

Coral Cay Conservation Sub-Aqua Club

Fal Estuary 1999 Expedition Report

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Supported by



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been sent out by CCC Expeditions to Belize where they received training in underwater survey techniques and marine identification skills.

Expedition Members

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Expedition Finance

The expedition was part financed by a grant from English Nature with the balance of funds raised by contributions from the participating volunteers. Assistance was also provided by the Devon Wildlife Trust who provided use of their RIB and transport.

General Note on Position Fixing

Every effort has been to ensure accuracy of positions given, however, it should be noted that the errors built into the GPS signals made pin point accurate position fixing difficult. Wherever possible, bearing on shoreline features were made to cross check the positions.

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 (*marina*, *angustifolia* and *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 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.

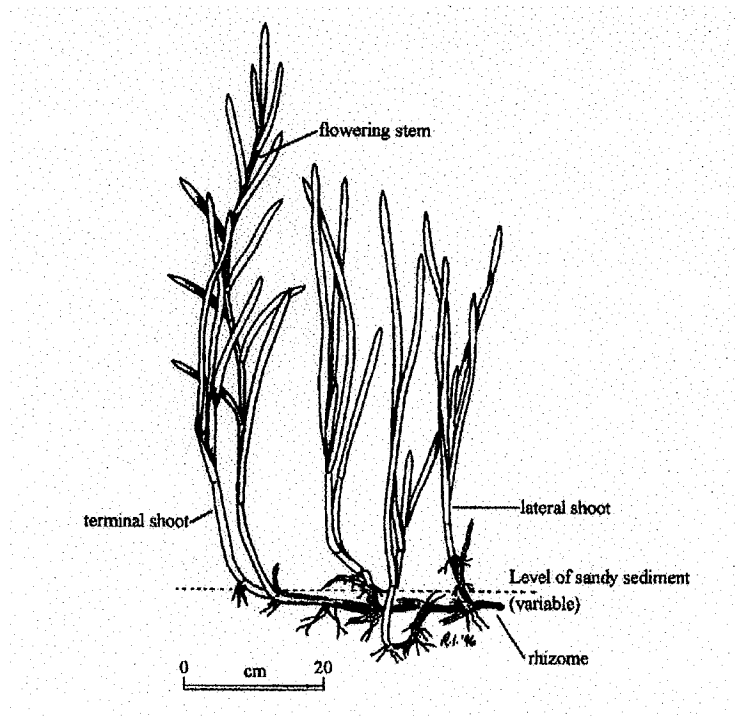


Figure 2 *Zostera marina*

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.

The *Zostera* beds found in the Isles of Scilly have been prone to infection with the parasitic slime mould *Labyrinthula*, more commonly called the wasting disease, which has led to concerns about a repeat of the widespread loss of plants such as occurred in the 1930s and 1940s in a number of beds in the south-west (den Hartog, 1987). The surveys carried out by the Nature Conservancy Council during the years 1984 to 1988 in the Isles of Scilly reported no incidences of *Labyrinthula* within the beds surveyed (Fowler & Pilly, 1992). Although no formal surveys of these 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.

Factors for *Zostera* growth

As a marine angiosperm, *Zostera marina* has a range of environmental conditions that are conducive to growth. As discussed above, it has been suggested that one of the causes of infection within the seagrass beds by *Labyrinthula* is environmental stress caused as a result of anthropogenic inputs. In a study to investigate the seasonal response of *Zostera marina* to varying conditions of light and nutrient enrichment, Moore and Wetzel (2000) showed that the prime controlling factor in growth rates is water column light availability. This study was linked to the effect that epiphytic growth had on growth rate and in a series of controlled experiments they showed that in moderately turbid environments and given adequate levels of epiphyte grazers increased levels of nutrients are unlikely to lead to a reduction in *Zostera* growth.

The prime controlling factor in *Zostera* growth is the amount of available light though temperature, salinity and nutrient availability are also important.

3 MAERL SURVEY

Aim

The aim of this survey was to assess the amount of maerl present on the St. Mawes bank and in Saint Mawes harbour.

The Importance of Maerl

Maerl is a collective term for a number of detached coralline algae. As with all algae it is able to fix carbon dioxide from the water column by mean of photosynthesis, however, it is also able to draw calcium from the water column which is stored in the cell walls as calcium carbonate. By this process maerl can form dense aggregations over the sea floor that are used as shelter by a number of small invertebrate species including a number of juveniles. Many corallines also produce chemicals which promote the settlement of the larvae of some herbivores which then help to keep the surface of the maerl clean from epiphytes.

Chemical analysis of maerl shows that in addition to the calcium carbonate, it also contains high levels of magnesium, strontium, boron and iron and has a high porosity. These factors make maerl commercially important. In excess of 500, 000 t of maerl have been dredged from Brittany and a further 200,000 t from the Fal estuary. Once dried and processed it is used as a an organic top dressing for soil and also as a filtration agent for the purification of water for human consumption. However, although it is estimated that there are substantial reserves of maerl at various locations, Galway Bay on the west coast of Ireland is thought to have about 8 million t of maerl, the regeneration rates are slow and therefore concern has been expressed at the rate of maerl extraction. The majority of beds are comprised of two species *Phymatolithon calcareum* and *Lithothamnion corallioides*, both of which have a range of morphologies and in recognition of their importance both have been listed as “subject to management measures” under the European Union Habitats Directive.

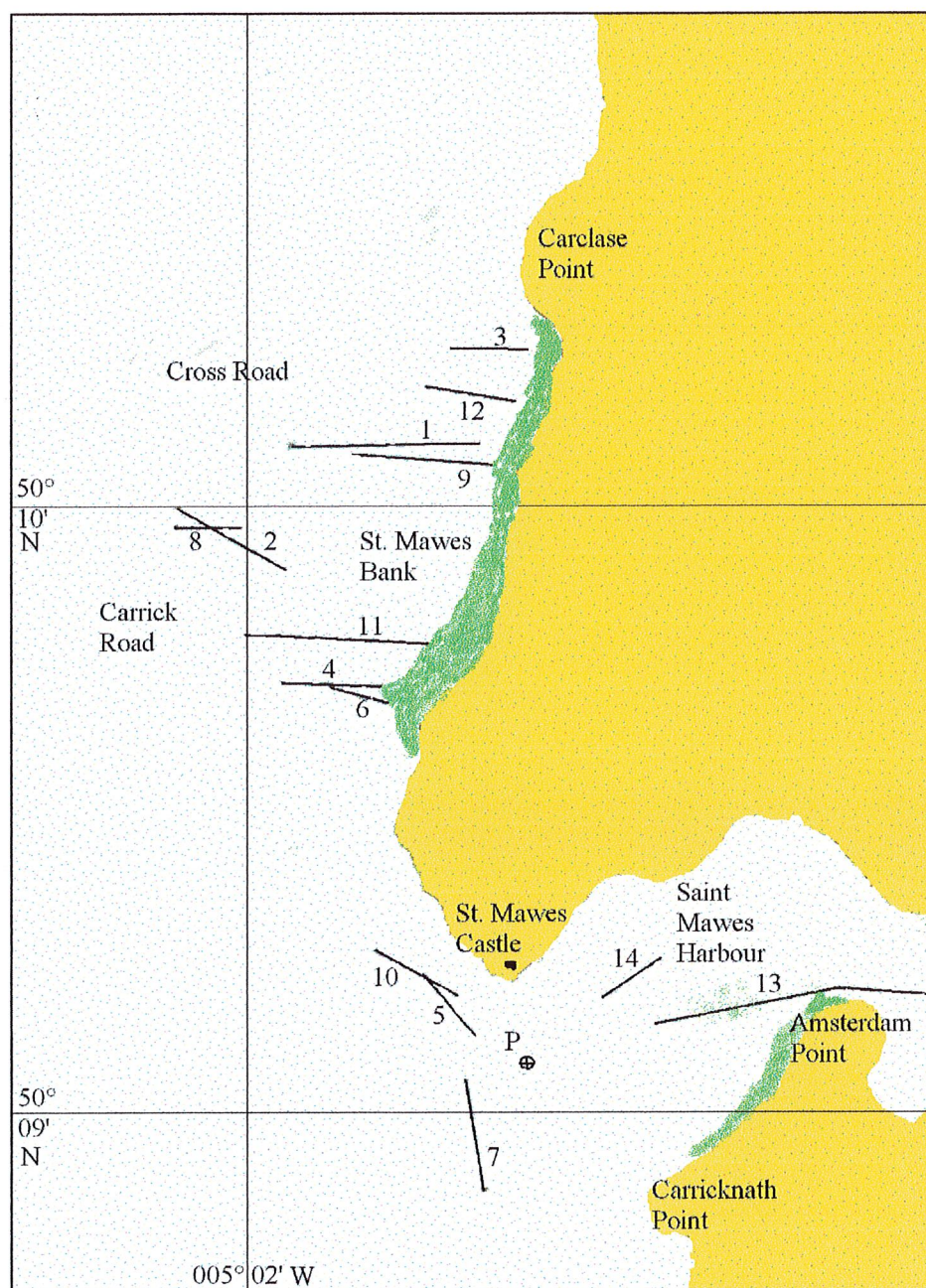
Method

Two methods were used in achieving the above aim.

The survey of St. Mawes bank was carried out by pairs of divers equipped with SCUBA equipment. Each pair carried a Surface Marker Buoy (SMB) to enable their position to be tracked whilst underwater. The divers were given a bearing along which to swim and were asked to record the percentage amount of maerl present and of this the amount of live maerl. This was done at depth increments of 0.5m or every 5 minutes. The chase boat recorded the Latitude and Longitude at the start and end of each transect.

The survey of Saint Mawes Harbour was achieved by way of a detailed survey about a central datum marker situated at 50° 09.21'N 5° 01.32'W. This was later supplemented by an addition transect was were carried out in the method described above.

Results



Presence of *Zostera*

Figure 3 Position of Maerl survey transects (numbers) and Central Survey Marker (P)

Detail from Transect Dives

Transect 1

Start Position N / W

50° 10.09'

005° 01.88'

End Position N / W

50° 10.09'

005° 01.43'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	8.5	80	0	
5	7.0	50	50	
10	7.0	40	60	
12	7.0	40	60	Some cobbles
15	6.5	30	70	
20	6.1	30	60	
23	5.9	80	90	Some cobbles and brown algae
25	5.9	70	80	Some brown algae
30	6.0	70	70	Some cobbles and brown algae
35	5.8	10	40	50% cobbles and some brown algae
40	5.7	80	80	50% cobbles and some brown algae
45	5.4	80	70	Some brown algae

Transect 2

Start Position N / W

50° 09.99'

005° 02.16'

End Position N / W

50° 09.91'

005° 01.91'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	9.6	80	0	
	7.5	80	1	
	7.0	70	5	
	6.5	40	5	
	6.0	20	30	
	5.5	60	80	
	5.0	80	80	
	4.5	80	90	
	4.0	70	50	
	3.5	80	70	
	3.0	80	70	
42	2.8	100	100	Wide plateau of coarse maerl cobbles

Transect 3

Start Position N / W

50° 10.26'

005° 01.50'

End Position N / W

50° 10.25'

005° 01.29'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	6.3	5	20	50% brown algae
5	5.9	5	30	50% brown algae
10	4.3	60	50	50% <i>Ulva</i> and some brown algae
15	3.8	10	50	Some brown algae
18	2.3	0	0	100% fine sand

Transect 4

Start Position N / W

50° 09.73'

005° 01.92'

End Position N / W

50° 09.66'

005° 01.71'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	7.1	40	80	50% brown algae
5	7.1	70	40	50% brown algae
10	7.2	90	90	50% cobbles and some brown algae
15	6.8	80	90	50% brown algae
20	6.8	70	70	25% brown algae
25	6.3	80	100	Some cobbles
28	5.8	20	50	Start of <i>Zostera</i> bed

Transect 5

Start Position N / W

50° 09.25'

005° 01.58'

End Position N / W

50° 09.17'

005° 01.46'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	7.2	80	70	50% brown algae
5	6.8	70	2	
10	6.2	0	0	100% kelp
15	6.0	10	50	
20	6.5	5	50	
25	6.6	70	20	

Transect 6

Start Position N / W

50° 09.71'

005° 01.79'

End Position N / W

50° 09.68'

005° 01.64'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	6.5		85	
10	6.5		60	
20	6.5		55	
25	6.2		50	
30	6.1		70	
33	5.9		90	Start of <i>Zostera</i> bed

Transect 7

Start Position N / W

50° 09.71'

005° 01.79'

End Position N / W

50° 09.68'

005° 01.64'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	5.0	50	100	Maerl present in clumps over sand
20	6.0	50	100	Maerl present in clumps over sand

Transect 8

Start Position N / W

50° 09.96'

005° 02.14'

End Position N / W

50° 09.94'

005° 02.02'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	6.5	50	20	
10	6.0	50	40	
15	5.5	70	70	
20	5.0	90	80	

Transect 9

Start Position N / W

50° 09.96'

005° 02.14'

End Position N / W

50° 09.94'

005° 02.02'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	7.0	40	0	
4	6.5	40	50	
13	6.0	20	80	Maerl under brown algae
17	5.5	70	50	Maerl under brown algae
26	5.0	80	80	Some brown algae, some cobbles
28	4.8	0	0	Start of <i>Zostera</i> bed

Transect 10

Start Position N / W

50° 09.96'

005° 02.14'

End Position N / W

50° 09.94'

005° 02.02'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	7.0	40	0	
3	7.5	80	90	
15	7.0	70	50	Some brown algae
19	6.5	80	90	Maerl under brown algae
25	6.5	90	90	Some brown algae
30	6.4	80	60	Some brown algae
33	6.0	90	90	Start of large maerl cobbles
40	5.9	20	80	Extensive brown algae
41	5.5	20	50	Extensive brown algae
43	5.5	0	0	

Transect 11

Start Position N / W

50° 09.81'

005° 02.00'

End Position N / W

50° 09.78'

005° 01.55'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	7.1	40	80	Some brown algae
5	7.1	70	40	Some brown algae
10	7.2	90	90	100% brown algae, 50% cobbles
15	6.8	80	90	Some brown algae
20	6.8	70	70	25% brown algae
25	6.3	80	100	
28	5.8	20	50	Start of <i>Zostera</i> bed

Transect 12

Start Position N / W

50° 10.19'

005° 01.57'

End Position N / W

50° 10.17'

005° 01.31'

<u>Time (mins)</u>	<u>Depth (m)</u>	<u>% Cover</u>	<u>% Live</u>	<u>Comments</u>
0	5.0	0	0	Mix of fine and muddy sand
5	4.5	20	0	Some brown algae
7	4.5	20	30	Some brown algae
8	4.5	30	30	
15	4.3	50	40	Some <i>Ulva</i>
22	4.3	40	40	
30	4.0	10	0	Sand

The main maerl species noted was *Lithothamnion coralloides* and was present in two main forms. In deeper water it was present as small granular deposits while in shallower water it formed larger

aggregations which are referred to cobbles in the comments column above. The brown algae registered in the majority of the transects listed above was *Cutleria multifida* although on some transects, divers did note the presence of some kelp species and also some occurrence of the green algae *Ulva lactuca*. Although a detailed species survey was not undertaken, divers did record the presence of the following invertebrate species:

Cerianthus lloydii, *Sabella pavonina*, *Pomatoschistus pictus*, *Pagurus* spp., *Myxicola infundibulum*, *Macropodia* spp., *Ostrea edulis*, *Littorina* spp.

Detail from Fixed Point Survey, St. Mawes Harbour

Meters from shot	North		East		South		West	
	% Total	% Living	% Total	% Living	% Total	% Living	% Total	% Living
10	100	5	80	3	20	80	30	50
20 (17.5N)	100	10	80	60	70	80	20	50
30			60	100	90	20	30	60
40			70	80	100	30	50	60
50			50	50	100	30	60	70
60			80	20			70	70
70			60	80			70	70
80			70	70			70	70
90			50	70			70	70
100			30	30				
110			50	40				
120			50	60				
130			20	50				
140			40	30				
150			90	30				

Table 1 Results of transect dives from central datum point at 50° 09.11'N 5° 01.32'W

At the base of the shotline, the amount of maerl found was 100% but with only 2-3% living. The maerl at the eastern extent of the area surveyed was found to be semi fixed under dense beds of *Cutleria multifida*.

The absence of data for the transects to the south and west of the datum marker is not indicative of no further maerl, rather that this was the limit of the survey area due to a lack of time. As shown above, the eastern transect recorded maerl to a distance of 150m away from the datum marker. In order to assess the limit of the maerl a free swimming transect was carried undertaken (transect 14 described in more detail below). This found the eastern end of the maerl bed to be at 50° 09.17'N 5° 1.46'W. Again, the maerl was noted to be under varying amounts of *Cutleria multifida*.

4 ZOSTERA SURVEY

Aim

The aim of the survey was to establish the boundaries of the *Zostera* beds on both the eastern and western banks of the Fal estuary around the Carrick Road, St. Mawes Harbour and the Percuil River.

However, it was not possible to survey the upper, intertidal reaches of the Percuil River due to the states of the tide during the time of the survey.

Method

The presence or absence of *Zostera* sp. was recorded by *in situ* observations using divers equipped with SCUBA equipment or by use of snorkels when the water was shallow enough to safely allow their use. Each pair of divers carried a Surface Marker Buoy (SMB) which allowed the divers location to fixed whilst underwater. Where water clarity allowed, visual observations of *Zostera* presence or absence were made from within the boat. This allowed a greater area to be surveyed in a given amount of time and also minimised the level of risk to divers. Position fixing was by means of a fixed GPS set in the cover / chase boat, a Rigid Hulled Inflatable Boat (RIB) and by checking against landmarks close to the area of survey. The divers were asked to swim around the perimeter of the *Zostera* bed and the boat followed their progress, noting their Latitude and Longitude at regular intervals. The divers had to judge the density of the bed in order to maintain their position on the edge of the bed. This was due to the fact that in places the perimeter of the bed was poorly defined as the growth was patchy in places.

Although the beds were not specifically surveyed for their density or the amount, if any, of *Labyrinthula* or epiphyte cover, the divers were also asked to take records of any notable occurrences.

Location Results

West Carrick Roads

This bed extends from Penarrow Point southwards in the shallow stretch of water between the land and the deeper channel of Cross Roads. The *Zostera* beds extended from 50° 10.45'N, 5° 02.50'W at the northernmost point to 50° 10.24'N 5° 02.58'W at the southernmost point. However the bed at these extremes was patchy and although *Zostera* was present it is debatable if this can be call a bed. The main body of the bed lay between 50° 10.41'N, 5° 02.51'W and 50° 10.26'N and 5° 02.50'W. The eastward extent of the bed lay in a line along the longitude of 5° 02.46'W and the westward edge of the bed was parallel with the coastline where the seabed was comprised of sand and muddy sand. The rocky part of the seabed was dominated by various algal species. These were not

surveyed. Here the bed was continuous and provided a dense canopy of leaves. Although no effort was made to survey the bed in any detail, it was noted that the leaves were covered in epiphytes and some silt. The absence of any black spots associated with the slime mould *Labyrinthula* was also noted. It is not known whether there have been any previous recordings of *Labyrinthula* within the *Zostera* population of the Fal estuary.

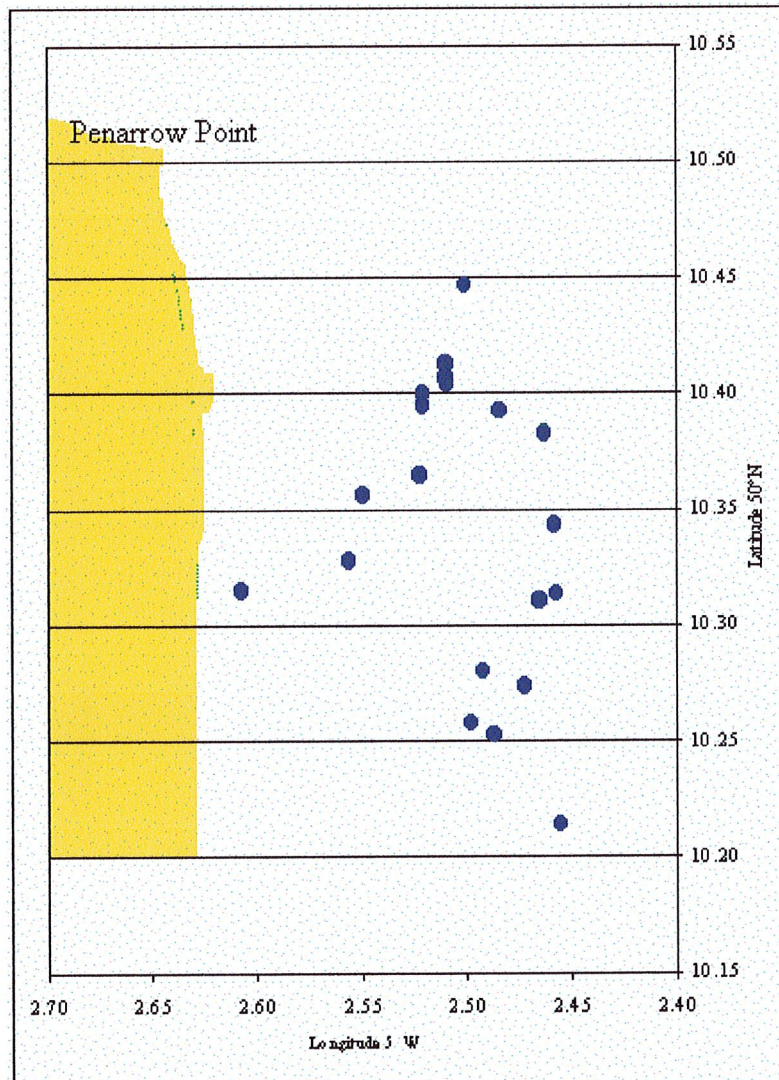


Figure 4 The location of *Zostera* around Penarrow Point

Saint Mawes Bank

The investigation to establish the extent of the *Zostera* beds on St. Mawesbank was carried out by two methods. The northern and southern edges of the beds were established with *in situ* observations made by snorkelling. The western edge of the bed coincides with the eastern edge of the maerl bed found on St. Mawes bank. The maerl transects were terminated upon reaching the

Zostera beds and the positions of the divers were noted upon surfacing giving the western edge of the *Zostera* bed. The western edge of the bed was also established by further *in situ* observations. No effort was made to determine the density of the beds, or to measure the amount of infection within the beds. No occurrence of the black spots indicative of slime mould infection was noted. During the course of the surveys, several boats were noted water skiing over the *Zostera* beds. To date, the effects of water skiing over shallow beds are unknown though it is possible the turbulence caused by the propeller wash of the boat may disturb the plants and even the rhizomes. However, on one occasion one of the boats was observed to be exchanging water skiers by walking over the beds to the shore to the south of Carclase Point. Repeated trampling will have a detrimental effect on the beds.

The Northern boundary of the *Zostera* bed was at latitude 50° 10.29'N and ran continuously along the eastern edge of St. Mawes Bank to the southern boundary at 50° 09.51'N.

Saint Mawes Harbour

This area was primarily surveyed for the presence and percentage cover of maerl. However, on the original map of the Fal estuary it was noted that *Zostera* had been present in 1992. Therefore all divers undertaking the maerl survey were asked to note the presence of any *Zostera*. The initial point survey of the maerl beds, centred at 50° 09.11'N 5° 01.32'W off Castle Point found no *Zostera*. However, two subsequent transects were swum from this point to investigate the presence of *Zostera* within the harbour.

Transect 13 From Maerl datum point across to Amsterdam Point and then to 50° 09.22'N 5° 00.34'W

The initial section of this dive was over the maerl bed and therefore no *Zostera* was recorded. After this, sparse *Zostera* growth was noted across the width of the harbour. However, this was in the form of occasional individual plants and could not be described as a bed. No attempt was made to record actual plant density though visual estimates would suggest a plant density of no more than 1-2 plants per square metre. In addition, no effort was made to establish the extent of the rhizome system beneath the seabed and as no historical data was available for comparison, it is not possible to say if this is new growth being established or if it is the end of a dying bed. The sparse cover extended across to Amsterdam Point where there was a dense bed of *Zostera* which marked the start of the bed that runs southwest from Amsterdam Point. The transect then continued east from Amsterdam point east across the bay adjacent to Cellars Bay. There the seabed comprised of more muddy sand and had a greater cover of algal growth. No *Zostera* was noted. This bay is a popular anchoring point for yachts and includes a number of chain based permanent moorings. Given this, it would be difficult for any significant amount of *Zostera* to become established.

Transect 14 From Maerl datum point to 50° 09.17'N 5° 1.46'W

The initial part of this transect was over the maerl bed and therefore no *Zostera* was observed. Following this, the transect continued over sand and although was in the area where *Zostera* had previously been reported, none was recorded.

Having established the eastern edge of the *Zostera* bed on the southern edge of the harbour, further searches were carried out by means of visual observations from the surface. This was carried out from the RIB by driving slowly along the edge of the bed and use of snorkellers. Although in patches, there is dense growth all along the southern edge of the harbour with *Zostera* extending to a depth of approximately 3m. During this part of the survey several yachts were noted at anchor, one of which was within one of the *Zostera* patches with two others probably also anchored within the *Zostera*. This activity may account for the patchy nature of the beds, however, due to the lack of time, no *in situ* investigations were made.

Percuil River

The *Zostera* beds further up the harbour were identified by observation from the RIB and by *in situ* observation from snorkel divers. The beds identified are small and highly patchy in nature. However, where present, the growth of *Zostera* was thick enough to be termed a bed. No effort was made to identify the species of *Zostera* present nor were any surveys carried out to establish the density or health of the bed. The growth was concentrated between the northeastern side of the Polvarth Point up to the slipway at the boatyard. This area is again a popular area for anchoring of yachts and the survey was complicated by the number of boats moored and the amount of traffic in the area.

5 Discussion

Maerl Survey

The survey of St. Mawes bank showed extensive deposits of maerl, a high proportion of which was live especially in shallow water. Although maerl was noted at depths greater than 6m the majority of this was dead and assumed to have been transported there from the bank by tidal water movement. As maerl is an algal species this is most probably due to the amount of ambient light available. Although no survey dives were carried out to the deepest part of the channel it is assumed that, due to the lack of light at these depths, there is no live maerl present. However, although where there was little or no live maerl present it is still possible that it forms an important habitat for other species. The eastern edge of the maerl bed often coincides with the start of the *Zostera* bed that is found in the shallow and intertidal water on the edge of St. Mawes bank. There were no recorded occurrences of maerl within the *Zostera* beds.

The maerl was present in varying amounts southwards from Carclase Point towards Castle Point at the entrance to St. Mawes harbour. Transects 10 and 7 show that this continues past the datum marker used off St. Mawes castle. However, the maerl is absent from the rocky ledge that forms the base of the seabed and intertidal area round Castle Point. The deposits of maerl continue up St. Mawes harbour away from the datum point in aggregations often in association with the brown algae *Cutleria mutlifida*. The reduction in the amount of live maerl found to the east of the datum point is probably due to the lack of ambient light as it is covered by the algae.

Zostera Survey

The surveys carried out have fixed the boundaries of the *Zostera* bed to the west of Carrick Road and also the area covered by the *Zostera* bed on the St. Mawes Bank. The combined use of SCUBA divers and surface observations worked well in the shallow water despite the presence of water skiers during the work around Carclase Point. However, this did require the close attendance of the chase boat. As mentioned above, the presence of water skiers working from the small beach at Carclase Point may pose a long-term threat to the *Zostera* through trampling and possibly the turbulence caused by repeated rapid overturn of the water column by the boat propellers.

The *Zostera* bed on the western side of Carrick Road around Penarrow Point was reasonably well defined though there were a few places where the *Zostera* was present only at a very low density. It is not known if this is evidence of a spreading of the *Zostera* rhizomes or a reduction in the bed area. The densest bed of *Zostera* was found on the eastern edge of St. Mawes bank. As noted, the start of this bed often coincided with the edge of the maerl beds. No *Zostera* was noted round the point of Castle Point nor along the northern bank of St. Mawes harbour except for some small patches round Polvarth Point towards the boatyard. The *Zostera* found on the southern shore of the harbour between Amsterdam Point and Carricknath Point was highly patchy in nature which may be evidence of anchor damage from the many yachts that were observed there during the period of the survey.

References

- Cleator, B., Nunny, R. and Mackenzie, G., 1996. *Coral Cay Conservation Sub-Aqua Club Isles of Scilly 1993 Expedition Report*. Coral Cay Conservation Sub-Aqua Club, London.
- den Hartog, C., 1987. 'Wasting disease' and other dynamic phenomena in eelgrass *Zostera* beds. *Aquatic Botany*, 27: 3-14.
- den Hartog, C., 1989. Early records of 'wasting disease' like damage in eelgrass *Zostera marina*. *Dis. Aquat. Org.*, 7: 223-226.
- Fowler, S.L., 1992. Marine monitoring in the Isles of Scilly, 1991. Report to the Nature Conservancy Council. 31pp.
- Grassle, J. F., and J. P. Grassle, 1978. *Life histories and genetic variation in marine invertebrates, in Marine Organisms*. Edited by B. Battaglia and J. Beardmore, pp. 347-364, Plenum, New York.
- IGC, 1996 [Online] *Marine Protected Areas*. Available from <http://www.igc.apc.org/habitat/treaties.mar-prot.html>.
- Moore, K.A. and Wetzel, R.L., 2000. Seasonal variations in eelgrass (*Zostera marina* L.) responses to nutrient enrichment and reduced light availability in experimental ecosystems. *Journal of Experimental Marine Biology and Ecology*, 244 (2000) 1-28.
- Raines, P., Nunny, R. and Cleator, B., 1993. *Coral Cay Conservation Sub-Aqua Club Isles of Scilly 1992 Expedition Report*. Coral Cay Conservation Sub-Aqua Club, London