions for *Zostera* growth. The slight rise in plant densities recorded at some sites may be linked to the low amount of *Labyrinthula* in the plants recorded in 1997. However, if this is the case the lower density recorded at two of the sites requires further explanation. To investigate this and other relationships, a more detailed study of the historic data would prove useful. In addition, future surveys should also attempt to record some of the physical parameters at the sites i.e. temperature, salinity, nitrate and phosphate concentrations.

***Labyrinthula* Infection and Epiphyte Cover**

With the exception of Old Grimsby Harbour, which showed 'modest correlation', there was no evidence of a relationship between Longest Leaf Length and Percentage Leaf Infection. As suggested by Irving *et al.* (1998) the infection and epiphyte cover are not related to the age of the plant. Although the mean plant infection was higher than the previous year, plant density did not appear to be affected.

3 Biotope Information, Isles of Scilly 1998

During the course of the 1998 expedition volunteers carried out a total of 41 Seasearch dives and described 51 habitats which have been divided into six different general biotopes:

Type of Biotope	Number of Records
Bedrock and Boulder Fields	17
Kelp Forest	12
Wreck	2
Mixed Horizontal Sediments	9
Sand	8
Vertical Habitats	3
Total	51

The general areas for the dives for the 1998 expedition were based on the requirement to record data on some of the previously unsurveyed sites. These concentrated on St. Mary's Roads, the channel between St. Mary's and Tresco / Samson, Hell Bay, Bryher and west of St. Agnes / south of Annet. These were also identified as being required to complete the ground truthing exercise for the Ambios RoxAnn survey carried out in September 1997. During the course of the expeditions made by Coral Cay Conservation members during the years 1995 to 1997, several sites around the Scillies archipelago have been surveyed giving a record of these biotopes.

There are, however, some general areas that have not been recorded and these are principally:

- Around the island of St. Martin's especially to the east and north of the island, the south and western sides being shallow and comprising of sand.
- North of Tresco and Bryher
- West of the area surveyed in St. Mary's Roads during the 1998 expedition out to the Western Rocks and the Bishop's Rock lighthouse.

However, these are some of the most exposed sites to be found around the islands and would require careful dive planning and execution as they are strongly tidal and also necessitate a long boat journey in potentially severe conditions.

The main biological features of these biotopes are described here although they are much as described in the report for the 1997 expedition (Irving, 1998). The physical features are described as part of the ground truthing exercise carried out for the Ambios RoxAnn survey of the Scilly Isles, see Chapter 4.

Newfoundland Point

This is an exposed site on the south-easterly side of St. Mary's, the main island in the Scillies archipelago which is exposed to the prevailing south-westerly winds and around which the tidal streams can be strong.

This site has been well dived and described in previous expeditions. It is dominated by a granite slope and boulders with a heavy covering of kelp and associated fauna. However, in March 1997 the wrecking of the *Cita*, a 3,900 tonne container ship, adversely affected the site. Although the wreck produced little oil pollution, there was concern about the amount of polyester film released from three of the broken containers. When surveyed during the 1997 expedition, large amounts of

small pieces of this film were in evidence in crevices and wrapped around the stems of kelp. Indeed, small pieces of this film were found in most of the areas of the archipelago surveyed during 1997, and the identification of any remaining pieces was one of the objectives for this year.

All members of the expedition revisited the site on 5th August 1998 with the sole aim of searching for the 'Cita film'. Although only 1 dive was recorded as a Seasearch dive, the site having been well surveyed in previous years, all members were tasked with checking for any remnants of film. None was noted around Newfoundland Point nor on any of the other Seasearch dives carried out during the 1998 expedition. However, small pieces were found on some of the beaches surveyed as part of the litter recording work (see Chapter 6). What has become of the remainder of the film is not clear. It is possible that biodegradation through wave action and sunlight has broken the film down although it is more likely that through tidal water movement it has been dispersed into the Atlantic and possibly into the Channel. To date, however, the authors are not aware of any reports of such film being washed ashore on any beaches in the south west.

Wreck of the *Cita*

The wreck itself has become a habitat in its own right and was dived briefly during the 1997 expedition. However, due to concerns as the stability of the wreck, no detailed Seasearch records were made.

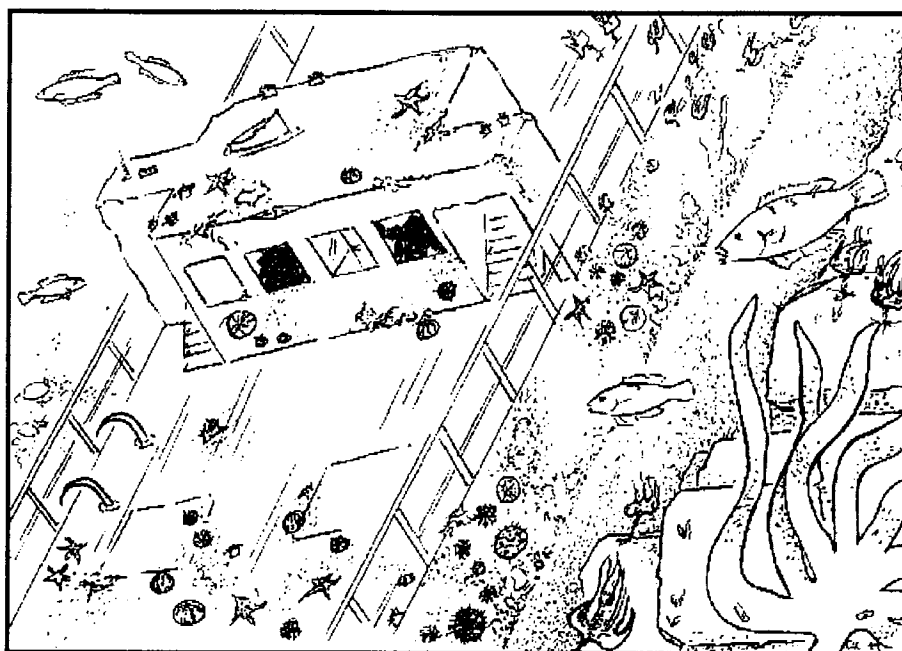


Figure 5. *The Wreck of the Cita*

This wreck lies in two main pieces, the bow having become separated from the main part of the ship following its stranding in 1997. This bow section lies in a shallower, more sheltered site than the main part of the wreck and is well broken up as a result of wave action. The main body of the wreck lies on its port side with the stern in 40m of water. As this wreck is one of the most popular dive sites in the Scillies with sports divers and has settled well into its current position the ban on dives imposed on the divers for the 1997 expedition was lifted for this year.

Two dives were carried out to record the colonisation of species on the wreck. The first concentrated on the section aft of the bridge where the most common species were the polychaetes

Hydroides norvegica and *Pomatoceros triqueter*, the former being listed as abundant. The most common algae were *Palmaria palmata* and the kelps *Laminaria hyperborea* and *L. digitata*, which occurred as small, single plants attached directly to the superstructure of the wreck. Also in evidence were Echinoderms with *Asterias rubens* being frequent and Bryozoans with *Bugula* sp. also being frequent. Also noted were small growths of the long-lived *Pentopora foliacea*. The second dive began at the same point as the first but investigated the shallower starboard side of the wreck. Here the most striking feature was the difference in algal growth (*Laminaria digitata* and *Palmaria palmata*) on the side of the ship above the hull and the hull itself where the anti-fouling paint was much in evidence. The most common animal phyla were the Echinoderms with *Asterias rubens* being abundant, *Echinus esculentus*, *Holothuria forskali* and *Marthasterias glacialis* all being listed as frequent. The two polychaetes found on the deeper part of the wreck were also evident here, as were the Bryozoan species listed above, *Bugula* sp. being frequent and turf being common.

Also of interest was the area of rock around the wreck that would have been impacted by it during the grounding. The wreck lies on the granite bedrock of Newfoundland Point and has the fauna and flora typical of this type of habitat and the action of the grounding will have caused some damage to these communities. However during the intervening year the rock surfaces have been extensively recolonised with Cnidaria dominating the rocks, *Corynactis viridis* being abundant and *Alcyonium digitatum*, *A. glomeratum* and *Caryophyllia smithii* being frequent.

The area around the wreck was dominated by kelp forest with cnidaria and Echinoderms covering the granite bedrock and boulders with *Corynactis viridis* being the dominant invertebrate species.

Horizontal Bedrock and Boulders

This habitat was encountered on 17 of the dives carried out and was the dominant type in Hell Bay, Bryher, one of the sites identified as being unsurveyed in previous years. The depth range varied between 6.4m and 30.2m below chart datum (bcd), both of which extremes occurred in Hell Bay. These habitats were found in a variety of tidal conditions from weak at the sites east of St. Mary's to strong over the Samson Ledges and were comprised of a minimum of 70% clean (save for a thin silt cover at some sites) bedrock or boulders. These sites were typical of many sites described over the course of the Seasearch dives carried out by CCC-SAC volunteers around the Isles of Scilly.

Although some of the sites described were shallower than the lower limit of kelp observed elsewhere, only four sites with a depth range of 6.4m to 15.6m bcd listed kelp species, *Laminaria hyperborea* (Frequent). These sites have been included under this heading rather than as Kelp Forest due to this general lack of described kelp cover. The most abundant algal species was *Dictyopteris membranacea* which was listed as Abundant at three sites, as Frequent at two more and as Occasional at a further one giving an average abundance of Common. Coralline crusts were also listed as Abundant at one site, Common at another and Frequent at three more giving an average abundance of Common.

There were a large variety of sponges present with the massive forms of *Cilona celata* (Boring sponge) and *Pachymatisma johnstonia* (Elephant's ear sponge), both having an average abundance of Occasional having been recorded at four sites. However, as with the vertical surfaces the invertebrate species were dominated by Cnidaria and Echinoderms. Devon cup corals, *Caryophyllia smithii* were noted at all but three sites and as Abundant at one giving an average abundance of Frequent. Jewel anemones *Corynactis viridis*, and Dead Man's Fingers, *Alcyonium digitatum*, were also listed at several sites with an average abundance of Frequent. Of the Echinoderms recorded,

the Spiny star fish *Marthasterias glacialis* and the holothurian *Holothuria forskali* were recorded at all but two of the sites with an average abundance of Occasional and Common respectively.

The fish present were dominated by two species, Ballan wrasse, *Labrus bergylta* and the Pollack, *Pollachius pollachius* both of which had an average abundance of Frequent. Other wrasse species were also recorded, as were three species of Goby and there was one sighting made of a Conger Eel (*Conger conger*) at Deep point.

Vertical Surfaces

This proved to be the habitat with the fewest species recorded. The depth range of these sites included Tolls Island, St Mary's at 29.5 bcd and SW of Great Arthur in the Eastern Isles at 6.8m. The former site was the only site that recorded a sighting of the nationally rare sea fan *Eunicella verrucosa* whilst the latter was the only site to record any algal species, Polychaetes or Bryozoans. However, though few in number those present formed a living carpet over the rock surfaces. As in previous years these sites were dominated by the Jewel anemones, *Corynactis viridis*, which formed dense carpets of varied colours formed by the budding of daughter cells from the original parents. These were present at all three sites recorded with an average abundance of Frequent. In addition to these several other Cnidaria species were present with the Devon cup coral, *Caryophyllia smithii*, also having an average abundance of Frequent.

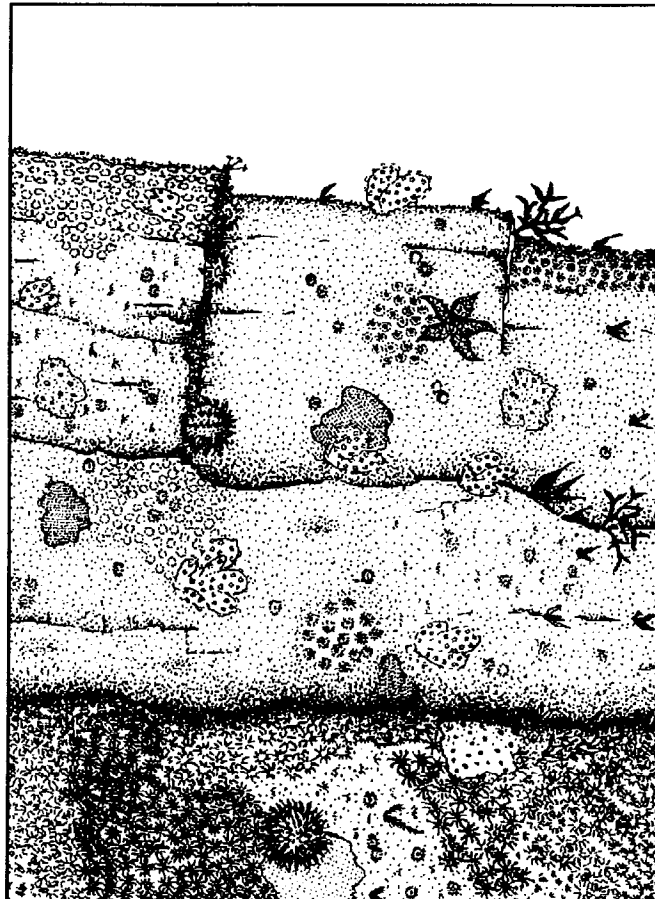


Figure 6 Diagrammatic representation of vertical surfaces

Mixed Habitats

This is a type of biotope not previously described but given the locations dived during the 1998 expedition was one encountered on nine occasions. The majority, six, of these were in the St.

Mary's Roads south of Samson with two others to the east of St. Mary's and one in Hell Bay, Bryher. The sites in St. Mary's Roads are all exposed to moderate to strong tidal streams. This has resulted in any fine material being washed away leaving a physical substrate that was comprised of a mixture of coarse sands, cobbles, pebbles with small occasional outcrops of bedrock and small boulders. The depth range varied from 7.2m to 23.9m bcd and the general underwater visibility was good.

This biotope was also one of diverse species. There was a range of algal species of which Batters Frond, *Dictyopteris membranacea*, was recorded as Abundant at one of the sites and present at three other sites giving an average abundance of Frequent. In addition, coralline crusts, *Delesseria sanguinea*, *Ptilota plumosa* and *Sphaerococcus coronopifolius* were all recorded as Common. Of the sponges present there were few massive forms and the majority of species present were small e.g. *Suberites carnosus* which was recorded at four sites with an average abundance of Occasional. In addition to this, several Cnidaria species were present with Dead Man's Fingers, *Alcyonium digitatum*, having an average abundance of Common although it was only recorded at three sites. It was also here that the molluscs the sea-hare, *Aplysia punctata* (average abundance of occasional) and Common cuttlefish, *Sepia officinalis* (average abundance of Rare) were recorded. Hermit crabs were also in evidence albeit only at two sites but recorded as Abundant at one and Frequent at the other. As with other sites, Echinoderms were present at the majority (six) of the sites with both the Common Sea Urchin *Echinus esculentus* and the holothurian *Holothuria forskali* recorded as Frequent. Another species recorded as Frequent and present at five of the sites was the Ascidian *Botryllus schloseri*.

Kelp Forest

During the 1998 expedition volunteers carried out ten survey dives in areas of kelp forest and this biotope proved to be the one with the most species. During the dives, the deepest recorded occurrence of kelp was south of deep point at 17.6m bcd where *Laminaria hyperborea* was listed as Abundant with five other algal species were recorded. *Laminaria hyperborea* was by far the most often recorded algal species being listed as Abundant at six other sites and present at two other sites. The other large kelps, *Laminaria digitata* and *Saccorhiza polyschides* were also recorded giving rise to a distinctive habitat in their own right with the Bryozoan *Membranipora membranacea* and other general animal turf species inhabiting the fronds.

Beneath the kelp canopy the dominant species were mainly from the Echinoderms with the Common sea urchin, *Echinus esculentus*, being recorded at ten of the twelve described sites giving an average abundance of Frequent. The Starfish, *Marthasterias glacialis*, and Cotton Spinner, *Holothuria forskali*, were also recorded at a number of sites with an average abundance of Occasional. Also in evidence were several Cnidaria species with the Jewel anemone, *Corynactis viridis*, recorded at seven sites and *Caryophyllia smithii* and *Actinothoe sphyrodeta* recorded at five sites all with an average abundance of Occasional.

Sand Patches

This proved to be a surprisingly rich habitat although it should be noted that the majority of the species recorded were on the small boulders and outcrops of bedrock. There were several species of algae attached to small pebbles and cobbles including *Ulva lactuca* and *Saccorhiza polyschides*, both of which were recorded as Abundant at different sites south of Samson in St. Mary's Roads. *Laminaria saccharina* was also recorded at two sites with an average abundance of Frequent. Although the invertebrate species, typical of the harder biotopes described above, were mainly located on the small boulders etc., there were a number of errant species recorded present on the

sand. The principal one of these being Hermit crabs which were recorded at four sites with an abundance ranging from Rare to abundant south of Samson giving an average abundance of Frequent. In addition to this the Sand Goby, *Pomatoschitus minutus*, were recorded on the sand as was the only occurrence of a Brittle Star in any of the dives.

4 Physical Habitat Ground Truthing

St Mary's Roads

This is the area between the main island of St. Mary's and the islands of Tresco and Samson. The area covered by the Seasearch surveys concentrated on the ground to the south and south west of Samson including what are locally known as the Samson, Bartholomew and Minalto Ledges. These are generally shallow shelves of bedrock extending south and west from the island of Samson. The deepest recorded dive on any of these ledges was 23.8m bcd although outcrops of bedrock were also recorded at 27.3m bcd amongst the otherwise sand bottom.

The Ambios survey of this area give the sea floor of being comprised of variety of types. The fringing shelf around Samson is listed as Infralittoral (or littoral) bedrock or boulders with kelp/*Himanthalia*/fucoids-grazed. This was confirmed by the Seasearch dives carried out in this area. This self extends south-westwards from the bottom corner of Samson into the main channel on what have been described during the 1998 expedition as the Minalto Ledges. All four dives carried out on this ledge were recorded as kelp forest giving good correlation with the Ambios survey.

Further to the south and west, the Ambios survey described the sea floor as comprising of Cobbles, boulders and bedrock outcrops whilst to the south and east of Samson, it is described as Shallow (<20m) sandy gravel, cobbles, sm. boulders or sand veneers over bedrock. Further to the south the Ambios survey shows a patch of Shallow, moderately exposed well-sorted medium sand. The majority of dives undertaken by CCC-SAC volunteers were to the south and west of Samson. Those dives carried out at the eastern edge of the survey area are recorded as being either Sand or Mixed Horizontal Bottom. The area to the south and west is described as being a mixture of either Horizontal Bedrock and Boulders or Mixed Horizontal Bottom.

The Ambios survey indicates that this whole area is divided into three very broad areas with distinctive boundaries between the three different habitats. The evidence from the diver based surveys carried out as part of the CCC-SAC 1998 expedition is that this whole area is far more variable than this. There is broad correlation between the two surveys with the more exposed sites to the west being comprised with bedrock, boulders and coarse sediments whilst to the east, where the tidal streams and wave exposure are not as severe, they are comprised of mixed sediments and coarse sands. However, the CCC-SAC would suggest are greater "patch work" and graduation of habitats than suggested by the Ambios survey.

Hell Bay, Bryher

This is a small bay on the north west side of Bryher which is exposed to the prevailing wind and sea. Eight Seasearch dives, two of which described more than one biotope, were carried out covering the bay from north to south and to a maximum depth of 30.2m bcd. From these dives, seven of them recorded the biotope as comprising of horizontal bedrock and boulders biotope, two as kelp forest and one a mixture of 40% large boulders and 60% gravel. This site occurred at the southern end of the bay and was one of two biotopes, the other being kelp forest, recorded during that dive. From the evidence of the dives in Hell Bay, it is predominantly made up of bed rock and boulders with kelp forests around the rim commencing at a maximum depth of between 16m and 17m bcd. This is further borne out by two of the dives that were recorded as bedrock and boulders recording the kelp *Laminaria hyperborea* as Frequent at the shallow end of the area recorded. In

the area surveyed, the dominant invertebrate species were the cnidarians *Caryophyllia smithii* and *Corynactis viridis* both recorded as Frequent and the Echinoderms *Holothuria forskali*, Frequent and *Marthasterias glacialis*, Occasional, the latter being recorded on all the survey dives described as bedrock and boulders. However, within the kelp forest *Marthasterias glacialis* was not recorded although other Echinoderm species were present.

The data described above correlate well with that in the Ambios survey. The majority of the bay is recorded as Cobbles, boulders, and bedrock outcrops with infralittoral bedrock or boulders with kelp/*Himanthalia*/fucoids grazed, around the landward edge. In addition, there is one small patch of wave exposed coarse shell sand and a patch of exposed medium sand. Whether either of these is the patch recorded on dive 36 as a mixed habitat of boulders and gravel is uncertain as the error in the positional data from the GPS set used does not allow the accuracy used in the Ambios survey.

West of St. Agnes

This is a highly tidal and exposed site to the west of St. Agnes and south of Annet. In addition the whole area is studded with rock outcrops and therefore careful navigation and dive planning is required. For this reason only four dives were carried out in this area with a fifth off the exposed rock pinnacle of Melledgan. Of the five dives, one was recorded as horizontal bedrock and boulders, one as kelp forest, one as mixed horizontal bottom and two as sand. The depth range surveyed varied from 7m to 21.1m bcd with the shallowest site being the kelp forest west of Melledgan and the deepest two dives being on the sand. These two dives constituted the most westerly sites surveyed in this area with the remaining two sites being much closer to St. Agnes. The closest site to the island is recorded as being horizontal bedrock and boulders although the kelp *Laminaria hyperborea* is recorded as Frequent. Several invertebrate species were recorded with the Cnidaria *Corynactis viridis* and *Urticina felina*, the Echinoderms being Common.

The data recorded on the relatively limited number of survey dives appear to show good correlation with the data recorded in the RoxAnn survey. The latter indicate a coarse sand area in the deeper, tide swept channel between St. Agnes and the Annet ledges to the south of Annet fringed by bedrock and boulders with kelp forest in the shallower water close to the islands. The one feature not shown in the RoxAnn analysis is the small boulder and rock outcrops that are habitats for a number of invertebrate species. This may be due to these being, in the main small, and low lying, however, within the sand biotope these are also important habitats.

5 Bar Point Sediment Survey

Introduction

Lying 28 miles Southwest of Lands End in the English Channel, the Isles of Scilly are formed of a granite pluton of two main compositions. Glacial deposits are found on top of Lower Head deposits, raised beaches and shore platform and are buried by Upper Head deposits. The elliptical morphology of the Islands is constrained by bathymetric data. Weathering of the two granites created 'growan' or ram; a granitic sand of Pleistocene age which constitutes a sequence of glacial tills and outwash gravels. (Mitchell, 1966). In many cases these deposits were reworked during periglacial periods; glaciation is dated as Wolstonian with the deposition of post-glacial Heads during the Devensian.

Bar Point is a triangular spit of land forming the Northerly tip of Saint Mary's Island. It is composed entirely of Pleistocene ram and has an elevation below 10m AOD. The land is leased from the Duchy of Cornwall by the Isles of Scilly Environmental Trust.

In 1991 CCC-SAC requested permission from the IOS Marine Park Committee to undertake voluntary conservation work in the area. Bar Point was identified as an area of concern which might benefit from investigation. At that time the Duchy of Cornwall licensed the abstraction of aggregate material from the foreshore at Bar Point.

Aim

In view of the findings of the 1992 report (see Previous Work) the aims of the re-survey in 1998 were to:

map the subtidal sediment distribution around Bar Point to profile the development of transport patterns since 1992. Particularly regarding the existence of an offshore reservoir of beach feed materials.

This survey attempts to establish if sediment transport patterns have remained constant over the past five years and if there has been a significant change in source for the beach material.

Previous Work

In 1978 and 1990 English Nature undertook a series of beach profiles around Bar Point which, along with observations from local people, identified the high rate of erosion evident around the western exposures of the ram. An average recession rate of 0.35m/yr on the Western Coast between 1900 and 1978 was reported based on historical map data. Severe erosion of the upper beach and cliffs were identified between 1978 and 1990 with MHWS (Mean High Water Springs) recession rate being up to three times greater than the former on some profiles. The CCC-SAC survey of 1992 included re-survey of the beach profiles. This confirmed the trends established in previous surveys of narrowing of the stormbeach with maximum regression of MHWS occurring at a rate of 1.5 to 3.5m/yr around the Northernmost profiles of the point. Plans for the siting of a waste tip in a disused quarry adjacent to the Bants Carn were abandoned due to concerns regarding erosion rates around the point.

The erosional trends were deemed to have implications for the long-term management of a tip site and for the sustainable abstraction of aggregate material. Coastal areas of sedimentary origin are particularly susceptible to erosion and redistribution of material.

The aims of the survey in 1992 were described as follows:

“IF

(i) it can be demonstrated that there is a large offshore/along shore reservoir of material suitable for feeding the beach at Bar Point, and (ii) wave and/or tide processes are competent to carry material from this reservoir to Bar Point in substantial quantities,

THEN

(iii) aggregate extraction from the beach can be viewed in a more favourable light, particularly if the reservoir is very large compared to total tonnage’s extracted, and the rate of transport exceeds the extraction rate, and (iv) there is a good chance for improving the stability of the shoreline at Bar Point in the future using economical protection methods, e.g. groynes.

HOWEVER

if either (i) or (ii) are shown to be absent then the beach extraction industry can only be having deleterious effects, and the chance of checking erosion at Bar Point using economical methods is very slim, and expensive protracted engineering works would have to be added to the cost of installing a tip in this area.” (R. Nunny, 1992).

Levels of aggregate extraction were found to be in excess of the natural supply of sediment to the area. The survey indicated the absence of a significant reservoir of material suitable for the replenishment of the beach deposits.

Repetition of the beach profiling studies in 1992 confirmed an accelerating trend of Eastward migration. The topography itself is naturally prone to Eastward migration but the practice of aggregate abstraction was found responsible for the acceleration of erosion. (R. Nunny, 1992).

Method

During the 1998 expedition, a team of six volunteer divers from Coral Cay Conservation were given a pre-dive training session accompanied by notes emphasising the objective of the data collected (Figure 7). Each diver was assigned a role as a physical or sedimentary surveyor to identify the following features.

PHYSICAL	SEDIMENTARY
Depth	Overall % sand
Vegetation cover	% pebbles
Faunal Groups	% boulders
Bioturbation	Bottom compaction
Bedforms	
Responsible for SMB, bag and sample carriage	Responsible for sample collection

Table 7 *Responsibilities of the Physical and Sedimentary divers in each buddy pair*

Physical divers were provided with a laminated bedform recording form. Sediment divers were provided with a laminated grain size, and percentage cover chart to increase internal consistency. The objective of the semi-quantitative observations was to support the quantitative sample measurements and provide a detailed reference work for future surveys.

Sampling

Surface samples were collected to obtain a six grain depth on an 8" sieve tray. This was approximated volumetrically to equal 1500 cm³ or three sampling cups when full. Grain sizes above granule size (>2800 microns) were deemed beyond the practical and necessary scope of this survey. Sampling was conducted every 50m along each transect with support samples, one sample cup, taken at each intervening 10m interval. Consecutive samples were carried using 20kg lifting bags. During sampling dives, boat traffic warnings were issued. The Harbourmaster was also made aware of research being conducted in the area.

Transects

Transect locations were derived from the 1992 report (Table 8). A single 500m line divided into 50 and 10m intervals was laid along each transect. Lines were laid at or before slack water from shoreface out using a bottom tensing lazy shot. The line was marked with 30m slack at either end thus when the line was dropped in a maximum depth of 10m the error margin was 10-15m dependent upon water depth at the time. The second main weight was used as a drag (i.e. on a rope held at depth below the surface) to minimise bowing due to currents and snagging due to boat traffic. This was found to be effective to ensure accurate emplacement. This arrangement also facilitated retrieval of line after each survey. Two buddy pairs were employed to start at either end of the transect working toward the middle. The third pair was then available, on their surfacing, to complete the remaining section. Time efficiency was paramount to enable completion of each transect during slack water. This period was taken as one hour before and after high or low water.

Transect	Position	True Bearing	Reference Location	True Heading
1	6° 18.34W	330°	Crow Rock	
	49° 56.10N	040°	Daymark	336°
		083°	Cable Marker	
2	6° 18.13W	273°	Crow Rock	
	49° 56.21N	342°	Round Island Lighthouse	338°
		039°	Daymark	
3	6° 17.94W	262°	Crow Rock	
	49° 56.27N	339°	Round Island Lighthouse	357°
		037°	Daymark	
4	6° 17.94W	264°	Crow Rock	
	49° 56.27N	337°	Round Island Lighthouse	044°
		035°	Daymark	
5	6° 17.57W	336°	Round Island Lighthouse	
	49° 56.16N	031°	Daymark	044°
		088°	Hats	

Table 8 *Bearings and Transects Used to Locate Sediment Transects*

Field Processing of Samples

Sub-aqua results and onshore descriptions were compiled during evening sessions (Figure 8). Onshore descriptions involved semi-quantitative analysis of 10m sample using grain size and sorting charts.

Laboratory Analysis of Samples

Wet samples were dried below 65°C for a minimum of six hours as required. A nest of eleven 8" diameter sieves separated in half phi intervals was used to determine the size distribution of grains sampled. Each sample was weighed before sieving and the cumulative weight calculated from each fraction to 0.01gm. Each sample was sieved for 20 minutes and a sub sample of each size fraction retained for reference. The percentage loss was generally found to be below the 0.5% acceptable standard; some samples were found to be in excess of this value but were included in the results for the purpose of this study. These were samples T1A, T3C, T4B and G, T5C and T2 Cliff and should therefore be regarded with caution. A slight increase in weight of samples T3K, T4E, T4I and T5H was observed. No explanation is offered for this variation although a delay between the weighing and sieving of some samples may have led to atmospheric equilibration.

Results

Raw data expressed as percentage of dry weight retained, (Table 9), was then converted to a cumulative percentage, (Table 10), and plotted to find D50 (Figures 9-14). D50 was taken where the trendline along a data series crossed 50%. This is the mean cumulative size fraction. The spatial distribution of sediments show characteristic trends:

The area to the west of Bar Point contains the coarser gravelly sand deposits. (> 2800 microns). An area trending SW-NE 100-150m wide is visible where over 50% deposits are above gravel size. A fining to coarse sand (1000-710 microns) at the end of Transect 1 is observed. An area of finer deposits are observed at the start of Transect 1. This area is characterised by less than 50 % sand (visual estimate) commonly between 10-30 %. The progression from medium sands (500-355 microns) to granules then occurs between the 50-150m range of Transect 1. The map of vegetation cover suggests the very coarse sand to granule area is well populated with dominantly tall vegetation.

An area to the north of Transect 2 also shows a coarser tendency. The intervening area is dominated by very coarse sand and granule deposits (2800-1000 microns).

The central area directly North of Bar Point is an area of well sorted medium sand dominated by current ripples with 98-100 % sand cover with occasional low vegetation (1-2% cover) generally attached to mobile granule or small pebbles.

Sand dominates Transect 4 with an area of boulders close to the shore. The trend is from coarse to medium to coarse grained with increasing distance offshore. The medium sands occupy the majority of the transect. Scour was observed in the 340-500m area. This corresponds with a coarse sand distribution of 90-95%. Vegetation cover in this area was 0-10% composed of mostly low growing plants. Fining within the central 300m reflects a broad trend of medium to fine sand trending NW-SE across to transect 5. This area (from 270m- 470m) was noted to have algal growth across the sand surface possibly accounting for the absence of bioturbation in this area.

The area to the East of Bar Point is distinctive in the dominance of boulder fields in the first 85m of Transect 5. These enable the settling of fine suspended sediment between the boulders during slack water. Tall vegetation cover is common in this area reaching 90-100%.

Notable on the cumulative D50 map is the size variation of the ram deposits; 250 microns is observed from the cliffs adjacent to Transect 1; 355 microns is recorded from Transect 2 and 3 cliff deposits. Transect 4 beach sample was taken from the dune system. This represents an aeolian deposit of reworked sand with D50 in the 250 micron size range.

Discussion

The distribution of sedimentary grain size depends upon the character of the source rocks, the weathering processes acting upon them, abrasion or the energy level of the environment and the selective sorting of grains during transportation. Transport may occur in three modes:

- traction where grains are in continuous contact with the substrate.
- intermittent suspension where grains bounce along the substrate.
- suspension in the transporting medium above the substrate.

These modes of transport are dependent upon the competency and capacity of the transporting agent, reflecting volume, velocity, bed roughness and turbulence.

West of Bar Point the substrate consists of dominantly granules to cobbles. To the East, medium to coarse sands dominate. Where boulders are dominant (in the East) fine sands are deposited in the sheltered intergranular spaces. Directly North of Bar Point, notably along Transect 3, medium sands show current ripple characteristics indicating tidally mobile sediments. From the direct Northern zone of Bar Point to the East, medium sands are found. Descriptions of the traces of benthic fauna indicate the stability of the substrate during the survey period.

These observations suggest the following:

- In the west, current velocities may under fair weather conditions, transport particles up to coarse sand. The concentration of granules to cobbles suggests a lag deposit.
- In the central Northern area, medium sands are frequently transported; bedforms and the absence of colonising flora and fauna suggest these to be highly mobile deposits.
- To the East, finer sand grades are colonised both by epifauna, infauna and algal growth. This indicates the stability of these finer sands during fair weather tidal conditions.

Previous studies in this area such as Admiralty float release, established that the rising tide currents set to the East. Whilst Ebb-currents bifurcate around Bar Point and St. Mary's to the South.

During August 1992, two "Sensordata" current meters sited on the west and east sides of the point indicated that flows were stronger on the Western side reaching 25 cm/s. This is enough to transport fine sands by traction or intermittent suspension. Flows to the East were not in excess of 13cm/s; this rate is insufficient to mobilise sands. These records refer to Neap tide cycles; it was suggested that during spring tides a doubling of these could be expected. This would enable active transport of sands to occur on the western side whilst being just possible on the Eastern side.

Asymmetry in flow strength between the flood and ebb tides on the western side was recorded. The strongest flows were found to be most prolonged when the tidal current is orientated to 060°: This would be anticipated to be true direction of sand transport. (R. Nunny, 1992).

The observations of sand transport characteristics were almost identical to those described in 1992. Observed distributions fit well with the tidal flow data established at that time. Selective erosion from the source material will result in the transported sediment being finer and better sorted than the source. The lag deposit (residual) will be coarser and better sorted (McClaren and Bowles, 1985). In this manner the transport direction of a sedimentary deposit may be inferred.

Given the tidal flow data available and the sediment distribution pattern, it would seem that the direction of transport is dominantly from Southwest to the East around Bar Point. Since the transportation of sediment is dependent upon the range of grain sizes available the absence of

transported sand in the Western area is inferred to reflect the absence of a significant sand source in this or adjacent to this region.

The dominance of granule to cobble size deposits in the western area is inferred to be a lag deposit. Since there is no significant observed sand supply to Bar Point or Crow Bar erosion of the ram deposits is suggested as the ultimate source for sand supply in this area. As such it is a finite resource with a direct limiting effect on sand supply to the beach.

The 1992 survey concluded that “there was unlikely to be a significant feed of sediments to the beaches from an offshore source” (R.Nunny, 1992). And that consequently, aggregate extraction was having a direct effect of increasing erosion rates on the Point. The removal of material from the beach effectively altered the plan of the tide line; in doing so this increased the angle of incidence at which storm waves from the West meet the beach. This increased the capability of wave action to transport sands around the spit by longshore drift, reducing the sand available to act as an energy buffer during storm periods. The overall effect of this is to render the cliff deposits more vulnerable to erosion during high energy periods.

Conclusion

The mapping of sediments and other features of the area (Appendix) around Bar Point has illustrated the transport and deposition patterns active at this time. The overall conditions of supply, transport and deposition appear to have remained the same since 1992 with exception of an increase in the abundance of sand observed in the depositional area to the East of the Point.

The pattern of grain size distribution suggests the Western zone to be a lag deposit without a significant offshore supply of sediment suitable for beach replenishment. The apparent increase in sand abundance in the central and Eastern areas of the survey suggest that the cessation of aggregate extraction over recent years has had a direct effect of increasing sediment available to supply to the area.

The correlation between ram deposit size and the dominant size of sands deposited in the central and eastern areas, coupled with the apparent absence of an offshore supply from the West, suggests the Point itself is the direct local source for sediment supply.

The validity of this suggestion could be established by the repetition of beach profiling and the calculation of a sediment budget for the area to establish the provenance of the sand deposits.

Notes for use with the Bar Point Recording Form

DEPTH:	Used as a profile record and to indicate potential depth of wave base if bedforms present.																		
VEGETATION COVER:	Extent of encrustation and weed growth often indicates stability of substrate. Long or tall weed growth increases the surface area available and increases the effects of current and wave action.																		
FAUNAL GROUPS:	The diversity and abundance of habitats may indicate stability and maturity of the substrate. General phyla e.g. Echinoderms, molluscs.																		
BIOTURBATION:	Mounds, casts, holes, burrows, faecal pellets, feeding traces where preserved indicate immediate stability and longer term stability since organisms are established in the area. An indication of the concentration (1=rare – 5=abundant) may indicate suitability of the environment.																		
BEDFORMS:	Distinctive patterns used to identify characteristics of water movement.																		
OVERALL SEA FLOOR:	% silt to sand, % granules to cobbles, % boulders: overview of sea floor to indicate bottom conditions. Used in conjunction with vegetation cover to present general picture and with % of sediment sizes to indicate conditions of transport. Bedrock % and description included for general overview and possible sediment source.																		
SIZE DISTRIBUTION:	Notes in this section used to supplement information from collected samples. In conjunction																		
SILT to BEDROCK:	with the % bottom cover size distribution is used to establish transport pathways around the survey area. Definitions: SILT (below 0.063mm) Very fine sediment of land (mud) or marine (algal/mucus) origin. Becomes resuspended easily when wafted with hand or disturbed. SAND (0.063-2mm) May be fine medium or coarse (some scales include very coarse). Use laminated cards to approximate sizes and proportions underwater (eg 10% sand 80% coarse sand 10% granules). Most beach sands are medium to coarse. GRANULES (2-4mm) PEBBLES (4-64mm) Small, medium and large to very large (see laminated cards) COBBLES (64-256mm) Fist to head size BOULDERS (256mm up) small (25-50cm), medium (50-150cm), large (over 150cm) BEDROCK notes on fractures & appearance e.g. rounded, angular, pitted, smooth. Are very useful including rock type if possible.																		
SPHERICITY:	The degree of rounding or angle or edges along with the sphericity of grains depends upon the original composition, the energy of the depositional environment and the method of transport as well as distance. Transport pathways and sources are established and confirmed by these features.																		
SORTING:	The sorting of grains depends upon their shape and density and the energy of water flow. Grain entrainment into the water column or as bedload transport is essentially the process under investigation at Bar Point. Quantitative description will supplement the detail from each sample. Shell fragments, known as bioclasts, have different hydrodynamic properties due to their irregular structure and lower density (compared to rock fragments generally) and may be transported with grains of smaller volume to settle at a slower rate leaving shelly material on the surface. The descriptions well sorted to poorly sorted (shown visually on the laminated cards) will give an indication of the water movement and energy.																		
COMPACTION:	Recently deposited sediments tend to be poorly consolidated especially in the smaller sizes such as silt and fine sand. The compaction or firmness (rated below) is a useful indicator of the stability of the sediment.																		
	<table><tr><td>Ratings:</td><td>Description</td><td>Score</td></tr><tr><td></td><td>Very firm (difficult to penetrate surface with fingers)</td><td>5</td></tr><tr><td></td><td>Firm (can't penetrate below the surface – approx. 5mm)</td><td>4</td></tr><tr><td></td><td>Soft (moves easily but has some substance)</td><td>3</td></tr><tr><td></td><td>Very soft (little resistance to movement)</td><td>2</td></tr><tr><td></td><td>Mud (virtually no resistance to movement)</td><td>1</td></tr></table>	Ratings:	Description	Score		Very firm (difficult to penetrate surface with fingers)	5		Firm (can't penetrate below the surface – approx. 5mm)	4		Soft (moves easily but has some substance)	3		Very soft (little resistance to movement)	2		Mud (virtually no resistance to movement)	1
Ratings:	Description	Score																	
	Very firm (difficult to penetrate surface with fingers)	5																	
	Firm (can't penetrate below the surface – approx. 5mm)	4																	
	Soft (moves easily but has some substance)	3																	
	Very soft (little resistance to movement)	2																	
	Mud (virtually no resistance to movement)	1																	

Figure 7 Notes for Sediment Survey

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S. No.	>2800	1000	710	500	355	250	180	125	90	63	<63
T1A	20.30	15.61	14.97	12.08	9.75	9.62	5.32	6.70	3.27	1.49	0.90
T1B	8.36	15.56	14.16	10.29	7.51	10.34	13.29	12.76	4.66	2.07	1.00
T1C	15.48	26.46	12.12	13.93	14.28	7.91	4.39	3.44	1.27	0.51	0.21
T1D	79.65	13.05	2.37	1.38	0.93	0.85	0.67	0.62	0.29	0.12	0.07
T1E	61.58	23.37	5.59	4.32	1.88	0.97	0.64	0.68	0.45	0.25	0.28
T1F	32.22	35.19	11.01	13.47	6.15	0.79	0.33	0.30	0.22	0.14	0.17
T1G	28.71	31.31	12.14	9.30	6.06	7.53	2.59	1.34	0.63	0.25	0.15
T1H	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T1I	33.05	26.51	9.20	8.12	7.66	8.59	3.46	1.57	0.87	0.52	0.46
T1J	33.04	17.03	5.55	13.35	15.61	10.53	3.39	0.86	0.35	0.18	0.11
T1K	35.50	14.15	4.78	10.17	15.06	13.34	5.08	1.11	0.42	0.24	0.16
T2A	29.37	13.94	12.10	12.88	9.02	7.53	7.33	4.76	1.99	0.69	0.40
T2B	32.06	37.97	13.11	6.69	4.21	3.07	1.44	0.79	0.42	0.15	0.09
T2C	22.84	37.11	14.51	10.17	7.27	5.22	1.74	0.71	0.27	0.10	0.06
T2D	57.16	17.18	7.63	5.90	4.40	5.59	1.31	0.43	0.20	0.10	0.10
T2E	69.66	12.01	3.08	2.83	2.81	5.17	2.59	0.97	0.46	0.23	0.18
T2F	53.76	20.68	6.65	9.38	5.35	2.12	0.77	0.40	0.34	0.25	0.30
T2G	37.89	15.16	3.17	5.50	10.85	17.67	6.21	1.77	0.91	0.55	0.33
T2H	49.68	16.50	3.82	5.62	8.92	9.66	4.08	1.00	0.36	0.20	0.16
T2I	37.65	20.03	4.60	5.92	9.63	11.96	6.15	2.22	0.94	0.54	0.36
T2J	31.02	29.88	4.85	3.96	7.17	12.63	7.38	2.04	0.59	0.26	0.22
T2K	57.77	25.45	4.79	5.40	3.50	1.81	0.62	0.25	0.16	0.09	0.15
T3A	0.17	0.80	0.85	5.52	20.23	18.92	30.99	18.54	2.64	0.96	0.38
T3B	25.04	4.96	2.71	8.25	29.98	12.41	8.22	4.91	1.70	1.12	0.70
T3C	3.72	14.20	8.43	13.19	38.49	17.38	2.54	1.05	0.56	0.28	0.16
T3D	0.77	5.60	3.86	6.98	65.17	16.80	0.76	0.05	0.02	0.01	0.00
T3E	1.50	3.99	2.65	8.96	58.01	23.96	0.78	0.04	0.02	0.06	0.02
T3F	0.57	9.32	5.69	15.37	52.16	16.17	0.57	0.05	0.03	0.02	0.04
T3G	0.01	2.13	8.68	35.00	47.89	6.11	0.07	0.03	0.01	0.05	0.02
T3H	0.02	3.69	9.67	24.96	50.57	10.74	0.25	0.02	0.02	0.01	0.05
T3I	0.18	3.83	5.97	23.18	56.20	10.20	0.35	0.00	0.02	0.02	0.04
T3J	0.03	2.15	4.38	30.79	56.78	5.56	0.25	0.03	0.02	0.01	0.00
T3K	0.16	1.70	4.54	29.03	52.58	11.16	0.69	0.06	0.03	0.02	0.03
T4A	0.86	2.22	6.90	27.59	30.33	18.44	11.55	1.71	0.23	0.10	0.07
T4B	0.19	0.41	2.27	11.51	40.91	23.92	14.86	3.98	1.39	0.44	0.12
T4C	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T4D	0.28	1.95	5.68	32.72	44.85	7.70	1.26	2.26	1.51	0.83	0.96
T4E	1.08	3.95	9.61	23.75	46.16	7.14	1.65	2.95	1.73	0.98	0.98
T4F	1.15	6.59	12.12	28.26	31.61	3.16	3.82	6.43	3.62	1.56	1.68
T4G	0.58	1.34	3.48	15.42	24.45	5.24	10.74	24.31	9.64	3.17	1.64
T4H	1.06	8.56	14.28	37.81	26.38	2.15	2.18	3.64	1.80	0.96	1.19
T4I	3.06	12.84	17.17	34.59	17.03	2.57	3.73	5.49	1.91	0.78	0.83
T4J	1.80	9.29	20.23	29.78	9.16	6.64	8.97	9.30	2.83	1.12	0.88
T4K	2.17	9.74	34.55	35.15	5.33	4.38	3.26	2.91	1.29	0.67	0.56
T5A	2.04	9.07	12.78	23.25	22.04	5.42	5.44	7.87	5.49	3.32	3.28
T5B	1.05	6.31	3.14	3.15	2.47	2.41	13.73	46.26	15.67	4.01	1.79
T5C	3.12	10.94	9.71	13.30	9.95	5.55	7.79	11.69	10.00	8.18	9.76
T5D	0.10	1.56	1.65	2.86	4.11	4.60	21.35	49.43	9.88	3.21	1.24
T5E	0.17	2.17	2.21	4.21	4.63	6.17	49.64	24.74	4.07	1.39	0.60
T5F	1.56	14.38	13.29	19.18	8.57	7.06	12.42	16.67	4.19	1.71	0.97
T5G	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T5H	33.43	9.17	6.01	7.43	4.04	4.42	5.99	17.36	7.81	2.92	1.41
T5I	59.00	6.56	1.53	1.39	1.69	3.04	5.06	10.61	6.98	2.70	1.46
T5J	37.96	10.05	1.55	1.48	0.87	1.95	8.31	27.84	7.20	2.06	0.72
T5K	61.28	4.16	1.36	2.08	1.59	2.05	5.11	12.51	6.67	2.25	0.95
T1 Cliff	0.00	0.11	1.31	11.79	29.05	27.51	20.39	7.59	1.05	0.38	0.81
T2 Cliff	4.72	7.51	10.70	24.73	4.48	31.77	12.43	2.00	0.47	0.33	0.87
T3 Beach	0.31	2.88	9.74	23.07	35.68	18.52	8.90	0.79	0.06	0.02	0.03
T4 Beach	0.00	0.09	0.21	2.22	30.69	45.77	18.70	1.91	0.21	0.08	0.13

Table 9 % Dry Weight Retained. Size: half-phi scale divisions in microns

S.No.	>2800	1000	710	500	355	250	180	125	90	63	<63
T1A	20.30	35.91	50.87	62.96	72.70	82.32	87.64	94.34	97.61	99.10	100.00
T1B	8.36	23.92	38.08	48.37	55.88	66.22	79.51	92.27	96.93	99.00	100.00
T1C	15.48	41.94	54.06	67.99	82.28	90.19	94.57	98.01	99.28	99.79	100.00
T1D	79.65	92.70	95.07	96.45	97.38	98.22	98.90	99.52	99.81	99.93	100.00
T1E	61.58	84.95	90.53	94.85	96.73	97.70	98.34	99.02	99.47	99.72	100.00
T1F	32.22	67.41	78.42	91.89	98.04	98.83	99.17	99.47	99.69	99.83	100.00
T1G	28.71	60.01	72.15	81.45	87.51	95.04	97.63	98.97	99.59	99.85	100.00
T1H	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T1I	33.05	59.56	68.76	76.88	84.54	93.13	96.58	98.15	99.02	99.54	100.00
T1J	33.04	50.07	55.62	68.97	84.58	95.11	98.49	99.35	99.70	99.89	100.00
T1K	35.50	49.65	54.43	64.59	79.65	93.00	98.07	99.18	99.60	99.84	100.00
T2A	29.37	43.31	55.41	68.29	77.31	84.84	92.17	96.93	98.92	99.60	100.00
T2B	32.06	70.03	83.14	89.83	94.05	97.12	98.55	99.34	99.76	99.91	100.00
T2C	22.84	59.95	74.46	84.63	91.90	97.12	98.86	99.57	99.84	99.94	100.00
T2D	57.16	74.34	81.97	87.86	92.26	97.86	99.17	99.59	99.80	99.90	100.00
T2E	69.66	81.68	84.76	87.59	90.41	95.57	98.16	99.13	99.59	99.82	100.00
T2F	53.76	74.44	81.09	90.47	95.81	97.93	98.70	99.11	99.45	99.70	100.00
T2G	37.89	53.05	56.22	61.72	72.57	90.24	96.44	98.22	99.12	99.67	100.00
T2H	49.68	66.18	70.00	75.62	84.54	94.20	98.28	99.27	99.64	99.84	100.00
T2I	37.65	57.68	62.28	68.20	77.82	89.78	95.93	98.16	99.10	99.64	100.00
T2J	31.02	60.89	65.74	69.71	76.88	89.51	96.89	98.93	99.52	99.78	100.00
T2K	57.77	83.22	88.01	93.41	96.91	98.71	99.33	99.59	99.75	99.85	100.00
T3A	0.17	0.97	1.82	7.34	27.57	46.48	77.48	96.02	98.66	99.62	100.00
T3B	25.04	30.00	32.71	40.96	70.94	83.35	91.57	96.48	98.18	99.30	100.00
T3C	3.72	17.91	26.34	39.53	78.02	95.41	97.94	99.00	99.56	99.84	100.00
T3D	0.77	6.37	10.22	17.20	82.37	99.17	99.92	99.97	99.99	100.00	100.00
T3E	1.50	5.50	8.15	17.11	75.12	99.09	99.87	99.91	99.93	99.98	100.00
T3F	0.57	9.90	15.59	30.96	83.12	99.28	99.86	99.91	99.94	99.96	100.00
T3G	0.01	2.14	10.82	45.82	93.72	99.82	99.89	99.92	99.93	99.98	100.00
T3H	0.02	3.71	13.38	38.34	88.91	99.65	99.90	99.92	99.94	99.95	100.00
T3I	0.18	4.02	9.99	33.17	89.37	99.57	99.91	99.92	99.94	99.96	100.00
T3J	0.03	2.18	6.55	37.34	94.13	99.69	99.93	99.96	99.99	100.00	100.00
T3K	0.16	1.86	6.40	35.43	88.01	99.17	99.86	99.92	99.95	99.97	100.00
T4A	0.86	3.07	9.97	37.56	67.89	86.33	97.88	99.59	99.82	99.93	100.00
T4B	0.19	0.59	2.87	14.38	55.29	79.21	94.06	98.05	99.44	99.88	100.00
T4C	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T4D	0.28	2.23	7.91	40.63	85.48	93.19	94.44	96.70	98.21	99.04	100.00
T4E	1.08	5.03	14.65	38.40	84.56	91.70	93.35	96.30	98.04	99.02	100.00
T4F	1.15	7.74	19.86	48.12	79.73	82.89	86.71	93.14	96.76	98.32	100.00
T4G	0.58	1.92	5.40	20.81	45.26	50.50	61.24	85.55	95.19	98.36	100.00
T4H	1.06	9.61	23.90	61.71	88.09	90.24	92.41	96.05	97.85	98.81	100.00
T4I	3.06	15.90	33.07	67.66	84.69	87.26	90.99	96.48	98.39	99.17	100.00
T4J	1.80	11.09	31.32	61.10	70.26	76.90	85.87	95.17	98.01	99.12	100.00
T4K	2.17	11.91	46.45	81.60	86.94	91.32	94.57	97.48	98.77	99.44	100.00
T5A	2.04	11.11	23.89	47.15	69.19	74.61	80.05	87.92	93.41	96.72	100.00
T5B	1.05	7.36	10.50	13.66	16.13	18.54	32.27	78.53	94.20	98.21	100.00
T5C	3.12	14.07	23.78	37.08	47.03	52.58	60.37	72.05	82.06	90.24	100.00
T5D	0.10	1.66	3.32	6.18	10.30	14.90	36.24	85.68	95.55	98.76	100.00
T5E	0.17	2.34	4.55	8.76	13.39	19.56	69.20	93.93	98.01	99.40	100.00
T5F	1.56	15.95	29.24	48.41	56.99	64.04	76.46	93.13	97.32	99.03	100.00
T5G	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T5H	33.43	42.60	48.62	56.05	60.09	64.51	70.50	87.86	95.67	98.59	100.00
T5I	59.00	65.56	67.09	68.48	70.17	73.20	78.26	88.86	95.85	98.54	100.00
T5J	37.96	48.01	49.56	51.04	51.92	53.87	62.18	90.02	97.22	99.28	100.00
T5K	61.28	65.43	66.79	68.88	70.47	72.51	77.62	90.13	96.80	99.05	100.00
T1 Cliff	0.00	0.11	1.43	13.21	42.26	69.77	90.17	97.75	98.80	99.19	100.00
T2 Cliff	4.72	12.23	22.93	47.66	52.13	83.90	96.33	98.33	98.80	99.13	100.00
T3 Beach	0.31	3.20	12.93	36.00	71.68	90.20	99.10	99.89	99.95	99.97	100.00
T4 Beach	0.00	0.09	0.30	2.52	33.20	78.97	97.68	99.58	99.79	99.87	100.00

Table 10 Cumulative % Dry Weight Retained. Scale: half-phi scale divisions in microns

Transect 1: Mean D50 from Cumulative Weight %.

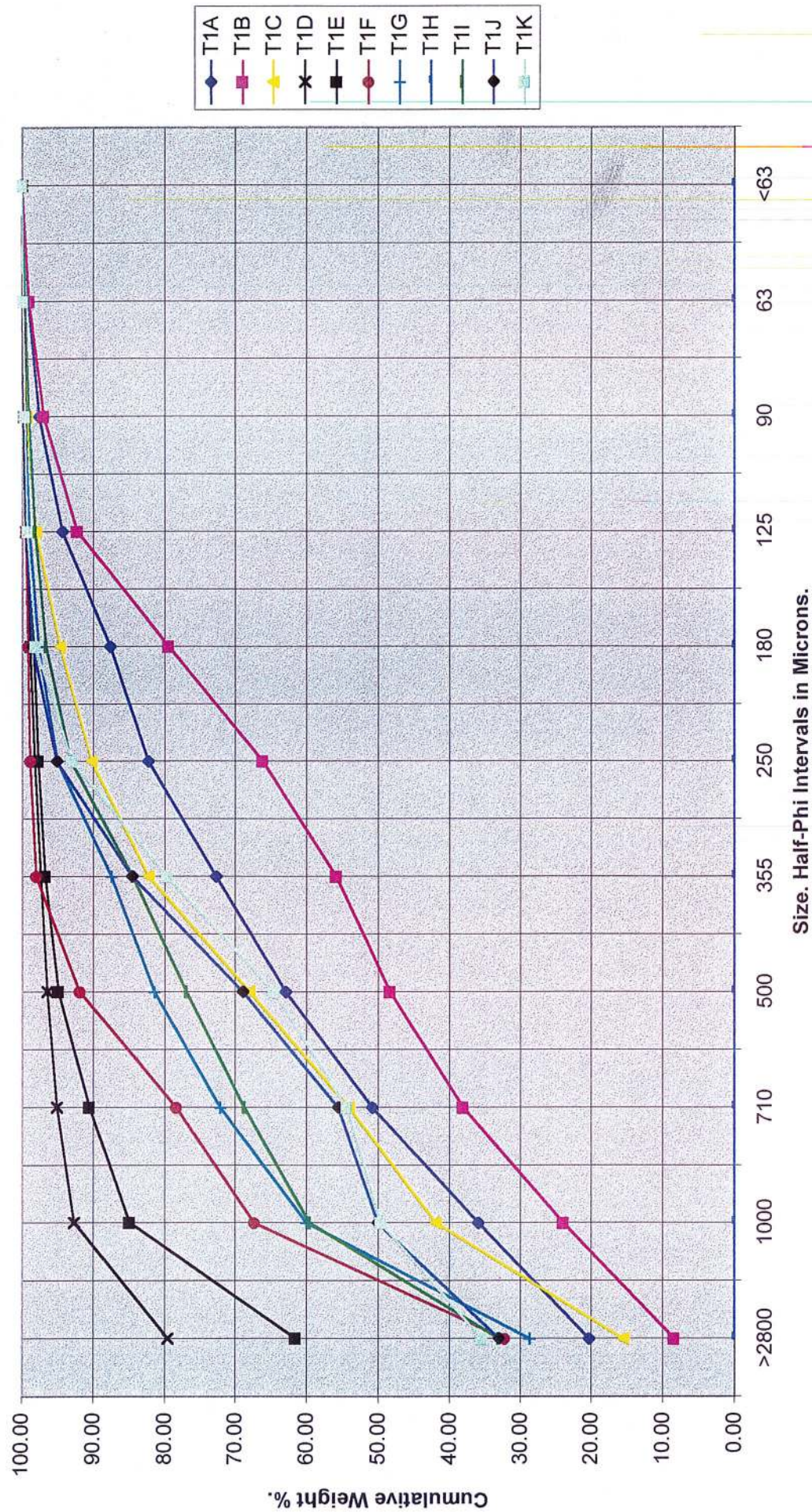


Figure 9 Transect 1 Mean D50 from Cumulative Weight %

Transect 2: Mean D50 from Cumulative Weight %.

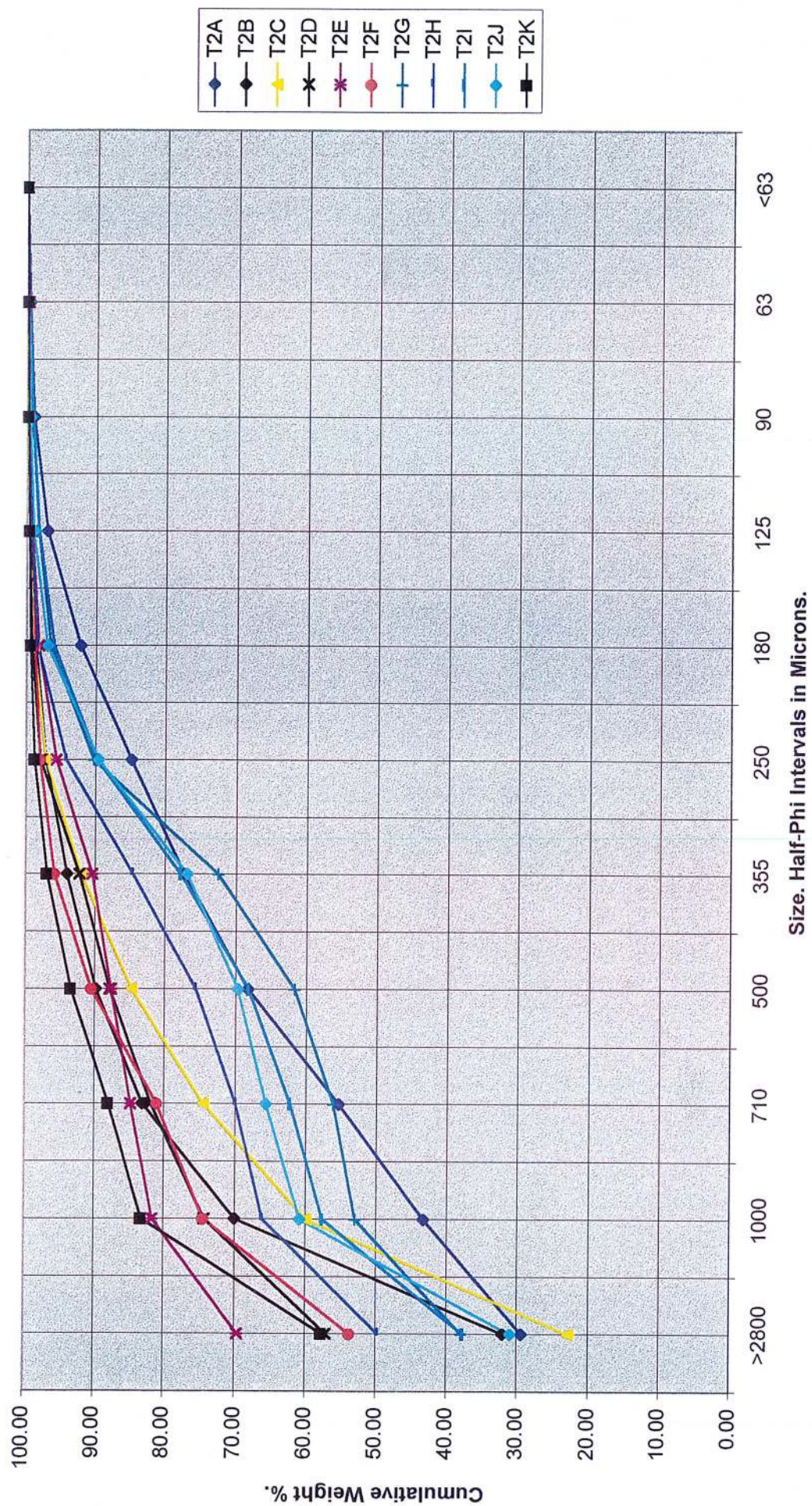


Figure 10 Transect 2 Mean D50 from Cumulative Weight %

Transect 3: D50 from Cumulative Weight %.

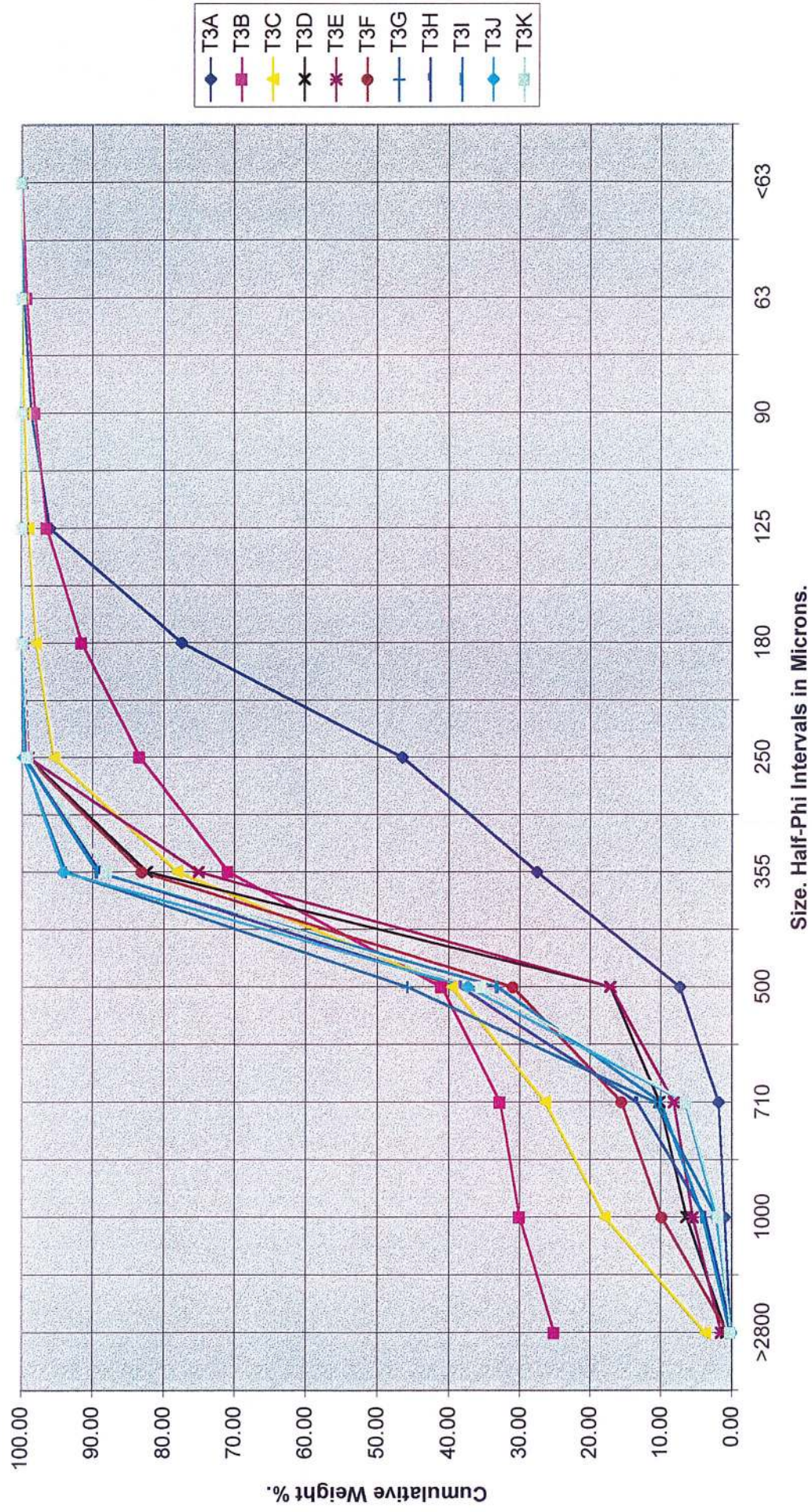


Figure 11 Transect 3 Mean D50 from Cumulative Weight %

Transect 4: D50 from Cumulative Weight %.

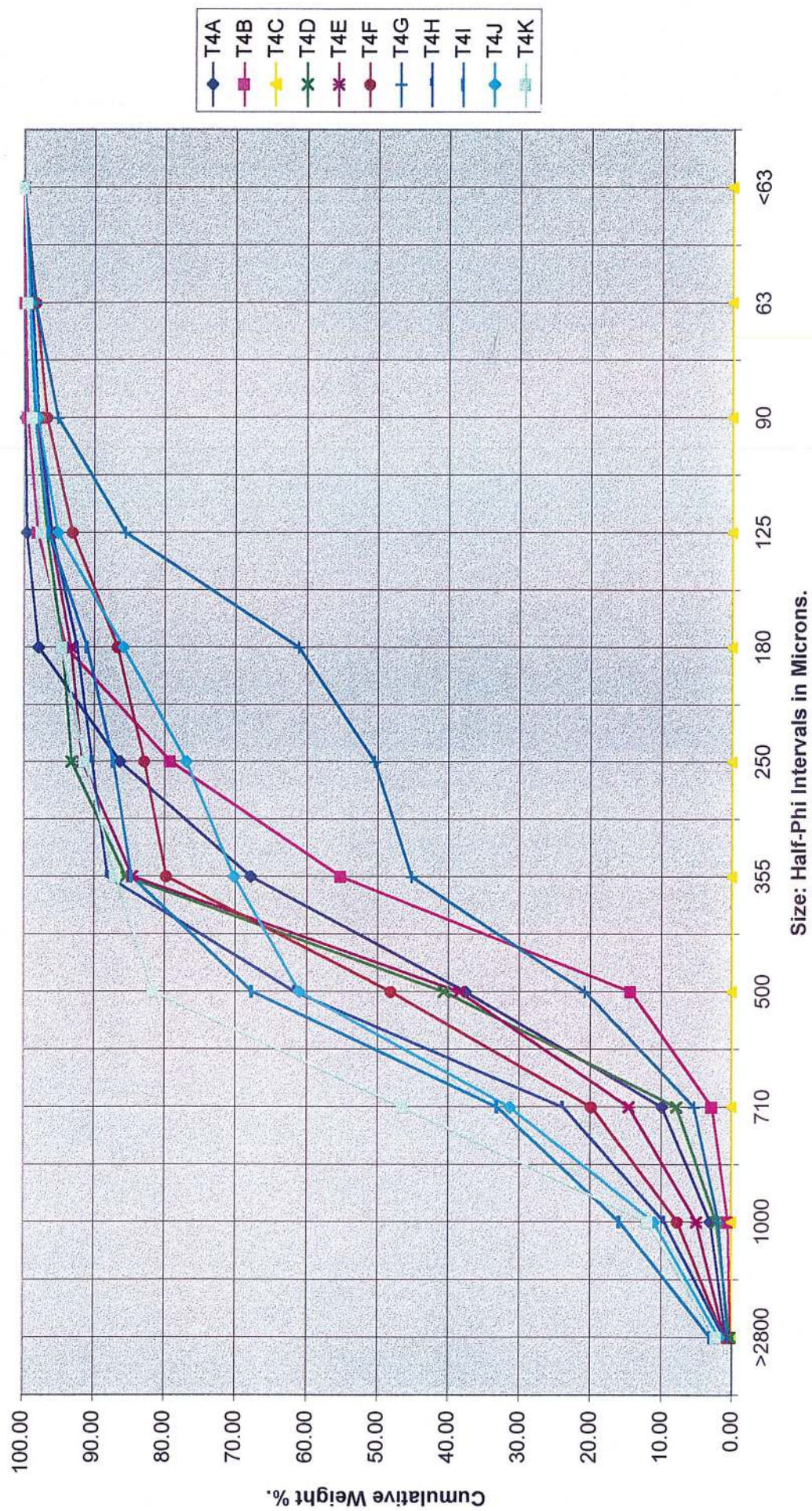


Figure 12 Transect 4 Mean D50 from Cumulative Weight %

Transect 5: D50 from Cumulative Weight %.

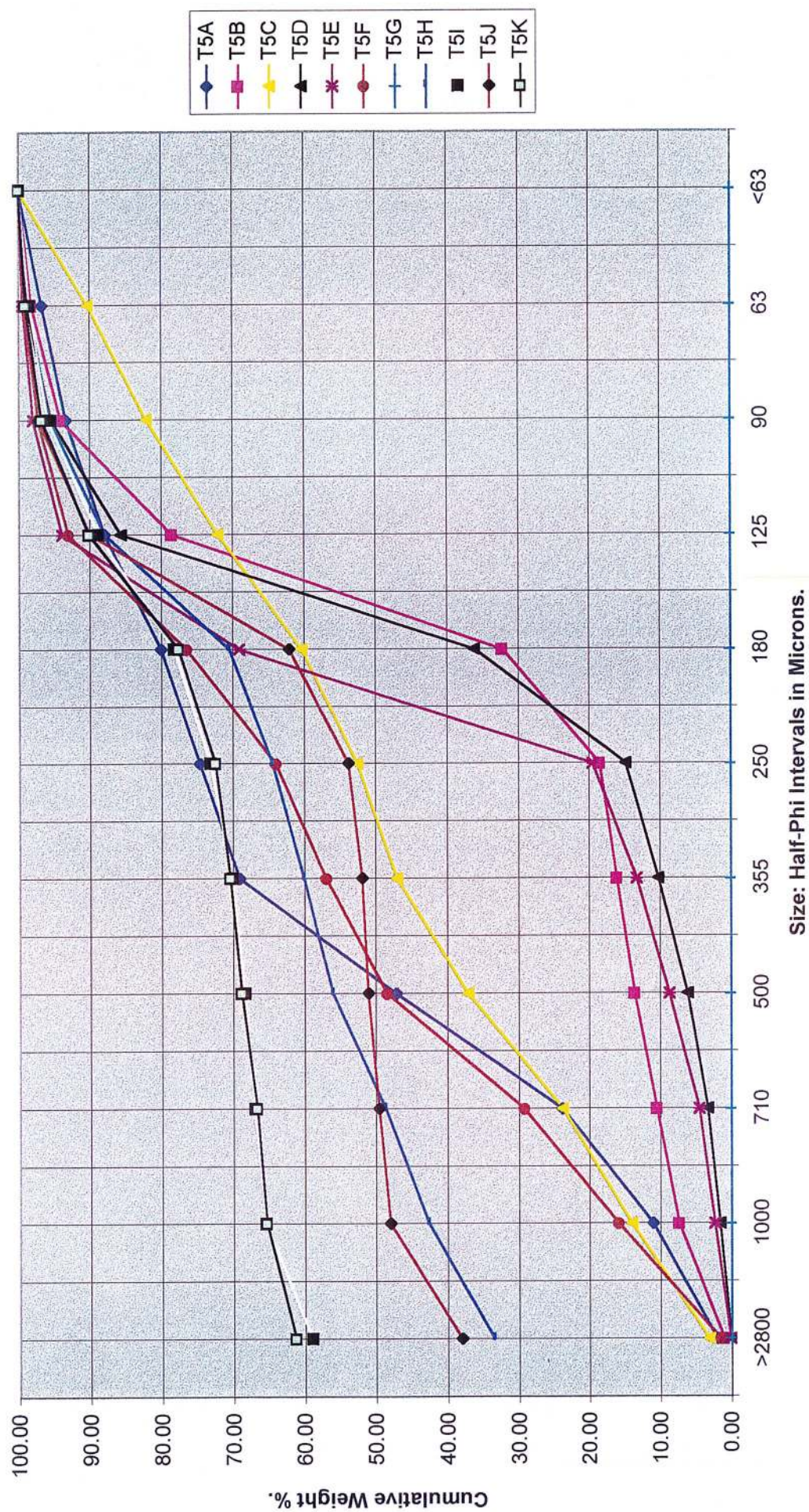


Figure 13 Transect 5 Mean D50 from Cumulative Weight %

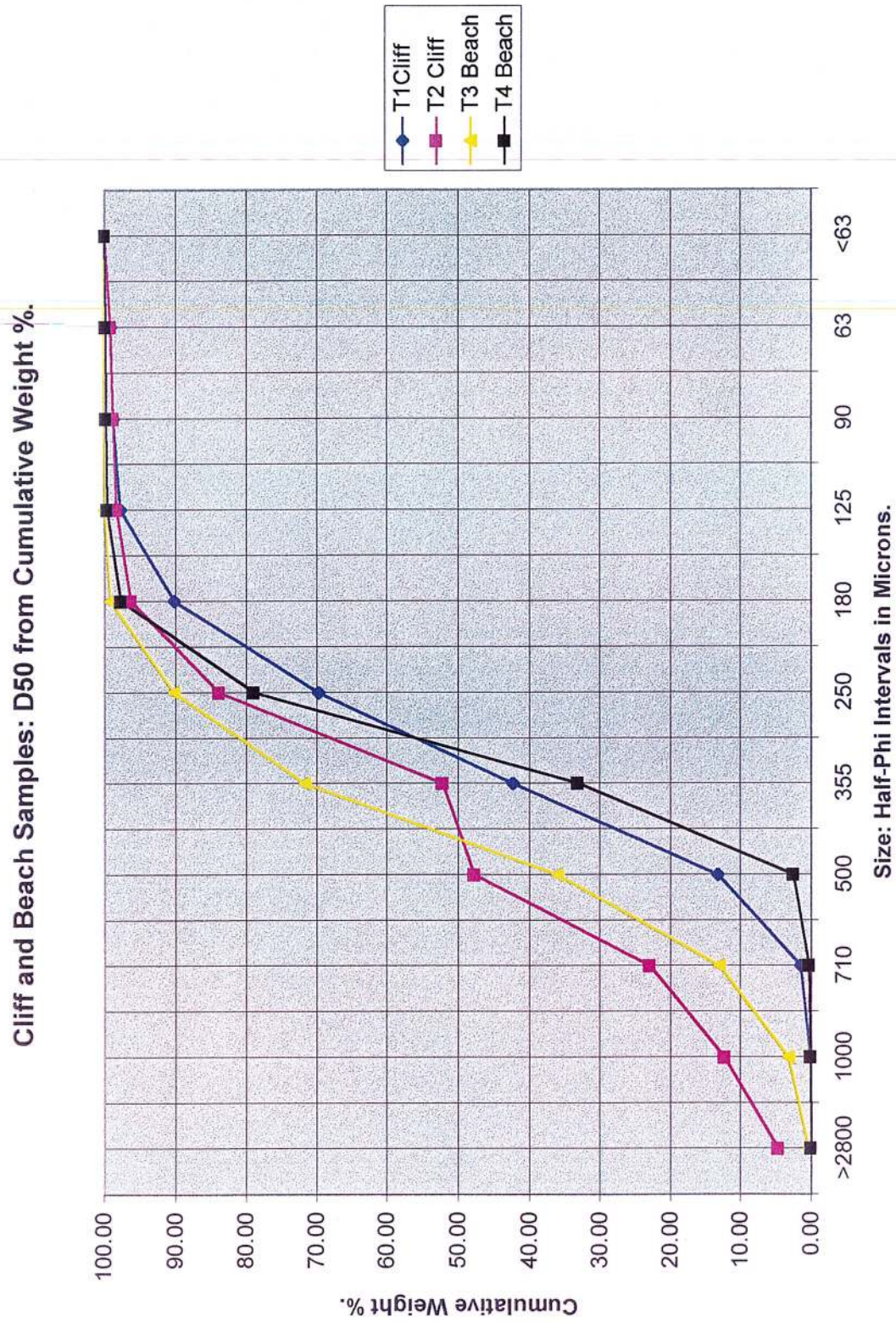


Figure 14 Cliff and Beach Samples: Mean D50 from Cumulative Weight %

6 Litter Survey

Marine litter can be defined as any man-made object that has been lost or discarded into the marine environment. The sources of this litter are many and can originate from either the sea or the land. Once in the marine environment litter can travel vast distances carried in the sea by ocean currents and blown by the wind before coming ashore on the coast. Depending on its composition, marine litter may remain within the environment for hundreds of years before decomposing and indeed some plastics may never decompose, just break-up into smaller and smaller pieces.

As well as the aesthetic problems associated with litter there are less obvious impacts. Marine animals can become entangled in discarded fishing line and plastics causing them injury or death. Many marine animals ingest marine litter having mistaken it for food again causing injury or death. Boat propellers and fishing gear can become fouled with discarded rope and plastics and engine water cooling system can become blocked causing damage and perhaps endangering life.

The Isles of Scilly, situated in the western approaches to south west England, as well as being a popular destination for tourists during the summer season, accumulates litter brought towards the British Isles on the prevailing south westerly winds and on the Gulf Stream. Using the form developed by the Marine Conservation Society for litter surveys, eleven beaches were surveyed around the Scillies archipelago. The beaches chosen included the popular tourist beaches of Porthcressa and Porthmellon on St. Mary's and Higher Town Bay, St. Martin's as well as some of the less visited beaches such as those on the Great Ganilly in the Eastern Isles and West Porth, Samson. The data recorded are simply the number of items found on the beaches and no attempt has been made to estimate the area of the beach and therefore calculate the amount of litter per unit area.

	West Porth, Samson	Porthmellon, St. Mary's	Porthcressa, St. Mary's	Old Town Bay, St. Mary's	Bar Point, St. Mary's	East Porth, Great Ganilly	West Porth, Great Ganilly	Porth Conger, St. Agnes	The Cove, St. Agnes	Great Bay, St. Martins	Higher Town Bay, St Martins	Total
PLASTICS	49	277	156	53	21	56	93	34	69	171	92	1071
POLYSTYRENE	2	19	11	24	3	2	0	0	2	11	8	82
RUBBER	2	1	5	4	0	2	3	1	2	17	7	44
WOOD	12	33	18	4	4	5	16	2	11	7	4	116
METAL	0	25	26	15	3	5	3	2	4	79	13	175
SANITARY Items	0	5	6	0	0	0	0	0	0	0	0	11
PAPER	0	89	132	12	0	0	0	2	0	2	1	238
CLOTH	4	14	23	3	2	1	3	0	6	16	3	75
GLASS	1	1	8	1	1	0	2	2	1	3	6	26
POTTERY / CERAMIC	0	1	8	3	4	0	0	0	0	0	0	16
TAR / OIL (Patches)	0	0	0	0	0	0	1	0	10	5	1	17
FAECES	0	0	1	0	0	0	0	0	0	0	0	1
Total number of items	70	465	394	119	38	71	121	43	105	311	135	1872

Table 11 *Summary of Beach Litter at Different Sites.*

The beaches with the most litter items were, not surprisingly, the popular tourist beaches on St. Mary's with 465 and 394 respectively. Of these, plastic and paper items formed the bulk with a significant proportion of the total from tourist sources. The popular beaches on St.

Mary's have been provided with litter bins though these were often observed to be full and overflowing. None of the other beaches surveyed had such waste reception facilities.

West Porth, Samson

This beach faces west and is exposed to the prevailing wind and waves. Samson is an uninhabited island and although it is often visited by tripper boats it is not one dominated by tourists. The litter found on the beach was trapped by rocks at the top of the shore and also found in the surrounding grass and dunes, probably the result of wind action blowing sea borne litter off the beach. The majority of the litter 58% was plastic bottles, containers and lids although plastic rope and strapping bands also formed a large part 34%. Also reported was one piece of the video film from the wreck of the *Cita*.

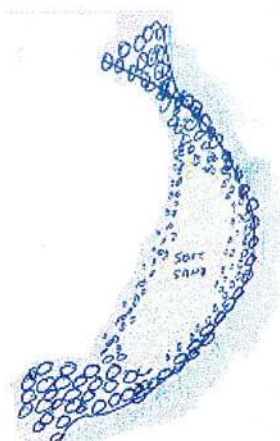


Figure 15 West Porth Beach, Samson

Porthmellon Beach St. Mary's

This is one the main tourist beaches in the Scillies and faces north east into the main harbour, Hugh Town. This beach is protected from the worst of the prevailing winds and the strong tidal currents that flow between the islands by the main body of the island. However, it had the highest number of litter items of any of the beaches surveyed. In addition to being visited by large numbers of tourists the beach borders the island's main harbour that is used by a large number of boats both local and visiting. In addition, the beach is close to local housing and holiday accommodation. The litter found here was dominated (61%) by plastics with items from tourists, food and drink packaging comprising 55% of this total and 36% from ship based sources. Four pieces of video film from the *Cita* were also reported.

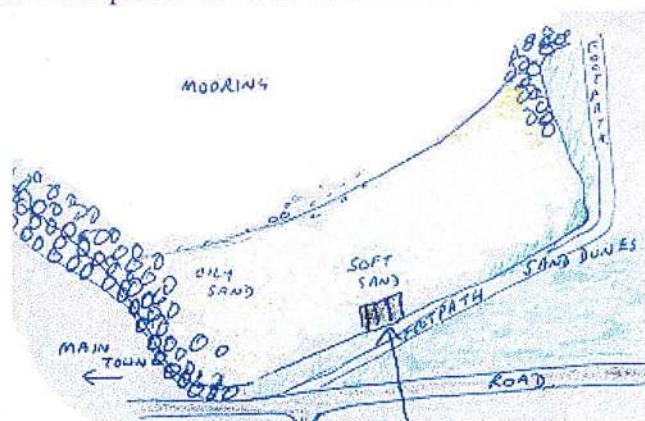


Figure 16 Porthmellon Beach, St Mary's

Porthcressa Beach, St. Mary's

This is the second main tourist beach on the island of St. Mary's and faces south west into the prevailing wind. This beach is also situated on the edge of Hugh Town and is popular with tourists and small boat users alike. The total number of litter items recorded was the second highest of those surveyed and again plastics formed a large part (40%). However, paper litter, of which 92% were cigarette stubs, was also much in evidence (34%). The litter on this beach was again dominated by that from tourist sources (68%) with litter from the sea only 11%. This was the only beach upon which any faecal matter (animal) was recorded.

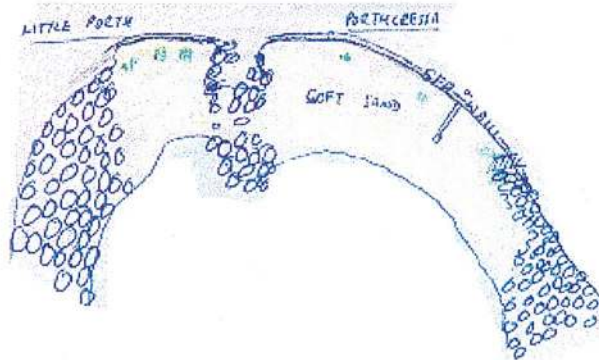


Figure 17 Porthcressa Beach, St Mary's

Old Town Bay, St. Mary's

Old Town Bay is situated on the landward side of Newfoundland Point, the site of the wrecking of the *Cita*. The beach is used by tourists but is not as popular as the two main beaches at Hugh Town. It is also used as a small high water harbour and has a few houses and one café on its eastern shore. This was the beach with the highest number of pieces (24) of video tape from the *Cita* representing 20% of the total. This is consistent with its proximity to the wreck site and may also account for some of the other debris on the beach. Litter from tourists was also in evidence with cigarette stubs and food wrappings comprising 22% of the total. However, there was also a large amount of material from the fishing boats that use the harbour.

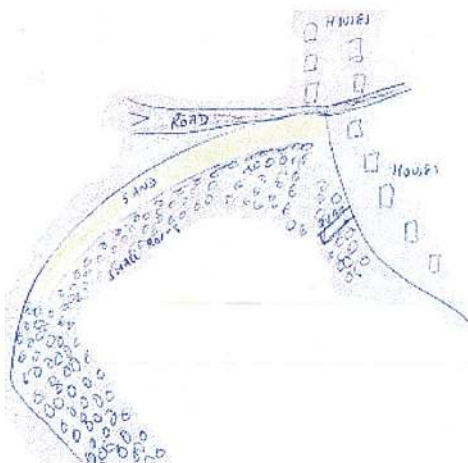


Figure 18 Old Town Bay, St Mary's

Bar Point, St. Mary's

Bar Point faces north with the beach on its eastern side. This is at the opposite end of the island from the main amenity beaches at Hugh Town and until April 1997 this was the site of aggregate extraction (see Chapter 5). Now this beach it is largely unused. Although there are strong tidal currents, the beach is sheltered from the prevailing winds by the island. This beach had the lowest number of items (38) found on any of those surveyed and the majority of these items (54%) were from the sea. There were also two pieces of video film from the wreck of the *Cita*.

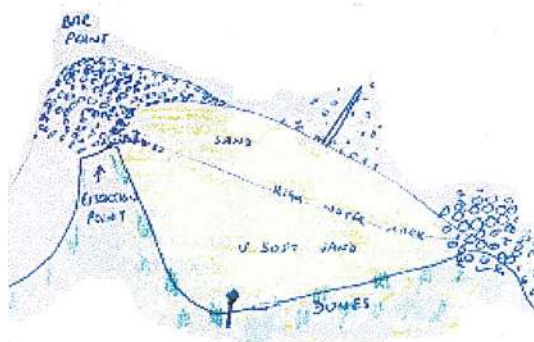


Figure 19 Bar Point, St Mary's

East and West Porth, Great Ganilly.

The Great Ganilly is a small uninhabited island in the Eastern Island and is an important habitat for a number of Grey Seals. The few people that visit the island come either from main islands on site seeing trips, or from the few boats that use the western side of the island as an anchorage. The two beaches surveyed are either side of the mid-point of the island although the more popular beach is one the eastern side where there is more sand. The litter on the eastern beach was found along the line of high tide and caught in rocks suggesting that it came from the sea and was dominated by plastics (79%). This pattern was repeated on the western beach with plastics comprising 77%, the great majority of which was found along the line of high tide.

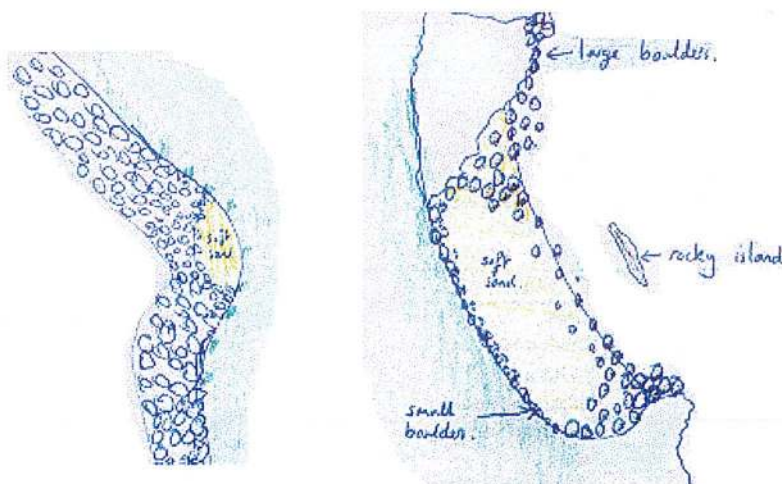


Figure 20 West and East Porth Beaches, Great Ganilly, Eastern Isles

Porth Conger and The Cove Beaches between St. Agnes and Gugh

These beaches are formed by the sand bar that lies between the islands of St. Agnes and Gugh and are the smallest beaches in the survey. This bar is covered at high water and therefore the majority of the litter recorded was found at the high water mark. Whilst, in the analysis the beaches are treated as separate, it is likely that due to tidal action, the litter is able to move freely between the two. St. Agnes is a sparsely populated island with a small number of tourists and although the Cove is used as an anchorage for small vessels (at the time of the survey there were 17 yachts at anchor), the island is not a major tourist destination. The quantity of litter recorded was 43 pieces on Porth Conger, the second smallest total, and 105 at The Cove. On both beaches the main type of litter was plastics, 79% and 66% respectively, whilst the amount from tourist sources was small and was mainly food wrappings. The majority of litter found appears to have been washed ashore by the prevailing wind and wave action. The fact that the beaches flood at high tide probably accounts for the higher amount of litter found on the more sheltered southerly beach.

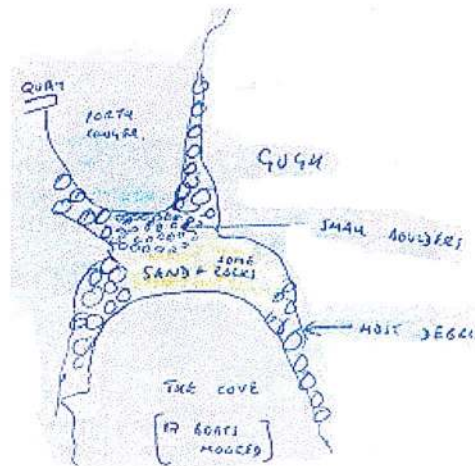


Figure 21 *Porth Conger and the Cove Beaches between St Agnes and Gugh*

Par Beach, Higher Town Bay, St. Martin's

This is a popular beach with tourists visiting the island and is close to the landing stage of the small boats that are used to ferry people to the island. The beach faces south and is backed by dunes into which litter has been buried at some stage in the past. These dumps are becoming exposed, probably by wind action and the litter that was once buried is now spilling onto the beach. During the survey it was noted that there was a marked gradient of increasing litter along the beach from west to east. This may be the result of wave and wind action blowing litter across the beach but is more probably due to litter from the dumps behind the dunes becoming exposed. However, the amount of litter recorded here, 135 pieces, was small given the large area of the beach. Of this, plastics formed 68% of the total of which bottles and containers, plus lids were 71%.

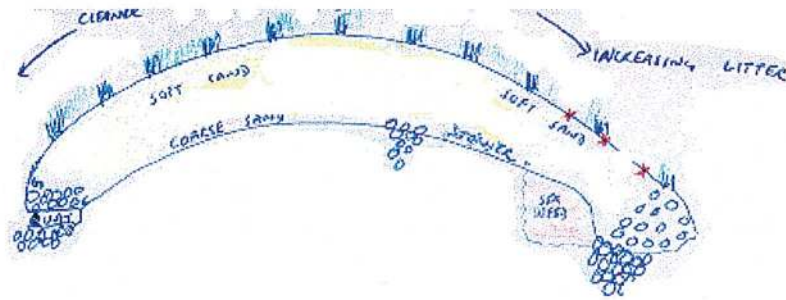


Figure 22 *Par Beach, Higher Town Bay, St Martin's*

Great and Little Bays, St. Martin's

These beaches, joined by a small rocky outcrop, face north and are exposed to the sea though sheltered from the prevailing winds by the island. They are not visited by large numbers of tourists but had the third highest number of items recorded and the highest number for any non-tourist beach. This is probably from the rubbish dumps that are situated at the northern end of the island having been transported to the beach by the sea. Again, the main type of litter was plastics (55%) although metal items were also much in evidence and formed 25% of the total and also the largest number of metal items recorded on any beach. The majority of these metal items (95%) were from drink containers, most of which had been chopped into small pieces. Pieces from plastic drink containers also constituted 42% of the total plastics with sheeting and rope pieces forming 43% of the total.

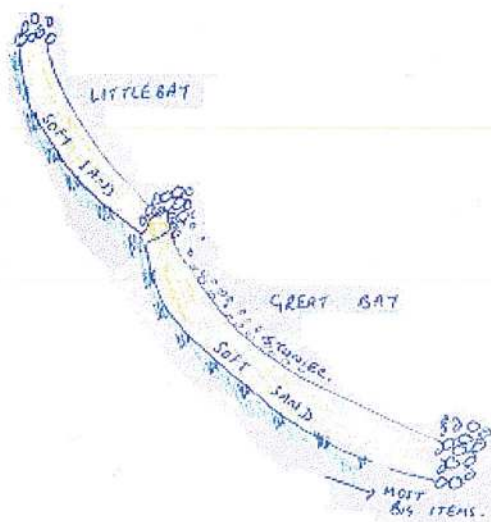


Figure 23 *Great and Little Bays, St Martin's*

7 Gap Point, St Mary's

Introduction

Gap Point, on the east coast of St Mary's, was identified in 1983 as exhibiting populations of Mediterranean-Atlantic species of high nature conservation interest, similar to those present off the east coast of Lundy. The monitoring site is slightly to the north and east of Gap Point itself, being relatively sheltered from wave action and the currents which run along this coast. It has steeply sloping bedrock outcrops separating small canyons, which contain large boulders. The rock extends down to a very gently sloping muddy sediment plain at about 26m bcd. Upward-facing rock surfaces can be heavily silted (Fowler & Pilley, 1992).

Two monitoring sites were established at Gap Point at the start of the Nature Conservancy Council's sublittoral monitoring programme in 1984. Site 1 (the site re-visited on this occasion) is about 1.3 m x 1.5 m in area on a vertical/slightly overhanging face of a bedrock outcrop. It was selected for its population of scattered sunset corals *Leptopsammia pruvoti*, although it also holds colonies of the carpet coral *Hoplangia durotrix*, very small *Parerythropodium coralloides* and some red sea fingers *Alcyonium glomeratum*. There is also a large population of Devonshire cup corals *Caryophyllia smithii* present on the rock face and some extensive encrusting sponges. Site 2 (which was not re-photographed) lies some 10m to the south of Site 1 at approximately the same depth (22m bcd).

The site was first photographed in 1984, with repeated visits in 1985, 1986, 1987, 1988 & 1991. The results from these years were analysed by Fowler & Pilley (1992). They found that, within an area of 0.16 m², the numbers of *Leptopsammia pruvoti* had fallen by 17% and those of *Caryophyllia smithii* by 43% between 1984 and 1991. However, in the 1991 survey, the monitoring team noted the recruitment of new, very young *Leptopsammia* at Gap Point (Fowler & Pilley, 1992). This had not been observed for this species before in the wild, although adults taken from UK waters and held in aquaria had produced planula larvae.

The purpose of our visit to the site in 1998 was simply to re-photograph the small area of vertical bedrock in question, in such a way as to make a mosaic of photographs, and pass these on to English Nature for eventual analysis of cup coral numbers. No attempt to count cup corals has been made by CCC-SAC.

Results

As in previous year's, Cyril Nicholas' knowledge of the area combined with the NCC's site plans of the Gap Point area meant that the site was successfully marked with a shot line.

The site is extremely silty and an unguarded fin stroke can lead to clouds of silt being stirred up, decreasing the visibility dramatically. The fine particles take a long time to settle again, and, once this has occurred close to the site to be re-photographed, it is probably better for the dive to be aborted rather than wait twenty minutes for the visibility to improve sufficiently.

Photographs were taken using a Sea and Sea Motor Marine II fitted with a 2:1 macro lens with a framer and a wide-angle lens. Unfortunately, a lack of experience at producing photomontages meant that the images produced do not overlap sufficiently for the photographs to be of use.

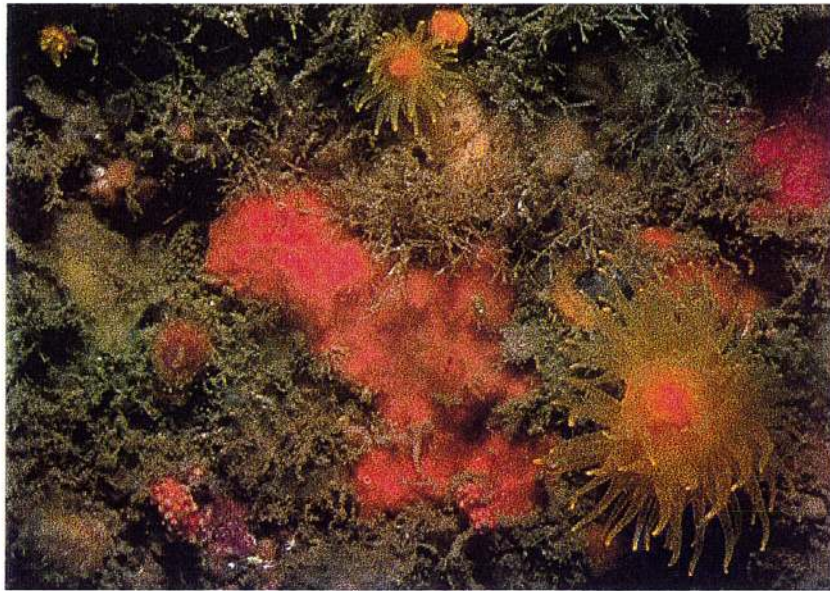


Figure 24 *Leptopsammia pruvoti* at Gap point

Recommendation

It was noted that there appeared to be a greater depth of sediment at Site 1 than in 1997. It is suggested that future monitoring of the site should include measurement of the distance between the permanent marker line fixed to the rock face and the surface of the sediment at the foot of the rock face.

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Nunny R., 1992. A survey of foreshore erosion at Bar Point, St. Mary's, Isles of Scilly.

Admiralty Chart 883, From England-West Coast Isles of Scilly, Saint Mary's and the Principal Off-Islands, Scale: 1:12500, 1992. HMSO

Appendix List

Incident Report

The Diary

The DAFTAs

Full Species Lists:

- Vertical Surfaces
- Mixed Habitats
- Horizontal Bedrock and Boulders
- Wreck of *Cita*
- Kelp Forest
- Sand Patches

IoS 98 Site Species Abundance List

Site Descriptions

- Physical Details
- Rock Features
- Sediment features

Bar Point Sediment Survey Maps

Incident Report

Number: 1

Coral Cay Conservation Sub-Aqua Club
Isles of Scilly Expedition 1998

Date: 09 August 1998

Time: 13:43 – 13:48

Position: 49 55.23N 006 20.91W

Persons Involved: Geoff Shaxton and John Davis

Geoff Shaxton and John Davis were diving as part of the CCC-SAC Expedition to the Isles of Scilly. They were to carry out a Seasearch dive on the Minalto Ledge to the SW of Samson. John had been diving as part of the expedition during the previous week while Geoff had done no previous dives in UK conditions during 1998, although he had done several such dives in the Scillies in previous years.

On the descent, Geoff experienced problems with his mask in that it felt too tight and was causing him discomfort. At 4m, Geoff, in order to relieve the pressure, attempted to pull the mask from his face. This failed to work and resulted in a loss of vision. John stood ready to provide assistance, which proved unnecessary and the descent was aborted and the divers returned to the surface. A further attempt to dive was also abandoned.

A contributing factor to this incident was Geoff's previous attempt to dive earlier in the day. Geoff had been due to dive again on a Seasearch dive but on entering the water had had problems with his mask flooding. Due to this he had aborted the dive whilst still on the surface. It should be noted that this was the first dive with the mask that had been purchased recently.

Geoff was examined by Dr. Drake at the out patients department at St. Mary's Hospital, who diagnosed a rupture of the blood vessels in his eyes. Dr. Drake advised Geoff to refrain from diving for the remainder of the week and to visit his own GP on his return home.

Kevan Cook (Diving Officer)

Geoff Shaxton

John Davis

The Diary

Scillies 1998 Expedition

Thursday

In a rerun of last year, Tom set off from London to meet Kevan in Dorchester. Tom had been delayed by his local police who were investigating a "suspicious death". So long as there aren't any more deaths Tom will be OK. Shortly after his arrival in Dorchester, Tom and Kevan set off for Penzance; the journey down giving rise to the first incident of the trip - in an attempt to return some coffee to Kevan's flask from an overfull cup Tom took a hot shower! Having made good time they got into Penzance, spent £265 on food for the expedition and then enjoyed the hospitality of a friend of Kevan's (probably shouldn't have had the second bottle of wine!)

Friday

Wind: 3
Visibility: Fair improving good
Cloud: Overcast to clear
Sea: Slight swell

Up to eggs and bacon - what hospitality - and then out to the quay to meet John, Heather and Sion. Kevan went to Tesco's to collect the perishables from their fridge - thanks again to Tesco's Penzance staff for being so helpful. The ferry journey proved uneventful - most slept for the duration. Unfortunately, as the Penzance dockers had not understood the complexity of moving our gear (a considerable amount for three divers) there was some confusion about transporting it to the Schoolhouse and getting *Hellbent* into the water. Once resolved Tom and Heather tried to sort out the food and personal effects to occupy as little space as possible in the kitchen - the previous occupants were still in and would not be leaving until Saturday morning. Sadly, on their return from their day's activities they proved remarkably hostile to our presence, despite Tom having made arrangements for us to share the building and kitchen. This hostility led to us having to vacate the kitchen and hide in our rooms. It also became clear that John, Kevan and Tom were seen as some sort of threat to the youngsters doing their Duke of Edinburgh residential projects. As a result we ended up with a list of banned words - we couldn't possibly be heard talking like divers around them!

The remainder of the day was spent getting the Duchy boathouse set up for use as a dive locker, greeting familiar locals and grabbing a well deserved bite to eat in the Bishop and Wolf.

Saturday

Low Tide: 5:30 1.96
High Tide: 11:40 4.21
Low Tide: 17:58 2.06

Wind: 3
Visibility: Good
Cloud: Overcast to fair
Sea: Slight swell

After grabbing hot water from the kitchen, a move accompanied by glares and palpable hatred, breakfast was eaten in John and Heather's room. Following the handover with Mrs Snowball, one of the local rep's, all piled out in *Hellbent* for a dive off Newfoundland Head - the *CITA*. Although obviously broken up in the winter storms, she is still a fantastic wreck. After lunch and general tidying up and preparations - posting of the new CCC-SAC Dive Rules and Risk Assessment - John, Kevan and Tom went to the quay to meet the *Scillonian* and main party. The weather had improved significantly so they arrived to see St Mary's almost at her best. General chaos ensued as the dockers gradually got their act together and finally transported the luggage to Mundesley. Most of the new arrivals visited the Duchy Boathouse - the dive store and Tom prepared a spag bol dinner - another rerun. Naturally, the annual inspection of St Mary's pubs began with a visit to the Atlantic.

The prize for Tact on the CCC-SAC IoS 98 Expedition has been awarded to Kevan for the delicate way he chose to describe the DoE group leaders.

Sunday

High Tide: 0:12 4.21
Low Tide: 6:34 2.07
High Tide: 12:49 4.16
Low Tide: 19:08 2.11

Wind: 2
Visibility: Good
Cloud: Clear
Sea: Calm

Julia needs to remember that shops are unlikely to be open at 8.00am on a Sunday - she receives the CCC-SAC IoS '98 prize for "Most Enthusiastic Shopper".

Diving - shakedown dives for all - Peninnis Head followed by dives over Teneers Ledge. All four waves out in good time from 8.00am.

As Adel decided to do a reccie on Bar Point, she did not dive in the morning. Kevan buddied her in the afternoon and, on checking her ascent signal (a thumbs up), discovered that she has double-jointed fingers. His reaction: "Which way are we going, up or to the right?"

A roast dinner with a veggie equivalent cooked by Julia, Adel, John D with assistance from Crystal was most appreciated. A few hard cases headed off to the pub for a nightcap, there to enjoy live music from a "mainlander" (said Crystal in a derogatory manner). And so to bed.

Monday

High Tide:	1:23	4.18	Wind:	5-6
Low Tide:	7:44	2.05	Visibility:	Poor
High Tide:	13:58	4.25	Cloud:	Dense and low
Low Tide:	20:20	2.00	Sea:	Swell and "lumpy" out round the top of Tresco.

The dawn light revealed heavy rain that by mid-morning subsided to drizzle. Diving on *Hellbent* and *Melza* planned for Old Grimsby Harbour. The first wave on *Hellbent* set off early and cracked into seagrass sampling. Cyril arrived late (delayed by refuelling problems) and by the time the second group arrived there were only half a dozen samples left to collect. However, the Harbour Master had informed Kevan of another *Zostera* sampling project that had shown there were two different *Zostera* populations in the Harbour - one healthy one, which had been sampled by CCCSAC in previous years and another less healthy one nearer the shore. The task for the divers on *Melza* was to collect samples from the less healthy site. However, after fourteen or so sample sites had been visited and only one very poor sample collected, it was decided to abort for the day.

On the way back through St Mary's Sound, Tim spotted "dolphins". Jim Heslin's boat, *Moonshadow*, was on the "dolphins" and circled back to follow them. *Melza* gave chase. As she drew closer it became apparent that the target was not dolphins but a 10-12 foot Basking Shark, *Cetorhinus maximus* (your correspondent hopes he is reliably informed). John D and Tom, with permission from Cyril, kitted up and jumped in. The shark circled a number of times - on one occasion gliding, mouth open directly beneath Tom.

The "I'll be in the Water Faster Than You" Prize on the CCC-SAC IoS 98 Expedition has been awarded to John D on the sighting of the basking shark.

Tuesday

High Tide:	2:29	4.31	Wind:	2-3
Low Tide:	8:50	1.9	Visibility:	Good
High Tide:	14:58	4.47	Cloud:	Clear
Low Tide:	21:22	1.78	Sea:	Gentle swell

With better weather, the diving off Great Arthur and Toll's Island, Seasearch in both cases, was a pleasure. After lunch on Higher Town beach, in hot sunshine, *Hellbent* went to Broad Ledge, Tresco to do the seagrass sampling and *Melza* followed to attempt an assessment of Japweed. The *Hellbent* crew finished their work but, due to the density of Japweed the crew on *Melza* were only able assess a fraction of the intended area.

Adel, on surfacing from her dive, took great pleasure in describing the Parrot Fish she had just seen. This, not surprisingly as Parrot fish are tropical species, generated a number of frowns on the faces of more experienced Scillies volunteers. As Adel was encouraged to elaborate on her description, it became clear that she had seen a male Cuckoo Wrasse!

The "It was a Parrot Fish, Honest" Prize on the CCC-SAC IoS 98 Expedition has been awarded to Adel.

Wednesday

High Tide: 3:24 4.54
Low Tide: 9:46 1.66
High Tide: 15:48 4.76
Low Tide: 22:15 1.49

Wind: 2-3
Visibility: Good
Cloud: Clear
Sea: Slight swell

With the good weather continuing, the Seasearch ground truthing of the side scan surveys off Annet commenced. John D and Tom, however, dived Gap Point with three objectives - Cyril to shot the *Leptopsamia* sites, Tom to take the location photographs of the corals at Site 1 and for the shot to be tied off. All three objectives achieved, although the photographing was carried out by Tom hanging upside down to avoid any chance of an accidental stirring up of the extremely fine sediment under the corals which would obliterate the viz.

On their ascent, a commotion on board *Melza* was taken to be a wind-up. All were shouting about a Basking Shark in the bay. It was not a wind up and with camera in hand a number of photos were taken then, and on a snorkel in the next bay. John D's behaviour with the shark is not to be repeated!

The *Hellbent* crew were lunching in Porthellick bay and, on hearing the news that there was a shark in their vicinity, gave a very good impression of a World War II air crew and scrambled in about three minutes flat. Chris, gutted not to have been on *Melza* when the first shark was spotted, was delighted to see it. Claudia, concentrating more on her photographic efforts than on self preservation, tried hard to become the shark's dinner. This lack of concern for her own well being proved worthwhile as the photos from this sighting are excellent.

The CCC-SAC IoS 98 prize for the "Jonah and the Whale Double Act" has been awarded to Claudia.

Thursday

High Tide: 4:11 4.83
Low Tide: 10:35 1.37
High Tide: 16:31 5.09
Low Tide: 23:02 1.18

Wind: 2
Visibility: Good
Cloud: Clear
Sea: Calm, lumpy in the west.

Seasearch was order of the day. Both boats headed off for N W Bryher; *Hellbent* ending up in Hell Bay. Claudia and Craig (in different boats) did not enjoy the lumpy seas. What does this indicate about members of the King's Diving Club?

On the way to the lunch beach on Tresco, Cyril slammed *Melza* into neutral to avoid running over a dozy basking shark. Another shark, this expedition's fourth, was immediately seen close to the shore.

The afternoon's diving in St Mary's Street was relatively uneventful - mostly Seasearch with Tom and Claudia somehow ending up on the wreck of the Colossus - curious that isn't?

On the return journey to St Mary's radio traffic between boats in the Street was heard to report the presence of Sun Fish in the Isles. Fingers crossed for a sighting soon.

The day ended with a Mexican meal care of John D and helpers and a trip to the Mermaid. This was preceded by mad antics on the beach as Adel tried to cajole her team of sediment samplers into some sort of order in preparation for the work on Friday.

Friday

High Tide:	04:53	5.13	Wind:	2-3
Low Tide:	11:20	1.08	Visibility:	Good
High Tide:	17:12	5.4	Cloud:	Clear
Low Tide:	23:45	0.9	Sea:	Gentle swell

Melza went out to the western isles to Seasearch an area south of Annet Neck before doing the West Broad Ledge seagrass bed and *Hellbent* headed off to Bryher in the morning and St Mary's Sound to start the sediment sampling work off Bar Point.

Tom and Craig aborted their dive after they found they were being swept in the opposite direction to the one that had been planned!

The remainder of *Melza's* divers enjoyed gentle Seasearch work in Melledgan Bay, followed by snorkelling with same slightly shy seals.

The sediment work started slowly but once the team got into the swing things picked up.

Saturday

High Tide:	5:33	5.4	Wind:	2-3
Low Tide:	12:02	0.83	Visibility:	Good
High Tide:	17:52	5.66	Cloud:	Clear
			Sea:	Gentle swell

After the excesses of Friday night - dinner at Juliet's Garden, beers in the Bishop, going to the gig in the town hall and singing and dancing on Old Town beach - most wanted a quiet day. Other than general preparation of a 500m line and a few other bits and pieces, very little work was attempted. *Hellbent* went out to the Eastern Isles on a seal hunt and was spotted by Geoff as he joined the expedition.

Roger Covey and Tim Hill kindly volunteered (or were they volunteered, Kev?) to cook dinner. At the moment, we await their fare.

Later.

And good it was too - with the garlic bread that Claudia didn't do with her meal.

On the food front, to avoid problems with early closing shops on Sunday, Julia, Leanne and Tom shopped and cooked for Sunday night. The Cottage Pie developed with the addition of various tins of beans and vegetables until a truly enormous amount of meat and potato had been prepared. The veggies had a version of Red Dragon Pie.

While these culinary delights were being prepared, Claudia, Chris and others went night snorkelling.

Sunday

Low Tide: 0:26 0.67
High Tide: 6:13 5.6
Low Tide: 12:43 0.65
High Tide: 18:32 5.83

Wind: 2
Visibility: Poor to Good
Cloud: Fog then clearing
Sea: Slight

After the lazy day on Saturday, this was a full-on day. Four waves of Seasearch diving, with the benefit of Tim and Roger on the species lists. Tim was in his element on the kelp in the afternoon.

The plan had incorporated a day on the beach with a sand castle building challenge. Unfortunately, the fog in the morning meant that it was impossible to drop the first wave off on any of the other islands - sunbathing and form filling instead at the School House.

Tragically, for Geoff, the morning's dive was marred by the cold - warm water diving in Malaysia had not prepared him for the Scillies - and the afternoon's dive had to be abandoned after very serious mask squeeze resulted severe bruising and damage to the blood vessels in his eyeballs! The local Doctor advised against further diving!

Dinner was a great success with people bloating on the pies.

Monday

Low Tide: 1:07 0.53
High Tide: 6:53 5.71
Low Tide: 13:24 0.56
High Tide: 19:13 5.89

Wind: 2
Visibility: Poor
Cloud: Fog, clearing slightly by the end of the day
Sea: Slight

The "Sediment Samplers" and the "Seagrass Assessors" set off in their different directions aboard *Hellbent* and *Melza* respectively. Unfortunately, the tide meant that Kevan, Chris and John D became the "Roller-coaster Kings" by travelling from 15 to 21m "in a nanosecond" on a dive that was aborted after 6 minutes. Other Seasearch diving was tried elsewhere but with less of a current.

Melza, diverted by the news of fast currents around Annet, went to an area south of Deep Point which Roger wanted ground truthing to determine a boundary between two different biotopes in the Gap Point and Newfoundland Point areas.

The afternoon was spent "seagrassing" and "sedimenting", although the fog made laying the sediment transect line difficult.

At the end of the seagrass sampling session, Roger announced that the bed was new (it is visible on the IoS aerial photographs but the analysis had not been believed) and unexpected as it is not situated in a likely area (too close to rocky islands). This was great news as it increases the value of the IoS SAC.

The sediment work went well - all of T3 complete. The 10m samples, when laid out back at the School House looked very impressive - it was also possible to see changes in the sediment at different locations down the transect.

On return from the day's diving, Tom, Kevan, Roger and Tim H. headed up to the Garrison for the annual meeting with Jeremy Pontin, Land Steward of the Isles of Scilly. This very productive meeting was followed by dinner in the Bishop and Wolf, which gave Kevan and Tom an opportunity to find out what Tim and Roger thought of the CCC-SAC operation. By all accounts, we seem to have passed the test.

Tuesday

Low Tide:	1:49	0.51	Wind:	2
High Tide:	7:36	5.7	Visibility:	Good - all day
Low Tide:	14:06	0.59	Cloud:	Negligible
High Tide:	19:57	5.82	Sea:	Calm

In anticipation of heavy fog, it was decided to dive/sample the English Island seagrass bed and another sediment transect later in the day and forgo a first dive.

On waking, the skies were clear and by the time some of the team got up it was already hot. Thank goodness Chris didn't take Tom's bet that there would be a lot of fog!

The Sediment Samplers got it together and completed their work almost without hitch - some needed more air as the site was relatively deep. The Seagrass Assessors got on site in good time and settled down to a long-ish wait for *Melza* to ground and the tide to fall to the spring low. Geoff, Andrew and Tom headed into the beach to sunbathe and buy drinks; Julia and Leanne enjoyed the company of Cyril aboard the boat. When it started, the seagrass sampling was, as in previous years, a fast wade racing against the incoming tide which otherwise makes English Island nearly impossible to sample. The work was completed just in time.

The hour until *Melza* floated again was whiled away with seagrass assessment.

Unfortunately, no one had been able to buy a chicken for John D's stir fry dinner so the fish and chips option was taken by most.

The day ended late for Adel and helpers as she started drying her main samples prior to their being taken to London for sieving.

Wednesday

Low Tide:	2:32	0.6	Wind:	3-4
High Tide:	8:21	5.58	Visibility:	Good
Low Tide:	14:50	0.73	Cloud:	Slight
High Tide:	20:43	5.64	Sea:	Swell

To be able to complete T1 and another transect the Sediment Samplers set off for their first dive at 0700. (What state was Adel in?) Cyril was given a late start as the second stage of the *Leptopsammia* re-photographing, the close up shots, was attempted.

Unfortunately, due to the current which was considerably stronger than that found on the first dive and a minor problem with a cuff seal, not all of the photos were taken.

The sediment work - one and a half transects - was completed and then followed by a seagrass mapping exercise over a bed found off Bar Point.

Dinner, a stir-fry cooked by John D and team included chocolate cake and ice cream - an expedition contribution for all the hard work that everyone has done.

And, as there appears to be a glorious sunset about to happen, this diary is done for the day.

Thursday

Low Tide:	3:17	0.8	Wind:	3
High Tide:	9:09	5.37	Visibility:	Good
Low Tide:	15:37	0.97	Cloud:	Some
High Tide:	21:34	5.36	Sea:	Slight swell

Another rethink on the methodology of the sediment sampling means that the final transect will be sampled by four buddy pairs, two pairs working from each end of the transect. It is hoped that by splitting the tasks into biological/physical recording and sediment sampling the pairs will take less time than two three's working from opposite ends of the transect doing all the work. As a result the two teams are to be mixed together - no longer the Seagrass Assessors!

The sediment sampling is to be preceded by diving on the *Cita* and off Gap Point - Tom to try to finish the photographs (12 taken in 16 minutes yesterday, 24 to take in the same time?)

Although the photos are finished, a lack of experience at producing photo-montages means that the images don't overlap sufficiently for a montage to be produced. Thought required if the montage is to be produced properly in '99.

Friday

Wind:	3
Visibility:	Good
Cloud:	Some
Sea:	Slight swell

A day of fun diving and then tidying up in the boathouse and around the Schoolhouse. Dinner at the Mermaid with what should be the annual Prize Giving: the Diving Activity and Team Fun Awards - the DAFTAs. Due to John W's desire to get to bed in advance of the journey home the award speech was somewhat shortened and presented at speed.

Saturday

Time to go home. Island Carriers collected the container on time and all made it on to the early ferry.

For most, the return journey proved to be uneventful. Unfortunately, John suffered a breakdown and received very little help from the breakdown services.

The DAFTAs

The Speech:

The American film industry has the Oscar's. The British film and Theatre Industry has the BAFTAs. CCC-SAC has the Diving Activity Fun or Team Awards – the DAFTA's

Or if you wish a DAFT Award.

All of you share the first prize. This is the Well Done for Getting off Your Backside Award to do Something about the Environment.

So in Kevan's words give yourself a pat on the back.

On a less serious note, there are other awards that are to be made to all members of the team.

The first award goes to someone who has done a lot for the expedition in terms of dive planning and organising the science. However, he very nearly wasn't here for most of the trip. The "if looks could kill" remark applies in this case.

You may be aware that John, Heather, Sion, Kevan and I shared the house with a group doing their Duke of Edinburgh Awards and that we did not receive a warm welcome. On the Saturday morning, Kevan described the group leaders somewhat bluntly – within their hearing.

For this act, which I doubt I will ever forget, Kevan is awarded the prize for Most Tactful member of the expedition.

The second award goes to someone who, quite possibly believed that they were still in London when they set off to the shops - at 8am on the first Sunday. To Julia I have great pleasure in awarding the Most Enthusiastic Shopper Prize

The third award is the first dive related one.

Another sight that I doubt I will forget is the reaction of John D to the news that there was a basking shark in the water. John kitted up at the speed of light and was in the water faster than . . . well a fast thing.

To John "David" Davis goes the I'll be in the Water Faster than You Prize.

The next award is also related to basking sharks. Although this diver has done a number of noteworthy things this week including fighting with talcum powder, the rashest of them all has to be putting herself in the path of a basking shark.

To Claudia goes the prize for the Jonah and the Whale Double Act.

It is well known that there are many exotic fish in the waters of the Isles of Scilly. I understand from Andrew Gibson, Director of the Isles of Scilly Environmental Trust that, in addition to the sharks that we have seen, others have spotted leatherhead turtles and sunfish – Cyril, what happened to the Five Star Tour!

However, one fish yet to be recorded here, at least in the open water, is the Parrot Fish.

Adel – please accept the “It was a Parrot Fish, Honest” award

I do not suppose that it is possible to talk about our work out here without mentioning seagrass. It is important that we have continued to assess its health and this year we have the added benefit of “discovering” a new seagrass bed thus adding to the value of the Scillies SAC.

However, there was one person who seemed to be in her element when dealing with the wretched stuff. Leanne, we hail you “The Seagrass Queen”.

Returning to the diving, the next award winner has entertained us all in one way or another. His award, however, is given much more because he was “entertained” on one particular dive. Chris – snail man extra-ordinaire – join our royal family by being “The Roller Coaster King”.

One award has to be made in absentia. The prize winning moment caused us all some consternation. Many felt that it could not have come at a worse moment – Tim Hill and Roger Covey were watching us closely. Any way – no harm done. But Geoff Shaxton wins the Tightest Mask Award. Geoff, wherever you may be at the moment I hope your eyes clear up quickly.

Someone else made the penultimate nomination. I was very happy to accept it as I had been working up to something similar but was not at all happy with my wording of the title.

Adel received an offer of help from one of our number, which she was only too happy to accept. I had noticed this very positive trait at other times and so am very pleased to award Andrew the prize for being the Most Helpful Person on the Planet.

Last but by no means least – one person here has slogged his guts out day in day out, in hot weather or in chilly fog. Without fail, *Hellbent* has been ready on the beach, waiting to take her load of divers to their next site and get them safely back to base – even through the rough waters north of Tresco. This would not be possible without the continuous round of labour, one of love I hope that John Whittaker has made this year. To John, with my very best wishes goes the Best Cox’n Prize.

Full Species List - Vertical Habitats

Mean abundance		Site	Newfoundland Point	Tolls Island	SW Great Arthur	
			Record Number	3	7	16
			Upper Depth	17.6	24.7	6.8
			Lower Depth	17.7	29.5	8.6
ALGAE						
O		<i>Laminaria hyperborea</i>			O	
F		<i>Lithothamnion sp.</i>			F	
PORIFERA						
O	Boring sponge	<i>Cliona celata</i>	O	R		
O		<i>Myxilla incrustans</i>			O	
R	Sea orange	<i>Suberites domuncula</i>		R		
CNIDARIA						
F	Dead Mans Fingers	<i>Alcyonium digitatum</i>	F	O		
F	Red sea fingers	<i>Alcyonium glomeratum</i>	F	O		
F	Devon Cup Coral	<i>Caryophyllia smithii</i>	F	F		
F	Jewel anemone	<i>Corynactis viridis</i>	A	F	O	
O		<i>Eunicella verrucosa</i>		O		
O	Plumose anemone	<i>Metridium senile</i>		O		
R	Oaten pipe hydroid	<i>Tubularia indivisa</i>		R		
POLYCHAETA						
O	Keel worm	<i>Pomatoceros triqueter</i>			O	
BRYOZOA						
O		<i>Bugula sp.</i>			O	
F	Bryozoan turf				F	
ECHINODERMATA						
F	Common starfish	<i>Asterias rubens</i>	F			
O	Common sea urchin	<i>Echinus esculentus</i>		O		
R	Cotton spinner	<i>Holothuria forskali</i>		R		
O	Spiny Star Fish	<i>Marthasterias glacialis</i>	O	O		
FISH						
O	Ballan wrasse	<i>Labrus bergylta</i>		O		
F	Pollack	<i>Pollachius pollachius</i>		F		

		Site	Tollis Island	S of Deep Point	Great Arthur	SW of Annet	St Marys Roads	St Marys Roads	S of Samson	S of Samson	Hell Bay
CRUSTACEA											
O	Edible crab	<i>Cancer pagarus</i>						O	R		
F	Common shore crab	<i>Carcinus maenas</i>							F		
O	Velvet swimming crab	<i>Necora puber</i>		R				F	O		
R	Long-legged spider crab	<i>Macropodia rostrata</i>						R			
C	Hermit crab	<i>Pagurus</i> sp.						F	A		
BRYOZOA											
O		<i>Bugula</i> sp.		R			O				
O	Ross Coral	<i>Pentopora foliacea</i>		O							
R	Bryozoan turf			R							
ECHINODERMATA											
O	Common starfish	<i>Asterias rubens</i>				O					O
F	Common sea urchin	<i>Echinus esculentus</i>	C	R	F	F		R			F
F	Cotton spinner	<i>Holothuria forskali</i>	R	F	C						
O	Spiny Star Fish	<i>Marthasterias glacialis</i>	C	O	F	O		O			
ASCIDIANS											
F		<i>Ascidia</i> sp.								F	
O		<i>Botryllus leachi</i>		R	F					O	
F	Star squirt	<i>Botryllus schloseri</i>		F	C		O		R	F	
O	Light-bulb sea squirt	<i>Clavelina lepadiformis</i>	R	R							C
F	Gooseberry sea squirt	<i>Dendrodoa grossularia</i>		O	F						
FISH											
C	Dragonet	<i>Callionymus lyra</i>							C		
C	Goldsinny wrasse	<i>Centrolabrus rupestris</i>									C
R	Ballan wrasse	<i>Labrus bergylta</i>	R	O		R					
O	Cuckoo wrasse	<i>Labrus mixtus</i>				O					
R	Short-spined sea scorpion	<i>Myoxocephalus scorpius</i>							R		
O	Pollack	<i>Pollachius pollachius</i>				O					
C	Sand goby	<i>Pomatoschistus minutus</i>				F	C				
O	Fifteen-spined stickleback	<i>Spinachia spinachia</i>		O					R		
C	Leopard Spotted Goby	<i>Thorogobius ephippiatus</i>		C							

Full Species List - Mixed Horizontal Habitat

Mean Abundance		Site	Tolls Island	S of Deep Point	Great Arthur	SW of Arnet	St Marys' Roads	St Mary's Roads	S of Samson	S of Samson	Hell Bay	
			Record Number	8	12	14	21	22	23	25	32	45
			Upper Depth (m/bcd)	18.0	21.4	12.1	13.0	17.5	17.1	8.9	7.2	16.6
			Lower Depth (m/bcd)	18.9	23.9	12.4	15.0	18.1	17.6	9.4	8.7	19.6
ALGAE												
F		<i>Calliblepharis ciliata</i>	C	O	C	O	O					
C		<i>Coralline crust</i>		O	C			C			C	
O		<i>Desmarestia aculeata</i>				O						
C		<i>Delesseria sanguinea</i>					C					
F	Batters frond	<i>Dictyopteris membranacea</i>		A		F	O	F				
F		<i>Dilsea carnosa</i>		R			O	C				
O	Sea oak	<i>Halidrys siliquosa</i>								O		
O		<i>Laminaria hyperborea</i>		R						F		
F	Sugar kelp	<i>Laminaria saccharina</i>		R	O				F	F		
F		<i>Porphyra umbilicalis</i>				F			F			
C		<i>Pilota plumosa</i>				C						
O		<i>Saccorhiza polyschides</i>							O			
C		<i>Sphaerococcus coronopifolius</i>	C									
F		<i>Ulva lactuca</i>							F	O		
PORIFERA												
O		<i>Axinellid Sp.</i>		O								
R	Boring sponge	<i>Cliona celata</i>		R				R				
O	Breadcrumb sponge	<i>Halichondria panicea</i>		O								
O	Elephant's ear sponge	<i>Pachymatisma johnstonia</i>		R				O				
F		<i>Polymastia boletiforme</i>					F	O				
O		<i>Polymastia mammillaris</i>		O								
O		<i>Suberites carnosus</i>	O	O			O	O				
CNIDARIA												
O	Actinothoe sphyrodeta							O				
C	Dead Mans Fingers	<i>Alcyonium digitatum</i>	C	C							F	
O	Snakelocks anemone	<i>Anemonia viridis</i>		O				O				
O	Devon Cup Coral	<i>Caryophyllia smithii</i>		C			O	R			O	
F	Daisy anemone	<i>Cereus pedunculatus</i>						F				
O		<i>Cerianthus lloydii</i>	O	O			F					
O	Jewel anemone	<i>Corynactis viridis</i>	O	O		R		O				
O		<i>Sagartia elegans</i>	O				F				O	
F		<i>Sagartiogeton laceratus</i>						F				
O	Oaten Pipe Hydroid	<i>Tubularia indivisa</i>		O				O				
O	Dahlia anemone	<i>Urticina felina</i>	C			R				O		
POLYCHAETA												
R	Parchment worm	<i>Chaetopterus variopedatus</i>					R					
O	Sand Mason	<i>Lanice conchilega</i>		C			O		R			
MOLLUSCS												
O	Sea-hare	<i>Aplysia punctata</i>		O						O		
O		<i>Circomphalus casina</i>						O				
R	Pod razor shell	<i>Ensis siliqua</i>					R					
O		<i>Favorinus blianus</i>								O		
O		<i>Gibbula</i> sp.		R					R	C		
O	Blue-rayed limpet	<i>Patina pellucida</i>								O		
O		<i>Scaphander lignarius</i>		O			O		R	F		
R	Common cuttlefish	<i>Sepia officinalis</i>						R				

Full Species List - Horizontal Bedrock / Boulders

Mean Abundance			Tolls Island	Deep Point	S of Deep Point	SW Great Arthur	Annet Ledge	S of Sanson	Bartholmew Ledge	Spanish Ledge	Spanish Ledge	Spanish Ledge	Hell Bay	Hell Bay	Hell Bay	Hell Bay	Hell Bay	Hell Bay
	Site																	
	Record Number		5	9	11	15	18	34	37	38	40	41	42	43	47	48	49	50
	Upper Depth (m/bcd)		11.8	17.6	17.1	8.8	12.3	18.1	16.7	23.7	16.6	20.6	6.4	16.3	23.0	11.0	23.8	12.6
	Lower Depth (m/bcd)		18.6	25.2	23.6	10.6	15.3	20.4	17.9	27.3	20.8	23.8	19.2	19.4	25.3	21.3	30.2	15.6
ALGAE																		10.0
F	<i>Brongniartella byssoides</i>								F									
F	<i>Calothrix ciliata</i>								A									
C	<i>Coraline crust</i>			F				C		F		A					F	
O	<i>Cryptopleura ramosa</i>								O									
F	<i>Desmarestia aculeata</i>															F		
C	<i>Dictyopteris membranacea</i>			A				A	F	A				O				F
C	<i>Dictyota dichotoma</i>										C							
O	<i>Dilsea carnosa</i>																	
F	<i>Halidrys siliquosa</i>								F					O				
F	<i>Hildenbrandia rubra</i>					O										F		F
F	<i>Laminaria hyperborea</i>					F	F						F				F	
C	<i>Lithothamnion</i> sp.					C	C									F		C
O	<i>Nitophyllum punctatum</i>								O									
C	<i>Palmaria palmata</i>							C										
F	<i>Plocamium cartilagineum</i>								F									
F	<i>Plumaria elegans</i>							F										
O	<i>Saccorhiza polyschides</i>								O									O
O	<i>Scinaia forcillata</i>								O									
F	<i>Ulva lactuca</i>					F										O		
PORIFERA																		
O	<i>Axinellid</i> sp.			R	F													
O	<i>Cliona celata</i>			O	O			R			F							
O	<i>Breadcrumb sponge</i>																	O
O	<i>Halichondria panicea</i>																	
O	<i>Haliclona</i> sp.						O											
O	<i>Myxilla incrustans</i>						O											O
O	<i>Pachymatisma johnstonia</i>		O			O		R		O								O
C	<i>Polymastia boletiforme</i>				F						C							
O	<i>Polymastia mammillaris</i>							O										

		Site	Tolls Island	Deep Point	S of Deep Point	SW Great Arthur	Annet Ledge	S of Samson	Batholmew Ledge	Spanish Ledge	Spanish Ledge	Spanish Ledge	Hell Bay	Hell Bay	Hell Bay	Hell Bay	Hell Bay
F		<i>Raspoilea</i> sp.			F												
R	Purse sponge	<i>Scypher</i> sp.		R						R							
O		<i>Suberites carnosus</i>	O		F				O								
O		<i>Tethya aurantia</i>			O												
CNIDARIA																	
O		<i>Actinothoe sphyrodeta</i>		O											O		
F	Dead Mans Fingers	<i>Alcyonium digitatum</i>	O	O	R		O	R		F	C			R	O	F	O
O	Red sea fingers	<i>Alcyonium glomeratum</i>		F	O		O			F						O	
O	Snakelocks anemone	<i>Anemonia viridis</i>	R														
F	Devon Cup Coral	<i>Caryophyllia smithii</i>	F	F		R	O	O	O	O	O		F	A	F	F	O
O	Daisy anemone	<i>Cereus pedunculatus</i>					O	F									R
F	Jewel anemone	<i>Corynactis viridis</i>		F	O		F			F	F			O	F	F	C
F		<i>Dynanena</i> sp.				F											
O		<i>Halecium halecinum</i>		O						O							
O	Antenna hydroid	<i>Nemertesia antennina</i>		O						O							
R		<i>Paraoanthus axinellae</i>			R												
O		<i>Sagartia elegans</i>	F					O	O	O				O		C	F
F	Dahlia anemone	<i>Urticina felina</i>					F		F								
POLYCHAETA																	
R	Parchment worm	<i>Chaetopterus variopectatus</i>		R													
F	Keel worm	<i>Pomatoceros triquetter</i>		F		F			C	C				O		O	
O		<i>Sabillaria</i> sp.				O											
O		<i>Spirorbis</i> sp.				O											
MOLLUSCS																	
F		<i>Gibbula umbilicalis</i>				F									O		
F		<i>Gibbula cinnaria</i>				F	F										
O		<i>Gibbula</i> sp.		O													O
CRUSTACEA																	
O	Edible crab	<i>Cancer pagarus</i>		R					O								
O		<i>Gathea strigosa</i>		O													
R	Velvet swimming crab	<i>Necora puber</i>		R					O	R	O						
O	Sea spiders	<i>Pycnogonid</i> sp.					O										

	Site	Tolls Island	Deep Point	S of Deep Point	SW Great Arthur	Annel Ledge	S of Samson	Bartholmew Ledge	Spanish Ledge	Spanish Ledge	Spanish Ledge	Hell Bay	Hell Bay	Hell Bay	Hell Bay	Hell Bay	Hell Bay
BRYOZOA																	
F	<i>Bugula</i> sp.				A												
C	Sea Mat				C	C								F			F
F	Ross Coral							F	C	O							
C	Bryozoan turf		F			A		C	C								
ECHINODERMATA																	
F	Common starfish											C					
F	Common sea urchin	O	R		F	F	F		O	O		C	F	O	C	F	F
C	Cotton spinner	C	C	O		F	O	R	O	O	O	F	F	O	C	F	O
R				R													
O	Spiny Star Fish		O	O	R	O	F		O	O	O	C	O	C	O	F	O
ASCIDIANS																	
O	<i>Ascidia aspersa</i>	O															
O	<i>Ascidia</i> sp.		O			O											
O	<i>Botryllus leachi</i>					O											
O	Star squirt					O											
O	Light-bulb sea squirt	O	O			F						R		O			O
FISH																	
O	Goldsinny wrasse		R				O					F		O	O		
R	Conger eel		R														
O	Two-spotted goby		O														
F	Ballan wrasse	F			O	F	O					C			F		F
O	Cuckoo wrasse	F	R			O	R					F		O	O	O	
R	Ling		R														
F	Pollack	O			O	F						F		O	F	F	
O	Leopard spotted goby	R	O														
R	Topknot													R			
R	Goby sp.																R

Full Species List - Wreck of the *Cita*

Mean abundance		Site	Wreck of the Cita		
			Record Number	2	4
			Upper Depth (m/bcd)	14.7	17.3
ALGAE		Lower Depth (m/bcd)	21.6	23.3	
O	Batters frond	<i>Dictyopteris membranacea</i>		O	
R		<i>Dictyota dichotoma</i>		R	
F		<i>Hildenbrandia rubra</i>	F		
F	Oarweed	<i>Laminaria digitata</i>	F	O	
F		<i>Laminaria hyperborea</i>	O	F	
F	Dulse	<i>Palmaria palmata</i>	F	F	
PORIFERA					
F	Elephant's ear sponge	<i>Pachymatisma johnstonia</i>	F		
F		<i>Pseudosuberities sulphureus</i>	F	F	
O		<i>Suberites carnosus</i>	O		
CNIDARIA					
O	Dead Mans Fingers	<i>Alcyonium digitatum</i>	O	R	
O	Red sea fingers	<i>Alcyonium glomeratum</i>	O		
O	Devon Cup Coral	<i>Caryophyllia smithii</i>	O	O	
F	Jewel anemone	<i>Corynactis viridis</i>	O	F	
F		<i>Dynanena</i> sp.	F		
O	Plumose anemone	<i>Metridium senile</i>	O	O	
O		<i>Sagartia elegans</i>	O		
POLYCHAETA					
A		<i>Hydroides norvegica</i>	F	A	
C	Keel worm	<i>Pomatoceros triqueter</i>	C	C	
MOLLUSCS					
O	European Cowrie	<i>Trivia monarcha</i>	O		
BRYOZOA					
F		<i>Bugula</i> sp.	F	F	
O	Hornwrack	<i>Flustra foliacea</i>	O	R	
O	Ross Coral	<i>Pentopora foliacea</i>	O	R	
C	Bryozoan turf		C	O	
ECHINODERMATA					
A	Common starfish	<i>Asterias rubens</i>	A	F	
F	Common sea urchin	<i>Echinus esculentus</i>	F	O	
O	Cotton spinner	<i>Holothuria forskali</i>	F	R	
F	Spiny Star Fish	<i>Marthasterias glacialis</i>	F	O	
ASCIDIANS					
F		<i>Ascidia</i> sp.		F	
C	Star squirt	<i>Botryllus schloseri</i>	C		
FISH					
F	Ballan wrasse	<i>Labrus bergylta</i>	F	O	
O	Pollack	<i>Pollachius pollachius</i>	F	R	

Full Species List - Kelp Forest

Mean Abundance		Site	Wreck of Lady Charlotte	S of Deep Point	Great Arthur	W of Milledgan	S of Samson	Minalto Ledge	Minalto Ledge	Minalto Ledge	Minalto Ledges	SW of Samson	Hell Bay	Hell Bay
			1	10	13	17	26	27	28	29	30	31	44	46
			Record Number	6.5	6.1	9.4	6.9	4.7	3.8	4.3	7.3	6.7	4.7	13.3
ALGAE		Lower Depth (m/bcd)	10.5	17.6	9.7	12.7	9.3	11.8	9.7	10.6	7.5	6.2	16.4	16.6
F		<i>Brongniartella byssoides</i>							F					
C		<i>Calliblepharis ciliata</i>			C							O		
C		<i>Coralline crust</i>						F	C			A	C	C
F		<i>Cryptopleura ramosa</i>		F					F		C			
O		<i>Desmarestia aculeata</i>											O	
F		<i>Delesseria sanguinea</i>		F					F		F			
C	Batters frond	<i>Dictyopteris membranacea</i>		C	C	C			F					
F		<i>Dictyota dichotoma</i>							F		F	O		
O		<i>Dilsea carnosa</i>							O					
F		<i>Halarachnion ligulatum</i>							F		F			
C	Sea oak	<i>Halidrys siliquosa</i>			C									
F		<i>Halopteris</i> sp.							F					
O		<i>Hildenbrandia rubra</i>						O						
O		<i>Hypoglossum woodwardii</i>									O			
F	Oarweed	<i>Laminaria digitata</i>			F							C	O	
A		<i>Laminaria hyperborea</i>	A	A		A		C	A	A	A		F	A
O		<i>Lomentaria articulata</i>							O		O			
F		<i>Nitophyllum punctatum</i>							F					
F		<i>Membranoptera alata</i>							F		F			
F		<i>Phycodrys rubens</i>							F		F			
F		<i>Plocamium cartilagineum</i>		O					F		F			
O		<i>Polysiphonia</i> sp.									O			
O		<i>Ptilota plumosa</i>											O	
O		<i>Plumaria elegans</i>						O						
C		<i>Saccorhiza polyschides</i>		C		C			C			C		
O		<i>Scinaia forcellata</i>							O		O			
O		<i>Ulva lactuca</i>				F		O				O		
PORIFERA														
O		<i>Axinellid</i> sp.						O						
R	Boring sponge	<i>Cliona celata</i>				R								
F		<i>Haliclona</i> sp.						F						
O		<i>Myxilla incrustans</i>						O						
O	Elephant's ear sponge	<i>Pachymatisma johnstonia</i>					O				O			
O		<i>Suberites carnosus</i>								O				
F	Encrusting sponge										F			

	Site	Wreck of Lady Charlotte	S of Deep Point	Great Arthur	W of Melledgan	S of Samson	Minalto Ledge	Minalto Ledge	Minalto Ledge	Minalto Ledges	SW of Samson	Hell Bay	Hell Bay
CNIDARIA													
O		<i>Actinothoe sphyrodeta</i>				R	O	O	O		R		
R	Dead Mans Fingers	<i>Alcyonium digitatum</i>			F			R					O
R		<i>Anemonia sulcata</i>										R	
O	Snakelocks anemone	<i>Anemonia viridis</i>					O						
O	Devon Cup Coral	<i>Caryophyllia smithii</i>			C		O	O	O				O
O	Daisy anemone	<i>Cereus pedunculatus</i>			F		O					R	
F		<i>Cerianthus lloydii</i>				F							
O	Jewel anemone	<i>Corynactis viridis</i>		O	C		O	R	F	R		O	
C		<i>Dynanena sp.</i>					C						
O		<i>Halecium halecinum</i>			O								
O		<i>Sagartia elegans</i>								O		O	F
POLYCHAETA													
F	Keel worm	<i>Pomatoceros triqueter</i>					F						C
MOLLUSCS													
F		<i>Gibbula cinnaria</i>								F			
F		<i>Gibbula sp.</i>	F			F	F	O			C		
F	Blue-rayed limpet	<i>Patina pellucida</i>				F							
CRUSTACEA													
R	Common lobster	<i>Homarus gammarus</i>								R			
O	Velvet swimming crab	<i>Necora puber</i>					R			O			
R	Common prawn	<i>Palaemon serratus</i>					R						
BRYOZOA													
C	Sea Mat	<i>Membranipora membranacea</i>				F	C			C			
A	Bryozoan turf								A	C			
ECHINODERMATA													
R	Common starfish	<i>Asterias rubens</i>	R		R								O
F	Common sea urchin	<i>Echinus esculentus</i>	F	O	F	C		F	O	F	O	O	F
O	Cotton spinner	<i>Holothuria forskali</i>	R		C	F		O	R	O			C
O	Spiny Star Fish	<i>Marthasterias glacialis</i>	O	O	F	C		F	O	F	R	R	
ASCIDIANS													
O		<i>Ascidia sp.</i>								O			
F	Star squirt	<i>Botryllus schloseri</i>					O			F			
O	Gooseberry sea squirt	<i>Dendrodoa grossularia</i>								O			
O		<i>Diplosoma listerianum</i>					O						
C	Light-bulb sea squirt	<i>Clavelina lapadiformis</i>											C
FISH													
F	Goldsinny wrass	<i>Centrolabrus rupestris</i>										F	O
F	Corkwing wrass	<i>Crenilabrus melops</i>					F						
O	Ballan wrass	<i>Labrus bergylta</i>	F		R	O	F			O	R	C	F
F	Pollack	<i>Pollachius pollachius</i>			O		F					F	F
R	Common Dogfish	<i>Scyliorhinus canicula</i>					R						

Full Species List - Sand Patches

Mean Abundance		Site	Tollis Island	Annet Ledge	West of Annet	St Mary's Roads	S of Samson	S of Samson	Bartholmew Ledge	Spanish Ledge
		Record Number	6	19	20	24	33	35	36	39
		Upper Depth (m/bcd)	29.5	18.2	19.6	18.7	8.9	6.0	16.7	23.7
		Lower Depth (m/bcd)	29.6	21.1	20.7	19.1	9.7	6.1	17.9	27.3
ALGAE										
O		<i>Brongniartella byssoides</i>							O	
C		<i>Calliblepharis ciliata</i>							C	
F	Sea whip	<i>Chorda filum</i>					F			
O		<i>Coralline crust</i>							O	O
F		<i>Delesseria sanguinea</i>							F	
F	Batters frond	<i>Dictyopteris membranacea</i>							F	
F		<i>Dilsea carnosa</i>							F	
C		<i>Furcellaria lumbricalis</i>				C				
O	Sea oak	<i>Halidrys siliquosa</i>							O	
O		<i>Kallymenia reniformis</i>						O		
O		<i>Laminaria hyperborea</i>					O	O		
F	Sugar kelp	<i>Laminaria saccharina</i>					F	C		
C		<i>Lithothamnion</i> sp.		C						
F		<i>Plocamium cartilagineum</i>							F	
F		<i>Saccorhiza polyschides</i>					A		O	
C		<i>Ulva lactuca</i>					C	A		
PORIFERA										
F		<i>Ciocalypta penicillus</i>			F					
R	Boring sponge	<i>Cliona celata</i>		R						
R	Breadcrumb sponge	<i>Halichondria panicea</i>				R			R	
R	Elephant's ear sponge	<i>Pachymatisma johnstonia</i>			R			R		
O		<i>Polymastia boletiforme</i>			O				R	F
O		<i>Suberites carnosus</i>			O				R	O
CNIDARIA										
F	Dead Mans Fingers	<i>Acyonium digitatum</i>		R	O					
O	Snakelocks anemone	<i>Anemonia viridis</i>				O		R		
O	Devon Cup Coral	<i>Caryophyllia smithii</i>		O	F				O	
F	Daisy anemone	<i>Cereus pedunculatus</i>		O	F	F				F
O		<i>Cerianthus lloydii</i>								
O	Jewel anemone	<i>Corynactis viridis</i>		O	C					
O		<i>Sagartia elegans</i>		O	F				O	
O		<i>Sagartiogeton laceratus</i>			O					
O	Dahlia anemone	<i>Urticina felina</i>					O			
POLYCHAETA										
O	Parchment worm	<i>Chaetopterus variopectatus</i>							O	
O	Sand Mason	<i>Lanice conchilega</i>			O				R	O
F		<i>Spirorbis</i> sp.				F				

		Site	Tolls Island	Annet Ledge	West of Annet	St Mary's Roads	S of Samson	S of Samson	Bartholmew Ledge	Spanish Ledge
MOLLUSCS										
O		<i>Circumphorus casina</i>				O				
O		<i>Gibbula cinnaria</i>					O			
O		<i>Gibbula</i> sp.						F		
O	Blue-rayed limpet	<i>Patina pellucida</i>					O			
CRUSTACEA										
R	Edible crab	<i>Cancer pagarus</i>			O					R
O		<i>Galathea squamifera</i>				O				
O	Velvet swimming crab	<i>Necora puber</i>				C			O	
O	Long-legged spider crab	<i>Macropodia rostrata</i>								O
F	Hermit crab	<i>Pagurus</i> sp.			R	O	A		R	
O	Sea spiders	<i>Pycnogonid</i> sp.		O						
BRYOZOA										
O		<i>Bugula</i> sp.			O					
O	Sea Mat	<i>Membranipora membranacea</i>					O			
O	Ross Coral	<i>Pentopora foliacea</i>		R	O				R	O
O	Bryozoan turf								O	
ECHINODERMATA										
F	Common sea urchin	<i>Echinus esculentus</i>			R					
R	Cotton spinner	<i>Holothuria forskali</i>		R					R	
O	Spiny Star Fish	<i>Marthasterias glacialis</i>		R	F		R	R	O	
R		<i>Ophiura</i> sp.			R					
ASCIDIANS										
O		<i>Aplidium</i> sp.			O					
O		<i>Botryllus leachi</i>		O						
O	Star squirt	<i>Botryllus schloseri</i>		O					O	
O	Light-bulb sea squirt	<i>Clavelina lepadiformis</i>			O					
R	Gooseberry sea squirt	<i>Dendrodoa grossularia</i>		R						
O		<i>Morchellium argus</i>			O					
FISH										
C	Sand eel	<i>Ammodytes lanceolatus</i>		C						
C	Dragonet	<i>Callionymus lyra</i>					C			
O	Pollack	<i>Pollachius pollachius</i>	O	O				R		
C	Sand goby	<i>Pomatoschistus minutus</i>						A	F	

IOS 98 Site Species Abundance List

ALGAE	Vert	Mixed	Horizontal	Wreck	Sand	Kelp
Brongniartella byssoides			F		O	F
Calliblepharis ciliata		F	F		C	C
Chorda filum					F	
Coralline crust		C	C		O	C
Cryptopleura ramosa			O			F
Delesseria sanguinea		C			F	F
Desmarestia aculeata		O				
Desmarestia aculeata			F			O
Dictyopteris membranacea		F				
Dictyopteris membranacea			C	O	F	C
Dictyota dichotoma			C	R		F
Dilsea carnosa		F	O		F	O
Furcellaria lumbricalis					C	
Halarachnion ligulatum						F
Haldrys siliquosa		O	F		O	C
Halopteris sp.						F
Hildenbrandia rubra			F			
Hildenbrandia rubra				F		
Hildenbrandia rubra						O
Hypoglossum woodwardii						O
Kallymenia reniformis					O	
Laminaria digitata				F		F
Laminaria hyperborea	O	O	F	F	O	A
Laminaria saccharina		F			F	
Lithothamnion sp.	F		C		C	
Lomentaria articulata						O
Membranoptera alata						F
Nitophyllum punctatum			O			
Nitophyllum punctatum						F
Palmaria palmata			C			
Palmaria palmata				F		
Phycodrys rubens						F
Plocamium cartilagineum			F		F	F
Plumaria elegans			F			O
Polysiphonia spp.						O
Porphyra umbilicalis		F				
Ptilota plumosa		C				O
Saccorhiza polyschides		O	O		F	C
Scinaia forcellata			O			O
Sphaerococcus coronopifolius		C				
Ulva lactuca		F	F		C	O
PORIFERA						
Axinellid Sp.		O	O			O
Ciocalypa penicillus					F	
Cliona celata	O	R	O		R	R
Halichondria panicea		O	O		R	
Haliclona sp.			O			F
Myxilla incrustans	O		O			O
Pachymatasma johnstonia		O	O	F	R	O
Polymastia boletiforme		F	C		O	
Polymastia mammillaris		O	O			
Pseudosuberites sulphureus				F		
Raspoilea sp.			F			
Scypher sp.			R			
Suberites camosus		O	O	O	O	O
Suberites domuncula	R					

CINIDERA	Vert	Mixed	Horizontal	Wreck	Sand	Kelp
Actinothoe sphyrodeta		O	O			O
Alcyonium digitatum	F	C	F	O	F	R
Alcyonium glomeratum	F		O	O		
Anemonia sulcata						R
Anemonia viridis		O	O		O	O
Caryophyllia smithii	F	O	F	O	O	O
Cereus pedunculatus		F	O		F	O
Cerianthus lloydii		O			O	F
Corynactis viridis	F	O	F	F	O	O
Dynanena sp.			F	F		C
Eunicella verrucosa	O					
Halecium halecinum			O			O
Metridium senile	O			O		
Nemertea antennina			O			
Parazoanthus axinellae			R			
Sagartia elegans		O	O	O	O	O
Sagartiogeton laceratus		F			O	
Tubularia indivisa	R	O				
Urticina felina		O	F		O	
POLYCHEATA						
Chaetopterus variopedatus		R	R		O	
Hydroides norvegica				A		
Lanice conchilega		O			O	
Pomatoceros triqueter	O		F	C		F
Sabillaria sp.			O			
Spirorbis sp.			O		F	
BRYOZOAN						
Bryozoan turf	F	R	C	C	O	A
Bugula sp.	O	O	F	F	O	
Flustra foliacea				O		
Membranipora membranacea			C		O	C
Pentopora foliacea		O	F	O	O	
MOLLUSCA						
Aplysia punctata		O				
Circomphalus casina		O			O	
Ensis siliqua		R				
Favorinus bianus		O				
Gibbula cinnaria			F		O	F
Gibbula sp.		O	O		O	F
Gibbula umbilicalis			F			
Patina pellucida		O			O	
Scaphander lignarius		O				
Sepia officinalis		R				
Trivia monacha				O		
CRUSTACEAN						
Cancer pagarus		O	O		R	
Carcinus maenas		F				
Galathea squamifera					O	
Galathea strigosa			O			
Homarus gammarus						R
Macropodia rostrata		R			O	
Necora puber		O	R		O	O
Pagurus sp.		C			F	
Palaemon serratus						R
Pycnogonid sp.			O		O	

	Vert	Mixed	Horizontal	Wreck	Sand	Kelp
ECHINODERMATA						
Asterias rubens	F	O	F	A		R
Echinus esculentus	O	F	F	F	F	F
Holothuria forskali	R	F	C	O	R	O
Luidia ciliaris			R			
Marthasterias glacialis	O	O	O	F	O	O
Ophiura sp.					R	
ASCIDIANS						
Aplidium sp.					O	
Ascidia Sp.		F	O	F		O
Ascidella aspersa			O			
Botryllus leachi		O	O		O	
Botryllus schloseri		F	O	C	O	F
Clavelina lapadiiformis		O	O		O	C
Dendrodoa grossularia		F			R	O
Diplosoma listerianum						O
Morchellium argus					O	
FISH						
Ammodytes lanceolatus					C	
Callionymus lyra		C			C	
Centrolabrus rupestris		C	O			F
Conger conger			R			
Crenilabrus melops						F
Goby sp			R			
Gobiusculus flavescens			O			
Labrus bergylta	O	R	F	F		O
Labrus mixtus		O	O			
Molva molva			R			
Myoxocephalus scorpius		R				
Pollachius pollachius	F	O	F	O	O	F
Pomatoschistus minutus		C			C	
Scyliorhinus canicula						R
Spinachia spinachia		O				
Thorogobius ephippiatus		C	O			
Zeugopterus punctatus			R			

Site Description - Physical Parameters

Site Description - Physical Parameters													
Site	Rec	Dive	Record		Start Position		End Position		Depth Range		Physical Details		
	No	No	Date	Times	Lat. (N)	Long (W)	Lat. (N)	Long (W)	meters bcd	Wave Ex	Tides	Viz	
Horizontal Bedrock and Boulders													
Tolls Island, St Marys	5	4	4-Aug	10:18	10:48	49 55.27	6 16.41	49 55.70	6 16.48	11.8 18.6	Mod	Mod	10
Deep Point	9	7	10-Aug	10:51	11:17	49 55.24	6 16.45			17.6 25.2	Mod	Mod	6
S of Deep Point	11	8	10-Aug	10:17	10:39	49 55.32	6 16.44	49 55.32	6 16.45	17.1 23.6	Shel	Weak	6
SW of Great Arthur	15	11	4-Aug	10:09	10:39	49 56.57	6 16.12			8.8 10.6	Mod	Weak	10
Annet Ledges	18	13	5-Aug	09:59	10:27	49 53.07	6 22.22	49 53.06	6 22.258	12.3 15.3	Exp	Mod	15
South of Samson	34	29	9-Aug	08:38	09:07	49 54.80	6 21.76	49 54.75	6 21.871	18.1 20.4	Exp	Exp	7
Bartholomew Ledges	37	31	9-Aug	11:00	11:27	49 54.73	6 20.99	49 54.76	6 21.209	16.7 17.9	Mod	Mod	10
Spanish Ledges, Samson	38	32	9-Aug	09:20	09:45	49 54.74	6 22.00	49 54.73	6 22.164	23.7 27.3	Exp	Exp	8
Spanish Ledges, Samson	40	33	9-Aug	09:52	10:15	49 54.86	6 22.10	49 54.83	6 22.391	16.6 20.8	Exp	Exp	7
Spanish Ledges, Samson	41	33	9-Aug	09:52	10:15	49 54.86	6 22.10	49 54.83	6 22.391	20.6 23.8	Exp	Exp	7
Spanish Ledges, Samson	42	34	6-Aug	09:07	09:37	49 57.73	6 21.75	49 57.43	6 21.68	6.4 19.2	V Exp	Weak	12
Hell Bay, Bryer	43	35	6-Aug	09:08	09:36	49 57.43	6 21.75	49 57.45	6 21.743	16.3 19.4	V Exp	Mod	5
Hell Bay, Bryer	47	37	7-Aug	09:56	10:21	49 57.53	6 21.93	49 57.53	6 21.939	23.0 25.3	V Exp	Weak	12
Hell Bay, Bryer	48	38	7-Aug	09:11	09:41	49 57.56	6 21.98	49 57.51	6 22.07	11.0 21.3	V Exp	Mod	5
Hell Bay, Bryer	49	39	7-Aug	09:07	09:24	49 57.61	6 21.96	49 57.60	6 21.944	23.8 30.2	V Exp	Weak	4
Hell Bay, Bryer	50	40	6-Aug	10:20	10:50	49 57.85	6 21.75			12.6 15.6	V Exp	Mod	15
Hell Bay, Bryer	51	41	6-Aug	10:48	11:18	49 57.61	6 21.64			9.1 10.0	V Exp	Weak	10
Kelp Forest													
Lady Charlotte, St Marys	1	1	5-Aug	14:20	14:48	49 54.84	6 16.70			6.5 10.5	Shel	Weak	7
S of Deep Point	10	8	10-Aug	10:17	10:39	49 55.32	6 16.44	49 55.32	6 16.45	6.1 17.6	Shel	Weak	6
Great Arthur	13	10	4-Aug	10:30	10:59	49 56.44	6 16.17			9.4 9.7	Shel	Weak	10
West of Melledgan	17	12	7-Aug	11:47	12:17	49 52.42	6 22.30			6.9 12.7	Exp	Exp	12
South of Samson	26	21	6-Aug	14:42	15:11	49 55.35	6 20.70	49 55.41	6 20.768	4.7 9.3	Mod	Mod	6
Minalto Ledge	27	22	9-Aug	14:01	14:29	49 55.23	6 20.91	49 55.30	6 20.88	3.8 11.8	Mod	Mod	8
Minalto Ledge	28	23	9-Aug	14:23	14:53	49 55.25	6 21.01	49 55.30	6 20.96	4.3 9.7	Mod	Weak	7
Minalto Ledge	29	24	9-Aug	16:00	16:29	49 55.19	6 21.83	49 55.22	6 21.84	7.3 10.6	Mod	Mod	5
Minalto Ledge	30	25	9-Aug	15:41	16:10	49 55.31	6 21.99	49 55.27	6 21.96	6.7 7.5	Mod	Mod	10
South of Samson	31	26	6-Aug	15:15	15:41	49 55.30	6 20.79	49 55.30	6 20.792	4.7 6.2	Mod	Mod	5
Hell Bay, Bryer	44	35	6-Aug	09:08	09:36	49 57.43	6 21.75	49 57.45	6 21.743	13.3 16.4	V Exp	Mod	5
Hell Bay, Bryer	46	36	6-Aug	09:58	10:26	49 57.48	6 21.73	49 57.45	6 21.72	10.6 16.6	V Exp	Mod	9
Mixed Horizontal Bottom													
Tolls Island, St Marys	8	6	4-Aug	09:26	09:58	49 55.70	6 16.48			18.0 18.9	Mod	Mod	9
S of Deep Point	12	9	10-Aug	11:29	11:55	49 55.10	6 16.48	49 55.09	6 16.48	21.4 23.9	Shel	Weak	6
Great Arthur	14	10	4-Aug	10:30	10:59	49 56.44	6 16.17			12.1 12.4	Shel	Weak	10
SW of Annet	21	16	5-Aug	10:15	10:40	49 53.12	6 22.25			13.0 15.0	Exp	Exp	8
St Marys Roads	22	17	10-Aug	09:50	10:20	49 54.98	6 20.72	49 54.94	6 20.98	17.5 18.1	Mod	Mod	10
St Marys Roads	23	18	10-Aug	10:18	10:48	49 54.94	6 20.98	49 54.94	6 21.19	17.1 17.6	Mod	Mod	5
South of Samson	25	20	6-Aug	14:06	14:35	49 55.48	6 20.43	49 55.51	6 20.434	8.9 9.4	Mod	Mod	8
South of Samson	32	27	6-Aug	14:17	14:45	49 54.85	6 18.61			7.2 8.7	Mod	Mod	9
Hell Bay, Bryer	45	36	6-Aug	09:58	10:26	49 57.48	6 21.73	49 57.45	6 21.72	16.6 19.6	V Exp	Mod	9
Sand													
Tolls Island, St Marys	6	5	4-Aug	09:09	09:31	49 55.71	6 16.29			29.5 29.6	Mod	Mod	6
Annet Ledge	19	14	5-Aug	10:42	11:05	49 52.98	6 22.81	49 53.13	6 22.933	18.2 21.1	V Exp	Mod	10
West of Annet	20	15	5-Aug	09:12	09:42	49 53.12	6 22.54	49 53.14	6 22.564	19.6 20.7	Exp	Exp	15
St Marys Roads	24	19	9-Aug	11:09	11:38	49 54.77	6 21.17	49 54.80	6 21.27	18.7 19.1	Exp	Mod	10
South of Samson	33	28	6-Aug	14:06	14:35	49 55.48	6 20.43	49 55.51	6 20.458	8.9 9.7	Mod	Exp	15
South of Samson	35	30	6-Aug	14:30	15:00	49 54.70	6 21.64	49 54.70	6 21.64	6.0 6.1	Exp	Exp	8
Bartholomew Ledges	36	31	9-Aug	11:00	11:27	49 54.73	6 20.99	49 54.76	6 21.209	16.7 17.9	Mod	Mod	10
Spanish Ledges, Samson	39	32	9-Aug	09:20	09:45	49 54.74	6 22.00	49 54.73	6 22.164	23.7 27.3	Exp	Exp	8
Vertical Surfaces													
Wreck of Cita, St Marys	3	2	13-Aug	08:40	09:12	49 54.75	6 16.76			17.7 17.6	V Exp	V Str	5
Tolls Island, St Marys	7	5	4-Aug	09:09	09:31	49 55.71	6 16.29			24.7 29.5	Mod	Mod	6
SW of Great Arthur	16	11	4-Aug	10:09	10:39	49 56.57	6 16.12			6.8 8.6	Mod	Weak	10
Wreck of Cita, St Marys													
Wreck of Cita, St Marys	2	2	13-Aug	08:40	09:12	49 54.75	6 16.76			14.7 21.6	V Exp	V Str	5
Wreck of Cita, St Marys	4	3	13-Aug	08:37	09:00	49 54.75	6 16.76			17.3 23.3	V Exp	V Str	5

Site Description - Rock Features

Site Description - Rock Features																				
Site		ROCK			Shells					Rock Features							Aspects of Rock Faces			
		Tot	Bed	L Bo	S Bo	Cob.	Emp	Liv	Met	Rel	Text	Scr	Silt	Fis	Crev	Sed	Lev	Steep	Vert	Over
Horizontal Bedrock and Boulders																				
Tolls Island, St Marys		80	40	40	5		15			5	2	1	2	1	1	1	2	3	3	1
Deep Point		90	60	20	10	10				5	2	1	2	2	1		3	4	3	
S of Deep Point		100	100							4	1	1	3	1	1	1				
SW of Great Arthur		100		80	20			5									3	3	3	2
Annet Ledges		71	100							5	4	3	2	1	1	1		3	3	
South of Samson		90	10	10	20	60				3	3	1	1		2		5	3	3	
Bartholomew Ledges		80			20	80				2	2	1	1	1	1	1				
Spanish Ledges, Samson		80	100							1	3	1	1	1	1		5			
Spanish Ledges, Samson		100	100							4	2	1	2	2	1	1	3	3	2	1
Spanish Ledges, Samson		85		80	10	10				2	2	1	2	1	1	1	4	2		
Hell Bay, Bryer		95	50	50						4	3	1	3			1	5	2	2	
Hell Bay, Bryer		100	80	20						4	2	2	1	1	2		2		4	
Hell Bay, Bryer		90	70	15	15					4	3	2	2	2	2	1				
Hell Bay, Bryer		80	80	20						3	3					4				
Hell Bay, Bryer		95	85	10	5					5	2	1	2	1	1		5		1	
Hell Bay, Bryer		100	85	5	5		5			5	2		2				1	2	4	1
Hell Bay, Bryer		100	80	10	10					5	2									
Kelp Forest																				
Lady Charlotte, St Marys		90	60	30				10		4	2		2		2	1	2	1	3	
S of Deep Point		100	100							4	1	1	4	1	1	1	3	4	3	
Great Arthur		95		90	10					2	2		3				5			
West of Melledgan		100	80	20						5	3	1	2	1	1		1	1	5	1
South of Samson		60				100				3							5			
Minalto Ledge		90	35	20	20	20	5			4	3	1	2	4	3		3	3	2	1
Minalto Ledge		80	70	15	5	5	5			3	2	2	2	1	1	1	5	2	2	2
Minalto Ledge		90	80	15	5					5	4	3		3	3		4	2	2	1
Minalto Ledge		95	30	55	10	5				4	2	1	1	4	3		5			
South of Samson		80		50	25	25				2	2	1	1	1	2		4	1	1	
Hell Bay, Bryer		95	75	20			5			3	2	2	1	1	3		1	1	4	
Hell Bay, Bryer		100	100							5	2	2		2	3					
Mixed Horizontal Bottom																				
Tolls Island, St Marys		50	34	33	33					5	4	1	2	1	2	1	3	2	2	1
S of Deep Point		50	60	40						3	2	1	2	1	2		5			
Great Arthur		40			50	50				2	2		3							
SW of Annet		40		100						2	2		3							
St Marys Roads		50				75	25			2							5			
St Marys Roads		70		15	85					2	4	3	1		2	1				
South of Samson		40			25		75										5			
South of Samson		40				100				2	2	1	1	1	1		5			
Hell Bay, Bryer		40		100						4	2	2	3			1				
Sand																				
Tolls Island, St Marys		0																		
Annet Ledge		29	100							3	3	2	1	1	1		5	3	3	
West of Annet		30	20	50	20	10				5	3						2	2	2	
St Marys Roads		10	100							1	1	1	1	1	1		5			
South of Samson		15				90	10													
South of Samson		0																		
Bartholomew Ledges		20				100				2	2	1	1	1	1	1	5			
Spanish Ledges, Samson		15			10	80	10			1	3	1	1	1	1	1	5			
Vertical Surfaces																				
Wreck of Cita, St Marys		100	100							4	4	1	1	1	1					5
Tolls Island, St Marys		100	95		5					2	1	1	2	2	1	1	4			4
SW of Great Arthur		100	100																	
Wreck of Cita, St Marys																				
Wreck of Cita, St Marys		100						100					3							
Wreck of Cita, St Marys		100						100												

Site Description - Sediment Features

Site	Sediment		Cl	Mud	Med	Mud	Features of Sediment					
	Tot	M Cob	grav	Grav	San	Sand	Firm	Stab	Sort	Wav	Rip	Co
Horizontal Bedrock and Boulders												
Tolls Island, St Marys	20			100			2	2	3			
Deep Point	10	100										
S of Deep Point	0											
SW of Great Arthur	0											
Annet Ledges	29			100			5	3				
South of Samson	10	100					1	2	5			
Bartholomew Ledges	20		100				5	3	1			
Spanish Ledges, Samson	20		100				1	1	1			
Spanish Ledges, Samson	0											
Spanish Ledges, Samson	15	90	10									
Hell Bay, Bryer	5		80		20		2	2				
Hell Bay, Bryer	0											
Hell Bay, Bryer	10		100				2	2	1			1
Hell Bay, Bryer	20		100				5					
Hell Bay, Bryer	5		100				2	3	3			
Hell Bay, Bryer	0											
Hell Bay, Bryer	0											
Kelp Forest												
Lady Charlotte, St Marys	10			100			2	2	3		1	
S of Deep Point	0											
Great Arthur	5		100				1	3	4			
West of Melledgan	0											
South of Samson	40		100				1	1	1			
Minalto Ledge	10	50	50				4	3	4			
Minalto Ledge	20	50	50				4	4	2			
Minalto Ledge	10		100				2	2	2			
Minalto Ledge	5		100									
South of Samson	20		100				1	2	2			
Hell Bay, Bryer	5		100				1	4	3			
Hell Bay, Bryer	0											
Mixed Horizontal Bottom												
Tolls Island, St Marys	50			100			3	3	2		1	1
S of Deep Point	50			100			2	2	4			
Great Arthur	60	67	33				1	3	4			
SW of Annet	60			100			2	3	4			
St Marys Roads	50	80	20				4	2	3			
St Marys Roads	30		100				1	2	1		1	
South of Samson	60	15	85					3	3			
South of Samson	60	10	90				1	1	1			
Hell Bay, Bryer	60			100			2	2	3		1	
Sand												
Tolls Island, St Marys	100	5	50			45	1	1	4			
Annet Ledge	71		100						5		1	
West of Annet	70	10	90				1	2	1			1
St Marys Roads	90		100				4	2	1			1
South of Samson	85	10		60	30		2	2	3			
South of Samson	100				100		4	3	4			
Bartholomew Ledges	80		100				5	3	1		1	
Spanish Ledges, Samson	85	100					1	3	1		1	
Vertical Surfaces												
Wreck of Cita, St Marys	0											
Tolls Island, St Marys	0											
SW of Great Arthur	0											
Wreck of Cita, St Marys												
Wreck of Cita, St Marys	0											
Wreck of Cita, St Marys	0											

LOCATION MAP. LETTERS SHOW SAMPLE REFERENCES AND SITE OF COLLECTION.

