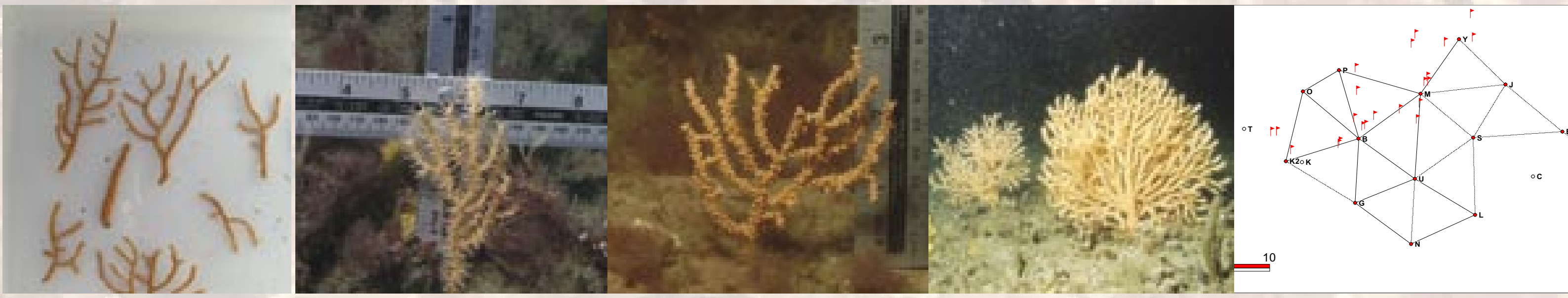
Dorset Wildlife Trust

THE wildlife TRUSTS

Worbarrow Reefs Seafan Project

2003-2005

ENGLISH NATURE



seasearch

Protecting *Wildlife* for the Future

Worbarrow Reefs Seafan Project
2003-2005

A Dorset Wildlife Trust report
by Peter Tinsley

Contents

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This project was carried out with financial support from English Nature

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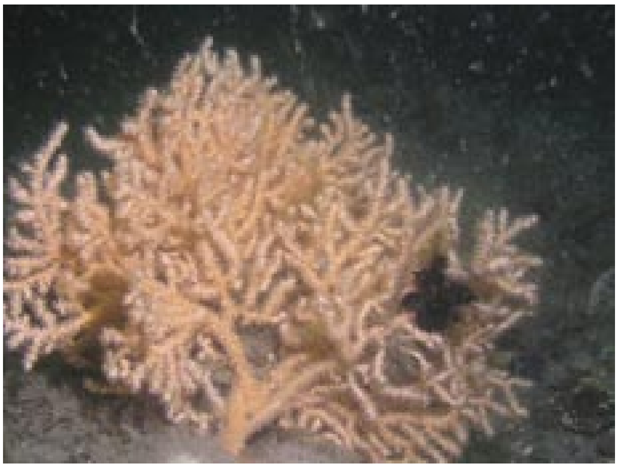
1. Background

This report covers work carried out by Dorset Wildlife Trust between 2003 and 2005, with the support of English Nature. The aims of the project were to: monitor the health of a recently discovered population of pink sea fans, *Eunicella verrucos*; develop a team of volunteer divers and raise awareness of seafans among the local community.

The pink seafan, *Eunicella verrucosa*, is a long-lived, slow growing gorgonian coral, one of two gorgonian species known from coastal UK waters and the only species likely to be encountered by divers in Dorset. It is found mainly on upward-facing bedrock where water movement (wave or tide) is moderately strong. It often occurs as part of a recognisable biotope - CR.HCR.XFa. ByErSp.Eun (*Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock), commonly found on rocky outcrops surrounded by coarse sediment[1].

E. verrucosa is a Biodiversity Action Plan (BAP) species and is protected under Schedule V of the Wildlife and Countryside Act 1981. Intentional damage, possession and sale of sea fans is illegal.



Single colony of E. verrucosa photographed on Southbourne Rough - currently the most easterly record (Photo: Mike Markey)

The distribution of *E. verrucosa* in the UK is given as north Pembrokeshire to Portland Bill (MarLIN, Fig. 1)[2]. Until fairly recently, other than anecdotal reports of seafans on the wreck of the *Black Hawk*, (a popular dive site in Worbarrow Bay), all records of *E. verrucosa* from Dorset were from west of Portland Bill and the above was considered to be a reasonable indication of the distribution of both the species and the biotope (see Fig. 2a)

Fig. 1 Distribution of *E. verrucosa* around British Isles. Source - MarLIN

During the summer of 1999 Dorset Wildlife Trust carried out a remote sensing survey of the Purbeck Marine Wildlife Reserve, using an acoustic ground discrimination system (AGDS) with an array of 100 drop-down video samples for ground-truthing. One of these video sequences revealed a single colony of the pink seafan, *Eunicella verrucosa*. Early in the following year a detailed sidescan survey of the same area revealed a series of concentric ridges and reefs in Worbarrow Bay, interspersed by waved coarse sand/gravel. Fig 3 (overleaf) shows the track of the drop-video sequences (in red) in relation to these ledges. Track no. 14 is the only one that recorded a seafan. Subsequent dives in this area, aided by the sidescan data, revealed an unexpected density of seafans on at least one of the ledges (highlighted in Fig. 3).

Further dives, targeting ledges revealed by the sidescan data, have produced other records of *E. verrucosa* off Worbarrow Bay. During the period of this study, the easternmost record for *Eunicella* has been extended as far as Southbourne by Seasearch divers (Fig. 2b)

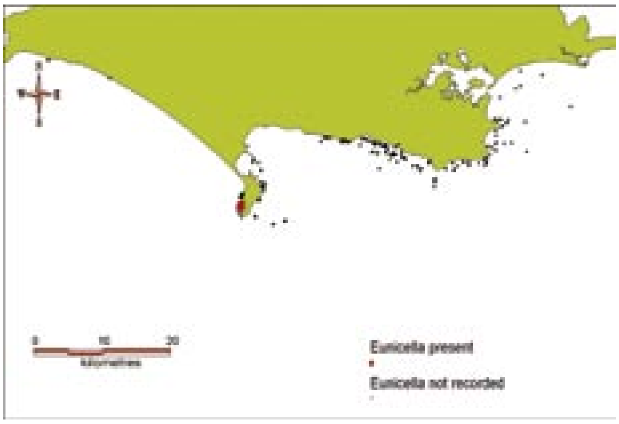


Fig. 2a Distribution of Eunicella verrucosa - pre 1999.
Source - Dorset Seasearch

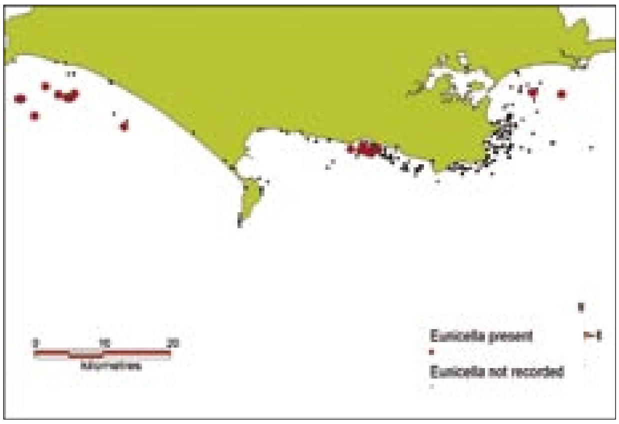


Fig. 2b Distribution of Eunicella verrucosa - 1999-2004
Source - Dorset Seasearch

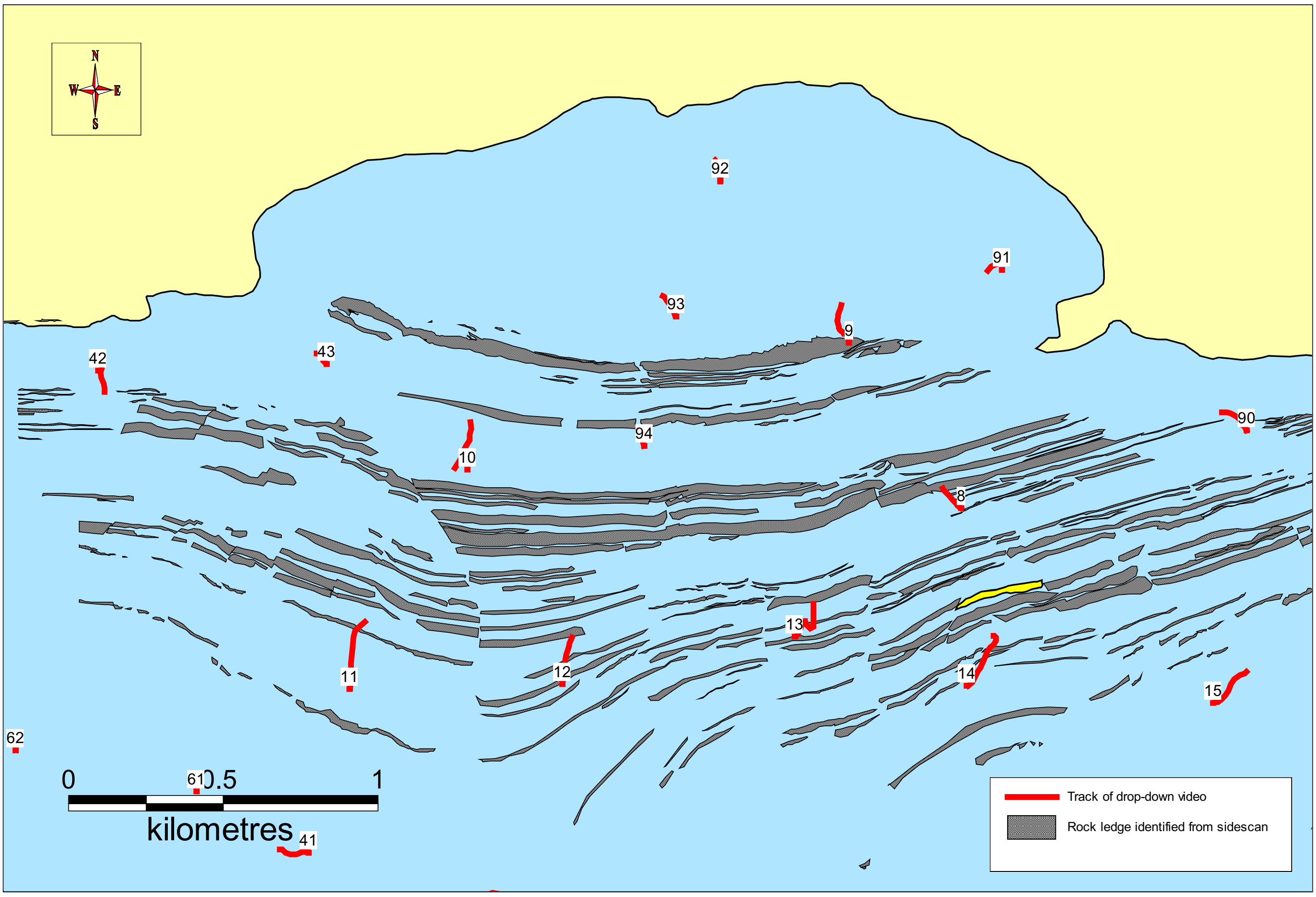


Fig. 3 Worbarrow Bay, showing location of rocky reefs determined from sidescan data. (Source, Alan Drayson, PhD thesis). The reef featuring in this report is highlighted in yellow

2. The Study Site

The reef chosen for this study is approx 15m wide and 200m long with a relatively even upper surface sloping up from a gravelly sand seabed at 22m in the north to a broken edge at 19m to the south. The study area is approx. 200m^2 and situated at the western end of the reef, near a noticeable fault.

The fault makes it easier for divers to relocate the site. Divers are dropped by a shotline deployed just to the north of the site, using GPS coordinates. Divers then swim south across the sand until they meet the reef - usually only a few metres. If the study site is not visible, the divers swim west along the lower edge of the reef until they reach either the study site or the fault. If they reach the fault without encountering the study site, they will be approx 30m away from the site, in the other direction.

The site was marked by installing 16 reference markers. These are small lettered floats attached to a short line, clipped to a seabed anchor point. The reference points were placed at approx 5m intervals to form a grid and were fixed to the seabed using a Rawl hand-drill and lump-hammer to drill a hole in the rock (limestone) before plugging and screwing with stainless steel screws. With practise, this tool can drill a 7mm diameter hole in approx 5 minutes.

Once the reference points were in place, divers with tape measures recorded the distances between pairs of points, which allowed a scale map of the site to be constructed.

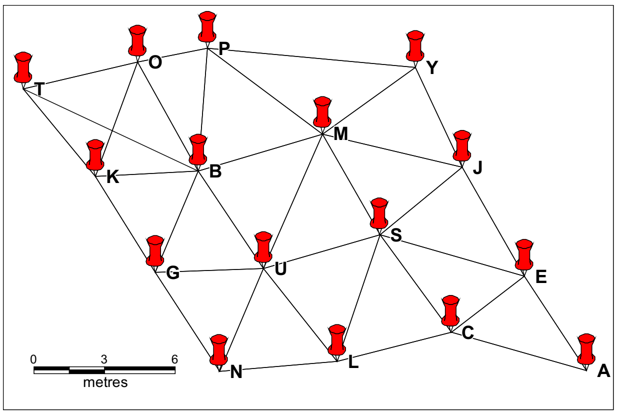
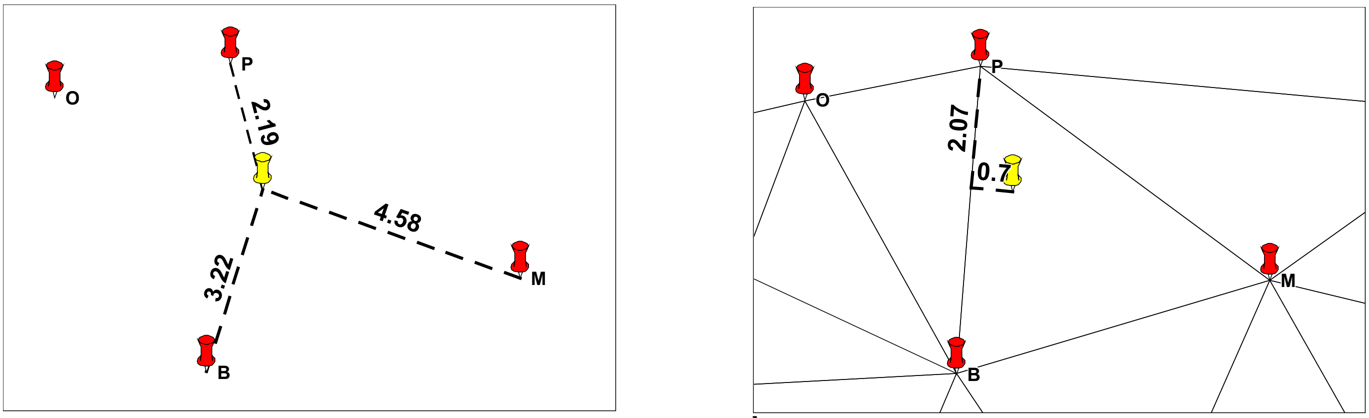


Fig. 4 Map of study site showing layout of lettered datum points

Two techniques were used to map individual fans within the study site. The first was a trilateration technique which involved a pair of divers taking measurements from three adjacent reference points to each fan (see Fig. 5a). This proved very time-consuming. A quicker method involved laying a section of tape measure between two reference points and the divers measuring the offset distance from the tape to the fan, also recording the distance along the first tape (see Fig 5b). A total of 22 colonies were mapped during the first year of the project. The fans occur at a density of 2-3 fans per 10m^2



a b

Fig. 5 Diagram illustrating the mapping techniques. a shows measurements necessary for the trilateration technique. b shows the datum offset technique

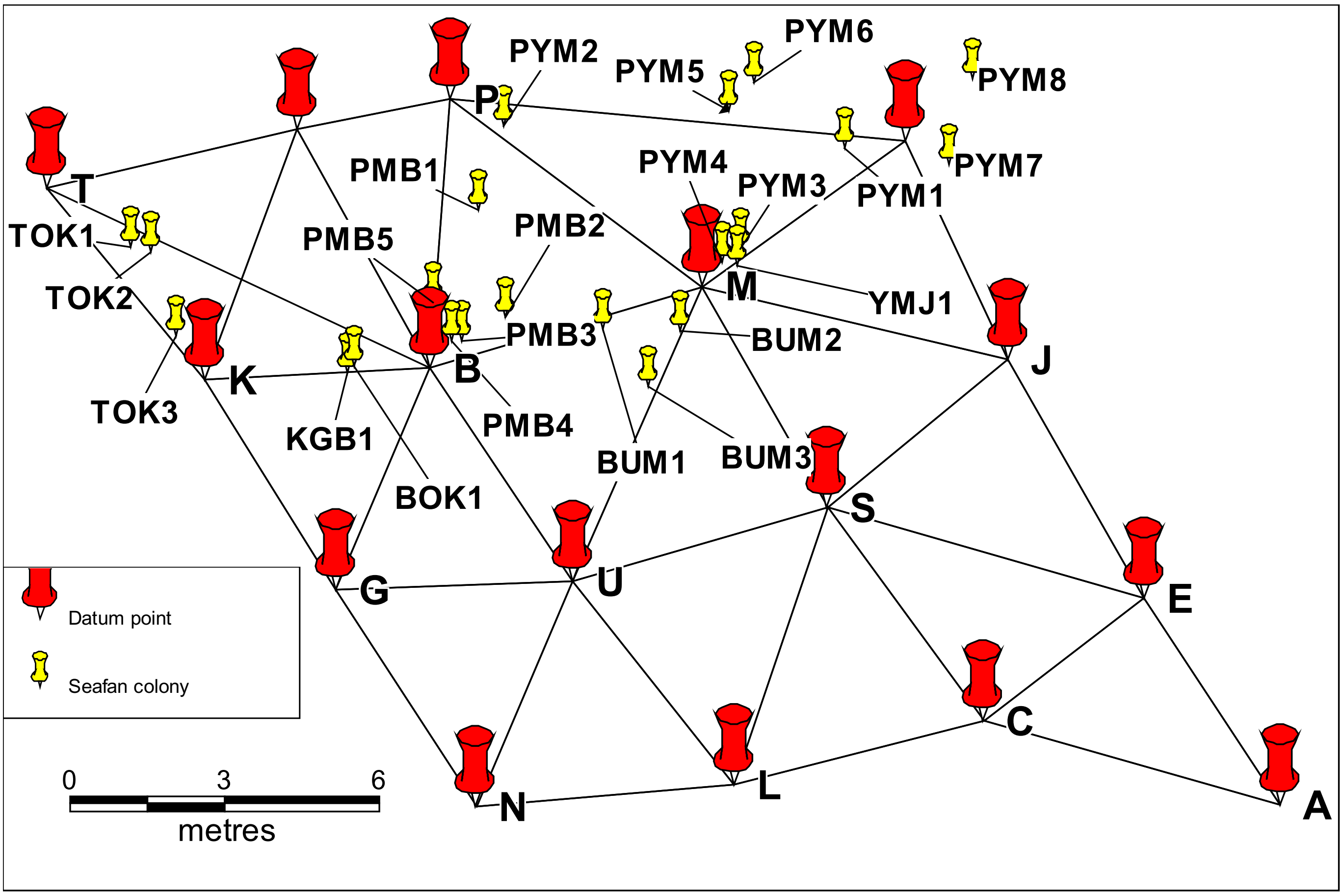


Fig 6 Map of study site showing location of seafan colonies mapped during this study

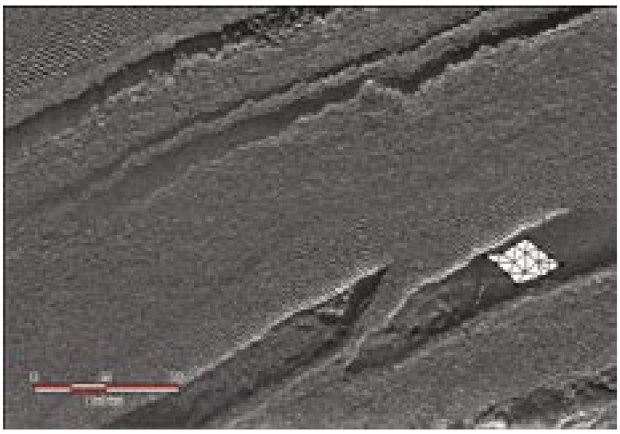


Fig. 7 Sidescan trace showing approx position of study site on reef. Narrower adjacent ridges are also visible

3. Use of volunteers

This project was heavily dependent on the use of volunteer divers to set up the site infrastucture and to collect the data. Divers were recruited through Seasearch and were offered subsidised training in underwater survey techniques (course run by Nautical Archaeological Society), underwater photography (course run by Colin Munro) and seafan ecology. The aim was to develop a team of trained volunteers who would stay with the project throughout the three years - this was partly successful, but many other people joined in as the project continued. This was less efficient (more time had to be spent in training and new volunteers were not familiar with the site, so were unable to find their way round as easily) but means there is now a larger base of experienced divers to continue monitoring into the future.

Seafans on display at the Fine Foundation Marine Centre, Kimmeridge Bay

4. Awareness raising

The project was advertised to divers through Dorset Seasearch newsletters and the Dorset Wildlife Trust website - www.dorsetwildlife.co.uk. Progress updates were mailed out to participants throughout the project.

To reach the wider public, an aquarium display was established at the Fine Foundation Marine Centre, Kimmeridge Bay, within the Purbeck Marine Wildlife Reserve. Approx. 22,000 people visited the centre during 2005. Two fans were collected under licence from the reef adjacent to the study site in 2004 and were placed in a custom-built cylindrical acrylic aquarium. The construction of the aquarium was funded by a grant from the Crown Estate's Marine Stewardship Grant Scheme. The fans were attached to rocks using the same method as described later for propagating the fans.

The fans are kept in cooled (below 18°C), filtered seawater with water flow maintained by two small powerhead pumps. They are fed on a commercially available frozen "red plankton" and Marine Snow™. Lighting is kept low to discourage algal growth - an overhead light switches on when visitors approach the aquarium and switches off automatically after a couple of minutes.

The exact requirements for keeping *Eunicella* in aquaria have not been worked out but the Zoological Society of London and The Deep aquarium in Hull are jointly working on an English Nature funded project to find the best conditions for keeping *Eunicella verrucosa* in aquarium conditions. Our experience is that the fans will survive well during the summer months but seem to reduce feeding during the winter, the colony becoming very thin. Minimum water temperature in the aquarium during this period is about 11°C - on the seabed, winter temperatures as low as 6.4°C have been recorded on the study site.

5. Seabed temperature

Munro (2003) maintained that it is essential to collect site-specific seabed temperature data[3]. To this end, a Tinytalk temperature logger was placed on the study site in Aug 2003. It was set to record the seabed temperature every 4 hours and can run for up to 300 days before running out of data storage.

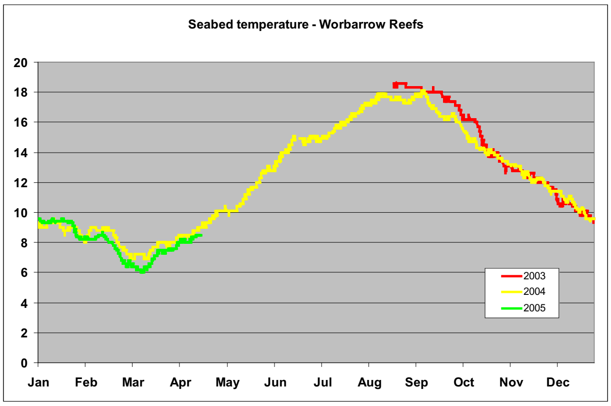


Fig. 8 Seabed temperature at the study site

The maximum temperature recorded so far is 18.6°C, during the last week of August 2003 - this was an unusually hot summer. The peak temperature for 2004 (18.1°C) occurred on 10/11 September.

Minimum temperature during the winter of 03/04 was 6.9°C, during the first week of March. In 2004 during the same period, the temperature dropped to 6°C.

It has been suggested that temperature is a cue for reproduction, though reproductive state was not studied in this project. Munro also suggested that *Eunicella* in UK waters may be living close to its upper temperature limit. Throughout the rest of its range it occurs only in deeper water, leading to the possibility that only at the northern edges of its range can it survive in shallow water. If this is true, then rising sea temperatures could adversely affect sea fan populations in shallow water.

6. Habitat

The study site is part of a broad rocky reef with a generally uniform, smooth upper surface rising at a gentle slope from duned gravel to the north (22m) up to a broken bouldery edge to the south (19m). The current here runs nearly parallel to the ledges with a spring tide maximum speed of 1.7kt (from tidal diamond at 50° 36.2'N 2° 16.3'W). The surface of the reef is covered with a low silty hydroid/bryozoan turf with filamentous and foliose red algae becoming more frequent at the shallower end of the reef. The more obvious species, apart from *Eunicella*, are branching and cushion sponges including *Polymastia boletiformis, Stelligera stuposa, Axinella dissimilis,* and *Dysidea fragilis*, occasional small *Pentapora foliacea* colonies, *Omalosecosa ramosa* and *Alcyonidium diaphanum.*

During the period of the project, divers visited several other nearby ledges, identified from the sidescan traces. The ledges immediately adjacent are similar in depth and are more or less parallel but are much narrower, with only the top edge of the ledge outcropping from the sediment and they are home to few seafans.

The most similar ledges are those at the opposite end of Worbarrow Bay, off Mupe Rocks. These were visited in September 2005 and appear to support a very similar habitat, but with a lower density of seafans, many of which had dogfish egg-cases attached.

Erect sponges, hydroids, bryozoans and red algae on the reef top

7. Photographic monitoring

The following equipment was purchased for this project:

Olympus C5050z digital camera in PT-015 housing

Ikelite DS50 digital strobe with TTL slave and diffuser

Epoque DCL20 Wide angle conversion lens

A reference scale was constructed from two aluminium rulers, fixed to the camera flash tray by an aluminium arm. This could be easily placed behind a sea fan colony to allow a scaled photograph to be taken. The wide angle conversion lens allows fans larger than 30cm high or wide to be photographed using the same set up - the lens can be screwed on to the camera housing lens port underwater.

The year 1 photographs were sealed in laminated "luggage tags" and strung together to form a waterproof identification guide which could be taken to the seabed by divers and used, in conjunction with a scale map of the site, similar to Fig. 6, to locate and re-photograph the fans.

In 2005, labelled tags were attached loosely around the base of some of the fans to make re-location easier - this has been done at other sites without any obvious damage to the fans.

Photographs taken using the wide angle adaptor show noticeable radial distortion. This was rectified using the Panorama Tools (available free from http://www.path.unimelb.edu.au/~dersch/PanoTools.zip) plug-in for Adobe Photoshop. The coefficients used for this correction were obtained from http://www.camerasunderwater.co.uk/info/m67_wide.html

The images are then registered in MapInfo using a non-earth projection and the polyline tool used to trace individual branches. These polylines can be translated to actual branch lengths and this allows comparison of individual branches year by year.

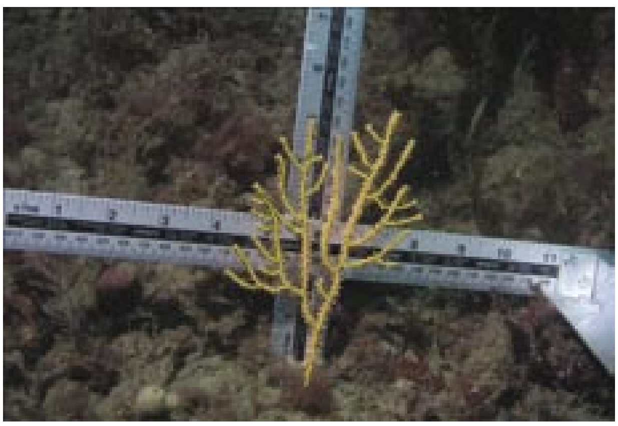


Fig. 9 Fan PYM5 with branches traced in MapInfo

Only the smaller, less complex fans were suited to this analysis and even then, some branches were impossible to trace year by year.

For other fans the overall height and width was taken from the images.

BranchID	Length	BranchID	Length
1	146.78	15	19.99
2	110.85	16	7.53
3	71.4	17	20.54
4	38.27	18	38.41
5	10.87	19	19.97
6	42.77	20	10.59
7	18.5	21	19.56
8	10.8	22	40.06
9	38.31	25	6.66
10	8.4	27	8.8
11	13.04	24	66.83
12	23.33	26	11.38
13	12.07	28	18.58
14	11.88		

Table 1 Branch lengths of fan PYM5 for Aug 2003

7.a Growth rates

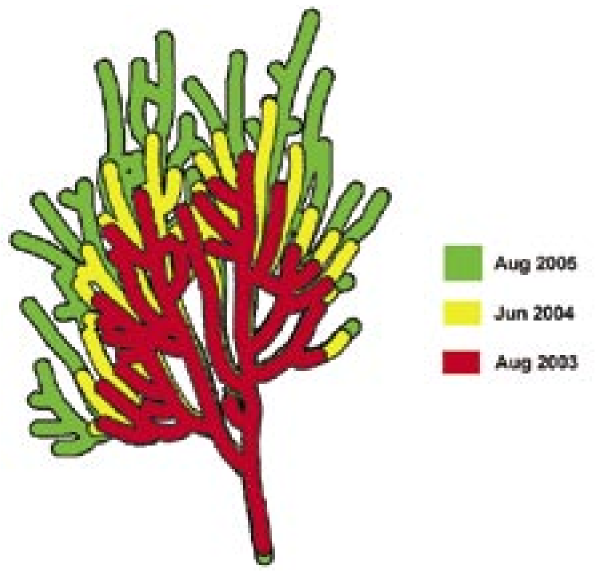


Fig. 10 Superimposed traces of branches of fan PYM5 over three years.

Above is a diagram showing the growth of fan PYM5 during the period of the study - this is the only fan for which it was possible to measure all of the branch lengths for three consecutive years. The greater increase in 2005 (green) compared to 2004 (yellow) is likely to be largely due to the longer growing time between photographs (extra three months).

It is reasonable to assume that the total branch length is more or less proportional to the feeding capacity (number of polyps) of each colony. Total branch length for fan PYM5 increased from 85cm (Aug 2003) to 116cm (Jul 2004) - an increase of 38%. This grew to 187cm by Aug 2005, an increase of over 60% (again, bear in mind that the periods between photographs are not constant)

There does not appear to be any relationship between the length of a branch and how much it grows - all "open-ended" branches appear to have the capacity to grow by a generally similar amount.

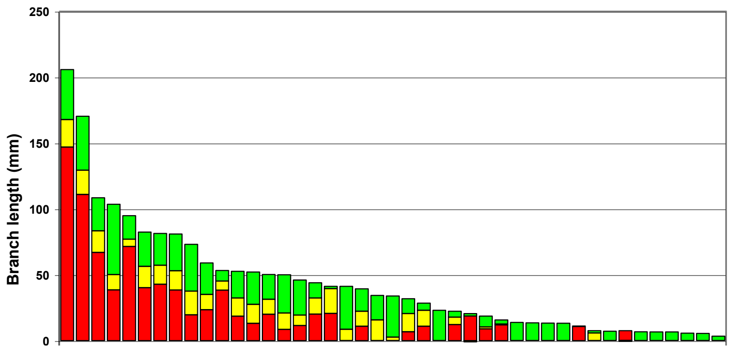
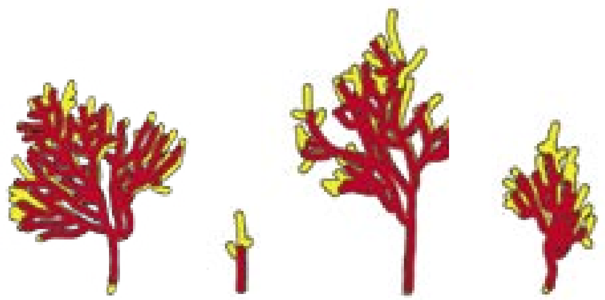


Fig. 11 Chart showing the increase (in mm) of individual branches of fan PYM5. Red - branch length in Aug 2003; Yellow - increase to Jun 2004; Green - increase to Aug 2005

Four other fans (PYM4, PYM6, PMB2 and YMJ1) had a simple enough growth pattern for all branches to be measured both in Aug 2003 and Jun 2004. Their overall increase in total branch length ranged from 20% (PYM4) to 144% (PYM6). The colony with the most dramatic increase was a single stem, less than 3cm high in 2003, almost doubling in height and adding two side branches by the following year. Conversely, PYM4, the colony showing the smallest percentage increase in overall branch length, was the most complex fan, having 40 branches in 2003, but was not the tallest.



PYM4 PYM6 PMB2 YMJ1

It also seems to hold true that the average growth in individual branches decreases as fans become more complex. This could be in part due to the increase in branches with no room for further growth as the fan becomes more complex.

7.b Fan size

A study carried out by Chris Wood[4] (2003)in 2001/2002 recorded the maximum, minimum and average sizes of seafans from a number of sites across the range of *E. verrucosa* in the UK. The largest fans, by far, were those from the Channel Islands, up to 75cm high and 100cm wide. The largest fans measured during this study were 38cm high and 48cm wide. This is larger than that recorded by Wood for Purbeck (25cm high and 23cm wide) but still puts Worbarrow Bay at the lower end of the size scale. As was noticed in Wood's study, the largest fans tend to be wider rather than taller.

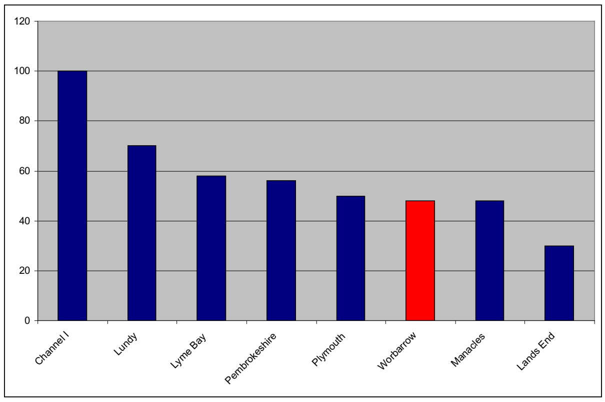


Fig. 12 Maximum fan size (height or width) plotted by area. Worbarrow data are from this study, other sites from Wood (2003)

7.c Growth patterns

From studying the branch growth, it would seem that the growth pattern of *Eunicella verrucosa* can be explained by a few simple rules, leading to the complex fan structures seen in large fans.

Suggested rules for fan growth

1 Colonies begin with single stem

2 All branches can grow from the tip, up to several centimetres per year

3 All branches can develop side branches

4 All branches "prefer" to grow vertically upward.

5 Growth is restricted to a single plane – perpendicular to the tidal current

2, 3 & 4 are subject to the following rules which are based around avoiding overlapping of branches and assume the ideal minimum distance between branches is 1cm – a distance which can just be bridged by two expanded polyps on adjacent branches

6 Daughter branches develop at approx 1cm intervals along either side of the main branch (subject to rule 6a)

a. Daughter branches develop only if there are no adjacent branches closer than 1cm – this often means that daughter branches can only develop on one side of a parent branch and will prevent many branches from ever bearing daughter branches

7 Daughter branches initially grow perpendicular to the parent branch (and perpendicular to the current) until the tip is approx 1 cm from the parent, after which growth will follow rule 4, unless this brings the tip closer than 1cm to another branch. In this instance, growth will tend to parallel the adjacent branch, returning to the vertical wherever possible

8 There appears to be an environmental factor limiting overall colony height, such that the larger fans tend to be wider rather than tall

Fig 13 shows how a branch of fan PYM5 developed between 2003 and 2005. The original branch (1) has a single daughter-branch (1.a) on its left hand side in 2003. The following year both of these branches have extended and 1.a has developed its own daughter-branch (1.a.1) on its outside edge

By 2005 there is a third level of branching as 1.a.1.a, 1.a.1.b and 1.a.1.c appear - again on the outside edge of the branch 1.b also appears near the end of the original branch. Note that growth of 1.a and 1.a.i closely parallels that of branch 1, maintaining the optimum distance between branches. Branch 1.b has developed near the tip of branch 1, which has, in turn, "pushed" branch 1.a further away from branch 1

Fig. 14 shows the development of fan PYM5, illustrating that most of the branches in the centre of the fan are second or third order branches, with the higher order branching restricted to the outer edges of the colony

Fig. 15 shows the structure of fan PYM5 in Aug 2005, but showing only "mother" branches (i.e. - those branches bearing daughter branches). This shows more clearly the tendency of branches to grow vertically wherever possible.

Fig. 16 shows how a small internal branch is blocked by surrounding branches and has failed to grow in two years

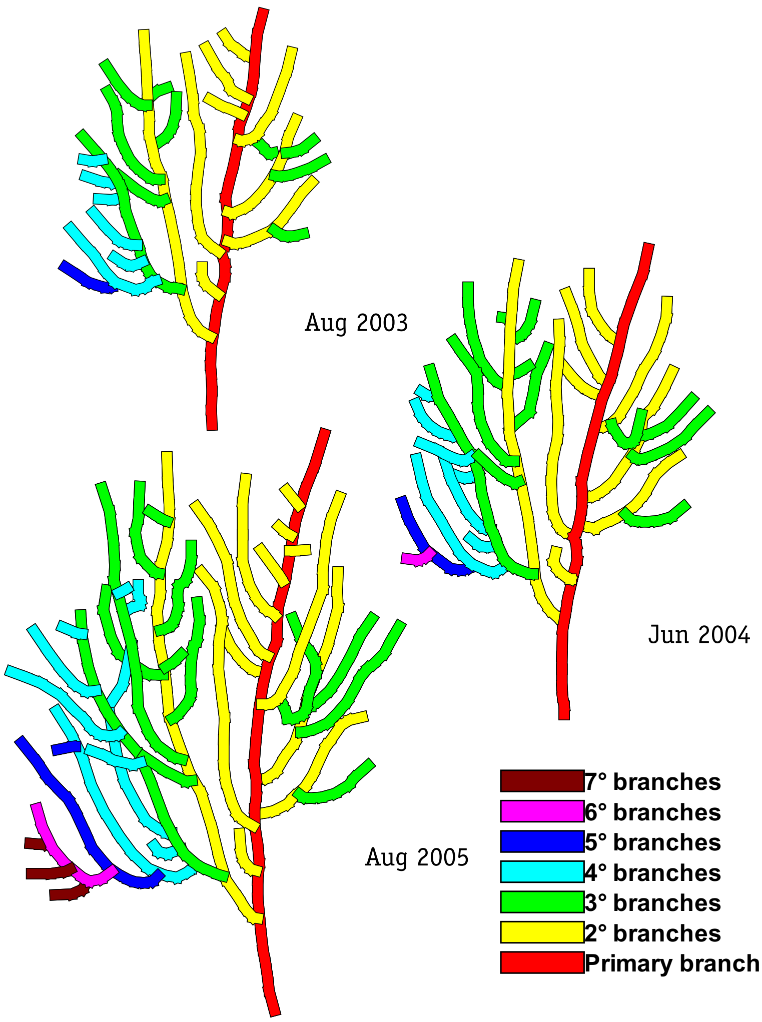


Fig 14 Diagram of Fan PYM5 showing the development of branching over three years

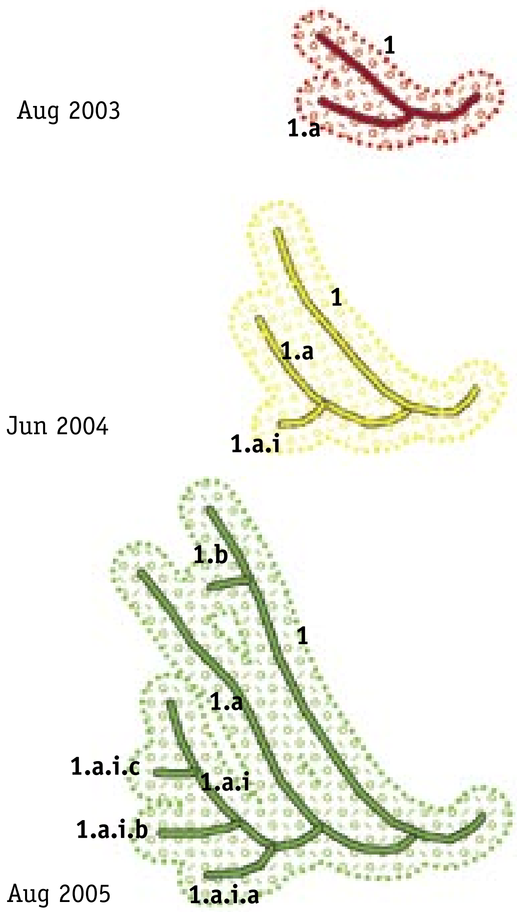


Fig. 13 Development of branching pattern in fan PYM5 between 2003 and 2005

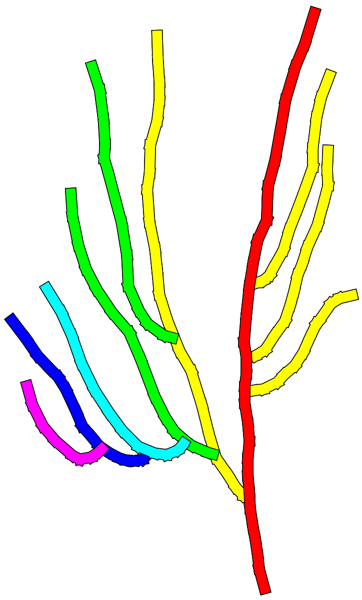


Fig. 15 Structure of fan PYM5 showing only "mother" branches

Fig. 16 A blocked internal branch as photographed in 2003 (left) and 2005 (right)

8 Propagation

Tropical corals and gorgonians have been propagated from cuttings for the aquarium trade for many years. A technique described for gorgonians[5] has been applied here to *Eunicella*.

A single colony was collected from adjacent to the study site in August 2004 and transported to the shore in a large bucket of seawater. This was then snipped into seven pieces with wire clippers (Fig 14)

5-10mm of the base of each clipping was stripped of coenenchyme, exposing the wood-like skeleton beneath. The clippings were left in a tray of seawater while the bases were prepared. (Fig. 15)

Pieces of rock (in this case, broken fragments of Purbeck limestone slabs) were pre-drilled with a masonry drill of similar diameter to the clippings. A numbered label was attached to each rock.

Cyanoacrylate (superglue) gel was squeezed into the holes and each clipping held in place until the glue set (around 10 seconds). Rocks and clippings were placed back in water and returned to the sea in August 2004, being placed alongside the study site. Photographs of each clipping were taken once on the seabed.

(Note - clipping 7 remained in the Marine Centre aquarium at Kimmeridge Bay until May 2005) during which time the top half of the stem lost all of its coenenchyme to nibbling blennies)

Clippings were re-photographed in August 2005.

The same technique was used to mount two complete colonies for display in the marine aquarium at the Marine Centre in Kimmeridge Bay.

Results

All clippings were found to be intact and growing in August 2005. There was no sign of any fouling, despite at least one of the more delicate clippings (No. 6) having lost some of its coenenchyme from the branches during the propagation process. This would suggest that slight abrasion would not normally be detrimental to healthy fans. All had healed over at the base - in one case (No.4) spreading over the surrounding rock surface (Fig. 18).

Clipping No.5 had lost a short section at the tip of one of the branches, but all clippings showed good growth. Overall 46 branches in 2004 had increased to 57 branches in 2005, adding a total of 50.2cm - about a 45% increase in total branch length. Average increase per branch was almost 9mm and the maximum increase was 21mm.

The relative ease with which *E. verrucosa* can be propagated from clippings opens up opportunities for ecological experiments, including transplantation experiments.

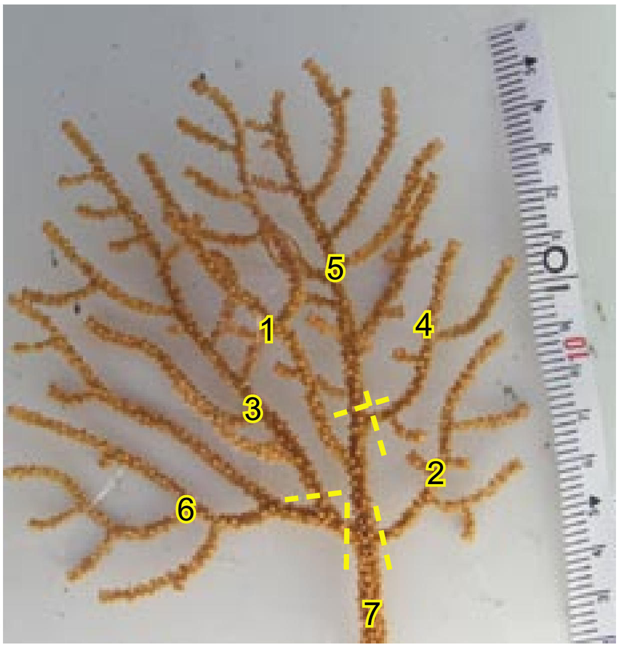


Fig. 14 Colony ready for cutting into clippings, showing location of cuts

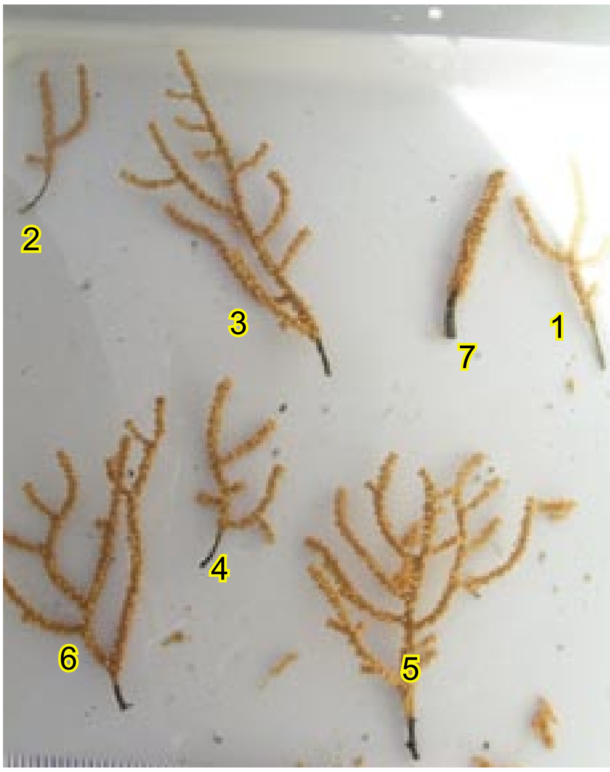


Fig. 15 Colony after division into clippings, bases stripped ready for mounting

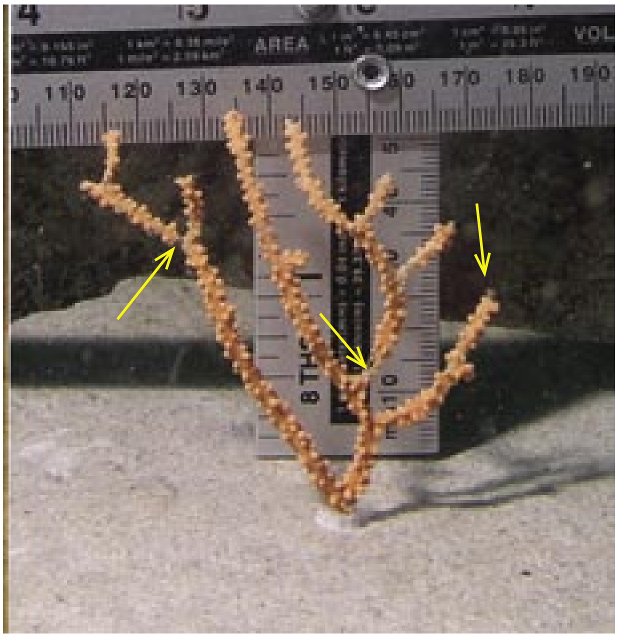


Fig.16 Clipping No.6 shortly after being returned to the seabed. Note several areas where the underlying skeleton is slightly exposed.

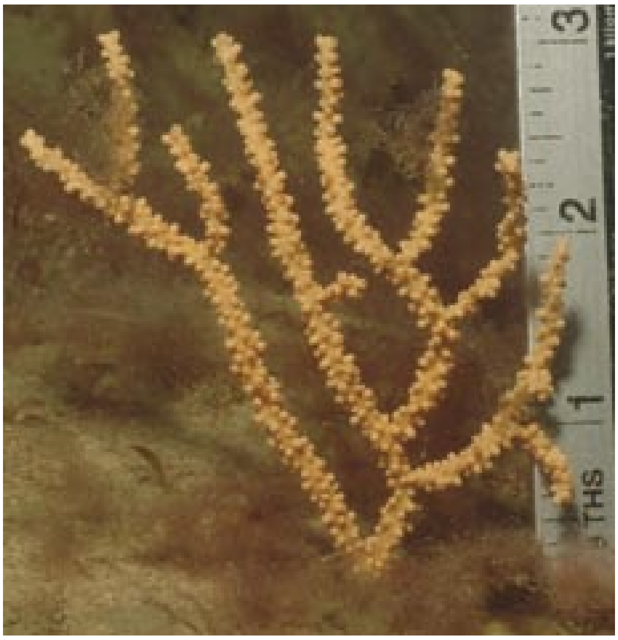


Fig. 17 Clipping No. 6 one year later

Fig. 18 Clipping No.4 after one year on the seabed showing how coenenchyme has spread over the surrounding rock

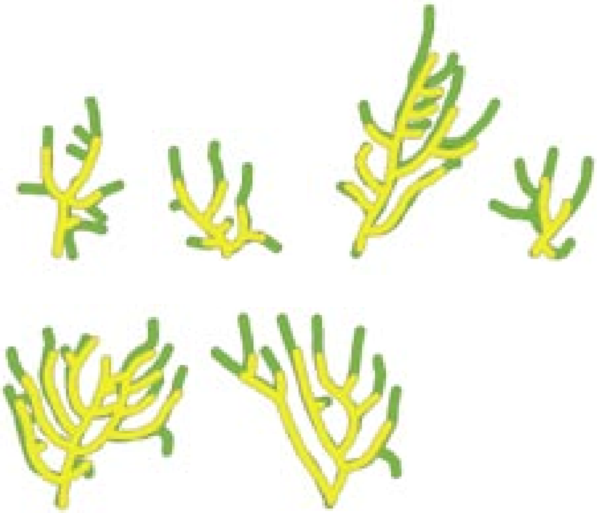


Fig. 19 Diagram showing growth of clippings between Aug 04 (yellow) and Aug 05 (green)

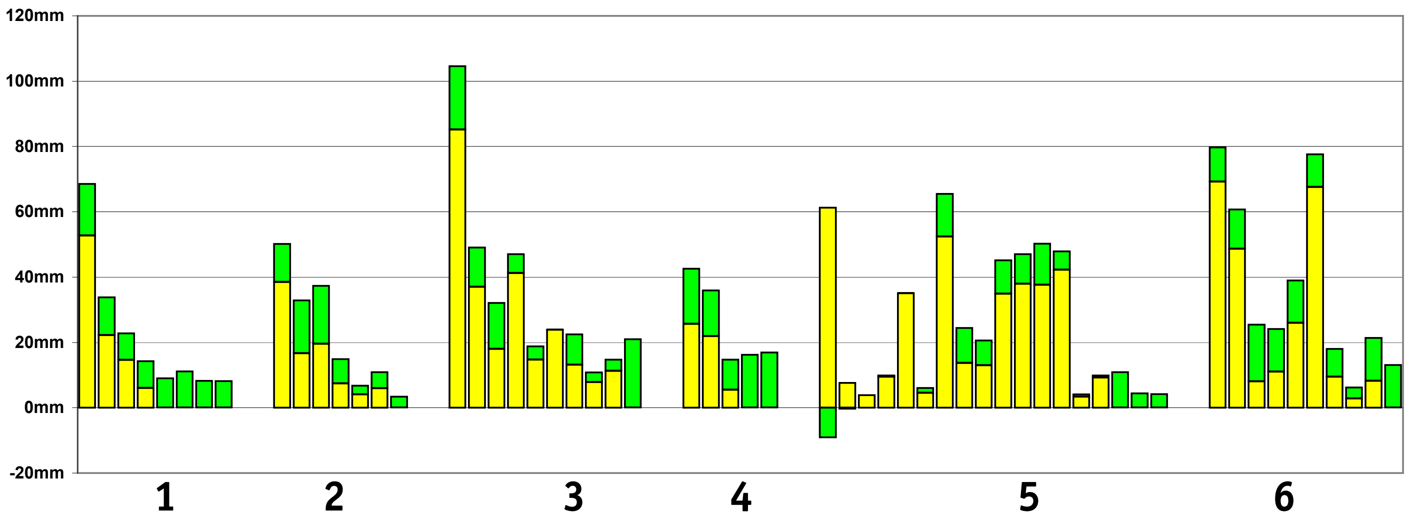


Fig.20 Growth of individual branches of grafted clippings. (2004 lengths in yellow, increase to 2005 in green)

9 Damage, fouling and predation

As the propagation experiment has shown, the seafan colonies have a considerable ability to heal after damage. The fans must have an inherent anti-fouling capability (at least one cytotoxic chemical has been isolated from *E. verrucosa*) and the spread of the base of the fan shows an ability to overgrow substrata previously occupied by other biota. One of the fans collected for aquarium display had a large swelling at the base, which turned out to be the tightly wrapped tendrils of a dogfish egg-case, subsequently overgrown by coenenchyme.

Wood (2003) used a 1-5 scale to assess the health of seafans, where 5 indicates a complete fan with no dead/damaged branches or obvious gaps and 1 indicating an almost completely broken or dead fan. He recorded that in all areas, with the notable exception of Lundy, the average score was above 4. Applying the same method to the fans photographed in this study produces an average score of 4.8, indicating a healthy population.

There are signs that some of the colonies studied have suffered some damage in the past. Several colonies are growing at an acute angle - TOK1, for example, is almost parallel to the seabed, presumably having been bent over by something landing on top of it. New growth tends to return to the vertical - this can be seen in the image of TOK1 in 2004, where the tips of the branches are growing into the camera viewpoint. An earlier study[6] showed that seafan colonies are robust enough to return to an upright position after bending under the weight of a lobster pot - the results of this study suggest that this might not always happen, leaving some colonies permanently bent and consequently suffering a reduction of filtering ability.

Fig. 21 Fan TOK1 showing tips of branches returning to the vertical

Seafans are much more vulnerable to mobile fishing gear and are particularly susceptible where they occur on low-lying reefs adjacent to scallop beds. Heavy gear can damage the seabed as well as removing benthic organisms such as seafans and sponges, making recovery less likely. At present there is no history of dredging or trawling at the Worbarrow reefs site, and the presence of strings of lobster pots may act as a deterrent, although there is no technical or legal obstacle preventing this site being dredged. Damage from entanglement by angling lines has also been recorded, but was not seen on the study site.

Other studies have recorded several fouling organisms on *Eunicella verrucosa*, including algae, bryozoans, sponges, tunicates and barnacles. These presumably take hold on areas of the fan where the coenenchyme is missing due to local damage or disease. There has been no sign so far at the Worbarrow Reefs site of the disease affecting seafan colonies in Lyme Bay, Bigbury Bay and Lundy, leading to necrosis across much, if not all, of the fan, allowing extensive fouling.

Several species also use the fans as an anchorage point for attaching eggs - within the study site, egg ribbons of the sea hare, *Aplysia*, were attached to fan BOK1 in 2004.

Fig. 22 Egg ribbon of sea-hare, Aplysia, attached to seafan

The egg cases of the dogfish, *Scyliorhinus*, were found attached to several fans near the study site. The egg cases are attached by long, tough tendrils tightly wrapped around (usually) the base of the fan. If attached higher up, this can have the effect of rolling the fan up, considerably reducing its feeding area.

Fig. 23 Dogfish egg-case wrapped around seafan, "rolling up" the fan

Cuttlefish eggs, *Sepia*, have also been recorded attached to seafans.

Many of the larger fans had pieces of drift algae snagged on the fan, but only small areas of actual fouling were recorded on the 22 fans in this study, with none falling below level 4 using the MCS Pink Sea Fan Survey criteria. One fan nearby, however, was seriously fouled by sponges, bryozoans and other organisms.

Fig. 24 Heavily fouled seafan recorded in Worbarrow Bay

The barnacle, *Solidobalanus fallax*, has been reported as a likely fouling agent of *Eunicella* in recent years (K. Hiscock, pers comm) and has been found on a fan skeleton washed up on Chesil Beach in 2003 (see below).

Fig. 25 Fouling barnacle, Solidobalanus fallax, on stranded seafan skeleton

To date, *Solidobalanus* has not been recorded on live fans around the study site, but settled heavily on the temperature recorder and on the floats marking the reference points during 2004.

The sea fan nudibranch, *Tritonia nilsodhneri*, was recorded at low levels throughout the study area, occuring on between 10 and 20% of fans during 2003 and 2005. This is greater than the level recorded in the MCS Sea Fan survey in 2001/2002 (Wood 2003) for Purbeck, but similar to the average rate for other areas of the UK. *Tritonia* feeds directly on *Eunicella* and has been observed in the aquarium to "ring-bark" some of the fan branches, but these soon healed over.

The sea fan anemone, *Amphianthus dohrnii*, is associated with *E. verrucosa* but there are no confirmed records of this species from Dorset. Its occurrence is very low in the UK - the 2001/2002 MCS Sea Fan Survey recorded *Amphianthus* on 0.07% of fans searched and most of these were on The Manacles (Wood 2003)

Fig. 26 Egg ribbon (left) and adult of Tritonia

10 Discussion

The seafans on the Worbarrow reefs form the most easterly significant population currently recorded. The density of seafans here is low compared to some of the "forests" of fans recorded off Plymouth, where densities can be in excess of 25 fans per square metre, and the maximum size of fans is at the lower end of the scale across its range in the UK.

The discovery of the site was a combination of luck and knowledge. The Worbarrow area had been dived quite extensively by Seasearch divers prior to 2000, but most divers reported largely sediment habitats with occasional small ridges of bedrock. The appearance of a single seafan on one of the drop-video sequences stimulated an exploratory dive in that area, but an incorrect GPS datum put the divers around 100m away from where they thought they were. This put them on the reef that is the focus of this study, but made it difficult to re-locate it subsequently.

The acquisition of the sidescan data clearly showed the location of the reefs, making subsequent study more straightforward, but also revealing that the reefs in question are not typical of the area, being smoother, broader and flatter, where most of the surrounding ledges are narrow and more broken.

Wood (2003) reported that the densest populations of seafans in the southwest of the UK occur on hard, horizontal surface, with the greatest density on the wreck of the Persier in Bigbury Bay. It appears from the illustration of the Persier in Wood (2003) that the structure of the wreck creates a remarkably similar habitat to that of the reef in this study - a long, broad, near horizontal reef with a smooth upper surface.

The low density of seafans at the study site meant that the number of fans monitored is too low to come to any conclusions about the level of recruitment or mortality. A much more rapid survey technique is necessary to cover the area needed for such a study - a video-mosaic map of a section of the reef, carried out annually, should help answer this question, as well as providing similar information on other long-lived species present, such as Axinellid sponges.

The disease recorded at other sites in the southwest in recent years has not appeared so far in Purbeck. Where it has been recorded, it appears to affect a large proportion of the local population, but nearby sites can remain unaffected.

The biggest threat to seafans is damage from mobile fishing gear, particularly scallop dredges. The species' preference for horizontal bedrock, often interspersed with the gravel habitat preferred by scallops, makes it especially vulnerable. There is no history of dredging at the Worbarrow site. The level of potting and the presence of the army range sea danger area may have helped deter dredgers but there is no legal barrier to dredgers working this area, other than a 10m limit on fishing vessel size imposed by Southern Sea Fisheries Committee.

The main commercial fishing activity in the area is potting for crab and lobster. The results of this study suggest that there might be a sub-lethal impact on seafans of potting, with colonies being permanently bent. This requires further investigation.

The propagation experiment has demonstrated that it is not only feasible, but straightforward, to propagate fans from clippings. This would greatly facilitate the setting up of public aquarium displays, without necessitating large scale collecting from the wild. The establishment of "forests" of seafans in large public aquaria would raise public appreciation of our native marine habitats. It is also hoped that this might stimulate interest in the propagation and display of other invertebrates, culminating in a display of British reef habitat in a UK public aquarium to rival the coral reef displays found in most large aquaria.

The easy production of seafan cuttings also opens up the way for a range of ecological experiments either in the wild or in the laboratory.

A valuable by-product of this study is the interest and involvement of a considerable number of divers. There is increasing interest among divers in getting involved with projects such as this, particularly those with a conservation benefit. Divers are vitally important monitors of the health of our marine environment - there is a degree of selfishness here, they want to be able to continue to dive in attractive sites and observe interesting species, but they are the first to see the signs of things going wrong and are increasingly willing to make their voice heard. It is important to cultivate this - projects such as Seasearch and this study help to educate and involve the diving community. The pink seafan is an ideal species around which to base such projects as it is attractive in its own right (a "flagship" species) as well as representing a habitat vulnerable to human activities, acting as an indicator of habitat damage.

11 Recommendations

This study has identified the most easterly significant population of the pink seafan, *Eunicella verrucosa*. Other than a relatively wide distribution of scattered fans, the habitat described here seems to be restricted to a small number of suitable rocky ledges near Worbarrow Bay. The habitat is not currently threatened by mobile fishing gear but it would be prudent to put measures in place to protect against any future developments.

The study site should be maintained for future investigations. This will require at least annual visits to ensure the datum points are replaced as necessary. There are financial implications to this but using volunteer divers will help keep costs low.

Further study of the effects of potting gear on seafans and other erect benthic species is recommended. This could be carried out using volunteer divers.

An annual video-mosaic of areas of reef is recommended to judge the balance of recruitment and mortality. This would also reveal information about the health of other long-lived species such as sponges.

Propagated cuttings could be used in manipulative ecological experiments, both at sea and in the laboratory, to help determine some of the ecological requirements of *Eunicella verrucosa*.

Propagation of other species should be investigated. Tropical soft corals are easily propagated - both *Alcyonium digitatum* and *Alcyonium glomeratum* could theoretically be propagated and grown in aquaria. With even just these two species and *Eunicella* , an attractive native reef display could be produced

The site should be monitored annually for signs of the wasting disease reported in other parts of the UK

Monitoring of seabed temperature should continue - this again could be carried out by volunteer divers.

11 References

1 Connor, D.W. et al., 2004. *The Marine Habitat Classification for Britain and Ireland Version 04.05* JNCC, Peterborough. Available from: http://www.jncc.gov.uk/MarineHabitatClassification

2 Hiscock, K., 2001. *Eunicella verrucosa*. Pink sea fan. *Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme* [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 09/01/06]. Available from: <http://www.marlin.ac.uk/species/adult_distrib_Eunicellaverrucosa.htm>

3 Munro, M (2003) Climate Change Impacts on Seafan Populations. A Report by Reef Research (UK) From: http://www.marine-bio-images.com/PDF Reports/Report RR 08 Jun 2003 Climate pdf.pdf

4 Wood C. (2003) Pink Sea Fan survey 2001/2. A report for the Marine Conservation Society

5 Gorgonian Propagation Using Super Reef Glue. Geothermal Aquaculture Research Foundation. http://www.garf.org/100/gorg/GORG1.html

6 Eno N.C., MacDonald D.S. & Amos S.C. (1996). A study on the effects of fish (crustacea/mollusc) traps on benthic habitats and species. Report to the European Commission.