

**Cyngor Cefn Gwlad Cymru**  
Countryside Council for Wales



**Skomer Marine Nature Reserve**  
**Project Status Report 2003/4**  
**CCW West Area Report 29**

**M. Burton, K. Lock, L. Luddington &  
P. Newman. March 2004**

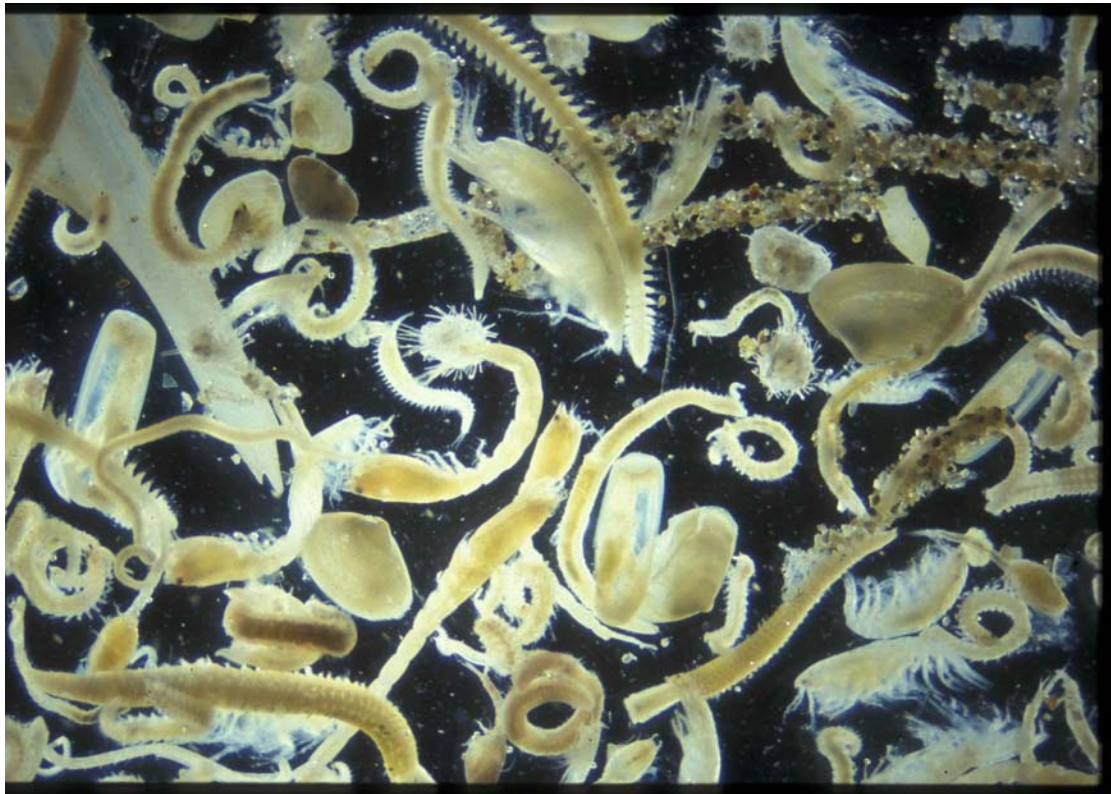


Photo: Dale Rostron

## **SYNOPSIS**

The second project status report produced by the Skomer Marine Nature Reserve summarises the progress and status of monitoring projects in the Skomer MNR in 2003. A summary of all established projects in the MNR is provided in a table format. For each project that was worked on in the 2003 field season a detailed account is given including a history and summary of the results so far.

Title: M. Burton, K. Lock, L. Luddington & P. Newman. (2004). Skomer Marine Nature Reserve project status report 2003/04. CCW West Area Report 29

## **CRYNODEB**

Mae'r ail adroddiad ar statws prosiectau, a luniwyd gan Warchodfa Natur Forol Ynys Sgomer, yn crynhoi cynnydd a statws y prosiectau monitro yng Ngwarchodfa Natur Forol Sgomer. Ceir crynodeb o'r holl brosiectau sydd wedi hen sefydlu o fewn Gwarchodfa Natur Forol Ynys Sgomer ar ffurf tab. Ar gyfer yr holl brosiectau yr aethpwyd i'r afael â nhw yn ystod tymor maes 2003, rhoddir mwy o fanylion, gan gynnwys eu hanes a chrynodeb o'r canlyniadau hyd yn hyn.

Teitl: M. Burton, K. Lock, L. Luddington a P. Newman. (2004). Skomer Marine Nature Reserve project status report 2003/04. Adroddiad 29, Ardal y Gorllewin, Cyngor Cefn Gwlad Cymru.

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# 1 INTRODUCTION

This is the second project status report produced by the Skomer Marine Nature Reserve. It summarises the progress and status of monitoring projects in the Skomer MNR in 2003. The project status table in section 2 provides a summary of all established projects in the MNR in 2003. Section 3 details projects that were worked on this year and where possible includes a summary of the results so far.

Notable events in the 2003 field season:

- A new site was established on the South side of Skomer (South of Middleholm). This has been incorporated into the *E. verrucosa* and *P. foliacea* projects.
- A new site on Rye Rocks was established for the *E. verrucosa* and *A. glomeratum* projects.
- The shallow transect at Bernie's Rocks was extended to include a greater number of *P. foliacea* colonies.
- The echinoderm volunteer project was successfully run involving 50+ volunteers from all over the UK.
- The infaunal communities project was completed in October using the MNR's day grab deployed from Skalmey. The samples were analysed by an external contractor. A report will follow in 2004.
- Contractors completed the sponge species survey at Thorn rock. The results will be used to produce a report comparing species methodologies with morphological methodologies.
- Students from Plymouth University tested methods for monitoring populations of commercial crustacean species (lobsters, edible crab & spider crab).
- The littoral monitoring contract was completed. Four new sites were established in the Reserve along with a new surveillance method. The MarClim methodology was incorporated into the overall methods to detect climate change effects.

## **2 SKOMER MNR PROJECTS STATUS SUMMARY TABLE**

	<b>Brief description</b>	<b>Year sets</b>	<b>Sampling frequency</b>	<b>Report</b>	<b>Data summary</b>
<b>PHYSICAL</b>					
Meteorological data	Wind, rain, sunshine, temp, humidity, radiation. Automatic station logging 10 minute means.	1993 - ongoing	Continuous	No	Yes-Skomer MNR office
Wave data	Height, period, etc. Automatic station logging every 10mins.	1993-1998	Continuous	No	No - raw only
Seawater data	Temp, salinity, conductivity, suspended sediment. Data collected by a range of methods.	1992 - ongoing	Weekly (May -Sept) Temp continuous all year round (since 99)	No	Yes-Skomer MNR office
Seabed sedimentation	Auto sampler	1994-1998	Continuous	No	Yes-Skomer MNR office
	Sediment trap	1994 - 2002	Every 14 days (April-Oct)	No	Yes-Skomer MNR office
	Idronaut Turbidity logger	2001 - ongoing	Continuous	No	No - raw only
Bathymetry	Sidescan & Multibeam (SAC)	2001		Longdin & Browning 2002	
<b>ACTIVITY</b>					
Recreation activities	Boats, divers, anglers recorded in the Reserve	1989 - ongoing	Weekly (May -Sept)	Skomer MNR annual reports	Skomer MNR annual reports
Commercial fishing activities	Pot buoys and fishing net positions	1989 - ongoing	Weekly (May -Sept)	Burton 2002	Yes-Skomer MNR office
Tankers in St Brides bay	Number and names of tankers and movements	1994 - ongoing	Daily	No	Yes-Skomer MNR office
<b>BIOLOGICAL</b>					
<b>Littoral communities:</b>					
Macro scale (view point photographs)	Time series photos/digitised.	1992 - ongoing	Annual	Yes not published	Yes-Skomer MNR office
Meso scale (transects)	6 Transects. Time series photos/digitised.	1992 - ongoing	Annual	Adams 1979/ Bunker 1983/ Crump 1993/96 Hudson 1995.	Yes-Skomer MNR office

	<b>Brief description</b>	<b>Year sets</b>	<b>Sampling frequency</b>	<b>Report</b>	<b>Data summary</b>
<b>Sub littoral communities:</b>					
Rocky reef communities	Time series stereo photos.	1982 - ongoing	Annual	Bullimore 1986 & 1987	Yes-Skomer MNR office
Algal communities	Survey and report completed	1999	Every 5 years Next survey planned 2004	Hiscock, S 1983 & 1986 Scott 1994 Broodie 1999/2000	
Sponge assemblages	Time series mono-photo/digitised. Species recording.	1994 - ongoing 2002/3	Annual Every 5 years	Bunker <i>et al</i> 1992	Yes-Skomer MNR office
Infaunal sediment	Surveys and reports completed	1993/1996/ 1998	Every 5 years Next survey planned 2003	Rostron 1994 & 1996 Barfield 1998	
Epifaunal sediment	Survey and report completed	1995/ 2001	Every 5 years Next survey planned 2006	Rostron 1996 Moore 2002	
<b>Flora:</b>					
<i>Zostera marina</i>	Extent of NHV bed & density distribution.	1997/2002 (boundary maps for 2000 & 2002)	Every 4/5 years Next survey planned 2006	Jones & Hodgson 1980 & 1981, Jones <i>et al</i> 1983, Lock 1998 & 2003	
<b>Fauna:</b>					
<i>Eunicella verrucosa</i>	94 colonies, time series mono-photo/digitised. 4 colonies, stereo-photo.	1993- ongoing 1982- ongoing	Annual	Bunker <i>et al</i> 1985, Bullimore 1986 & 1987 Gilbert 1998	Yes-Skomer MNR office
<i>Alcyonium glomeratum</i>	Time series stereo-photo/digitised. North wall 5 transects (% frequency)	1984- ongoing 2002 new transects	Annual	Bullimore 1986 & 1987	Yes-Skomer MNR office

	<b>Brief description</b>	<b>Year sets</b>	<b>Sampling frequency</b>	<b>Report</b>	<b>Data summary</b>
<i>Parazoanthus axinellae</i>	6 sites, time series mono-photo/digitised.	2001- ongoing	Annual	Burton <i>et al</i> 2002	Yes-Skomer MNR office
<i>Pentapora foliacea</i>	3 sites, time series mono-photo/digitised. New sites established 2002 & 2003.	1994- ongoing	Annual	Bullimore 1986 & 1987 Bunker/ Mercer 1988 Gilbert 1998	Yes-Skomer MNR office
<i>Balanopyllia regia</i>	Time series stereo-photo/digitised The Wick. 3 transects	1984 – 2002 2002 - ongoing	Annual	Bullimore 1986 & 1987	Yes-Skomer MNR office
<i>Cayophyllia smithii</i> .	Counted from sponge project quadrats (stereo-photo/digitised)	1993 - ongoing	Annual	No	Yes-Skomer MNR office
<i>Pecten maximus</i>	UCS survey,  Survey completed, 3 sites.	1979/80, 1979-82 2000	Every 4 years Next survey planned 2004	Bullimore 1985 Jones 1979 & 1980 Lock 2002	
Nudibranch species	Various surveys MNR survey completed.	1975-1991 2002	Every 4/5 years Next survey planned 2007	Bunker <i>et al</i> 1993, Luddington 2002	
Territorial fish	Survey methods developed. Survey completed.	1997 2001/2002	Every 4/5 years Next survey planned 2005	Lock 1998	Yes-Skomer MNR office
Atlantic Grey Seal	Surveys and reports.	1976- ongoing	Annual	Grey Seal breeding census, Skomer Island 1992-2003, Skomer MNR annual reports.	Yes-Skomer MNR office
Echinoderm Survey	Abundance of <i>Echinus esculentus</i> in Skomer MNR using volunteer survey methods. Data for <i>Marthasterias</i> , <i>Crossaster</i> & <i>Luidia</i>	2003	Every 4/5 years Next survey planned 2008		Yes-Skomer MNR office



### **3 SKOMER MNR BIOLOGICAL PROJECT SUMMARIES**

## LITTORAL COMMUNITIES AND ASSEMBLAGES (CMS code: RB03/02 & RB03/01)

**STATUS** Ongoing. Annual photographic sampling. Annual quantitative survey.

### PROJECT RATIONALE

Littoral communities are susceptible to impacts from the water and the air. They occupy a very harsh niche with an extreme range of environmental conditions. Salt tolerant terrestrial species exist within metres of truly marine species. These factors coupled with the relative ease of fieldwork compared to sub-littoral habitats make littoral communities useful for a wide range of environmental monitoring. There is a wealth of literature on the biology of rocky shores to provide guidance and support information for littoral monitoring projects.

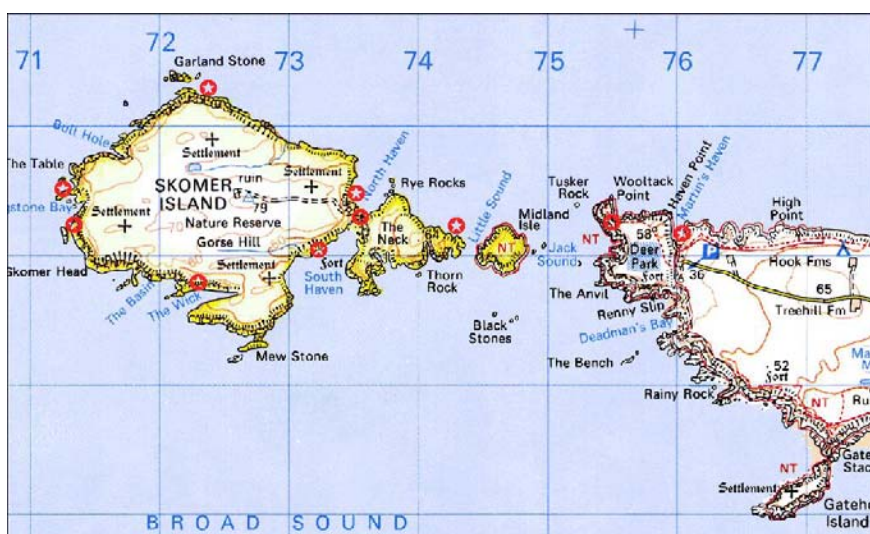
### A. LITTORAL COMMUNITIES MESO SCALE - SHORE TRANSECTS (CMS code: RB03/02)

#### OBJECTIVES

To monitor the littoral communities on bedrock shores over the continuum of exposure and aspect ranges.

#### SITES

- North Haven
- South Haven
- South Stream
- The Lantern
- The Wick
- Double Cliff
- The Spit (NW of Pig Stone Bay). New 2003
- Inside of Pig Stone. New 2003
- Jacksound / Wooltack. New 2003
- Martins Haven. New 2003
- Hoptang (North Marloes Peninsula) Lichen station only



## **METHODS**

Transects with permanent, fixed position quadrats were established in 1992. The quadrats extend from spring low water into the splash zone at regular height intervals. Species abundance was recorded using the semi-quantitative SACFOR abundance scale (Hiscock 1990) and photographs taken of each 50 x 50cm quadrat. In addition a selection of close up photographs of 10 x 10cm quadrats were taken within the main quadrat.

## **RESULTS**

1982 – Bunker *et al.* surveyed 22 sites in the MNR as a baseline littoral survey.

1992 – 6 permanent transects were established in the MNR and surveyed/photographed (Crump, 1993).

1992 – 2002 Photographs of the 6 permanent transects were taken and stored.

1996 – Following the Sea Empress oil spill (Feb 1996) the 6 transects were resurveyed and a lichen monitoring site was set up at Hoptang (Crump, 1996). The littoral shores around Skomer showed no significant changes after the Sea Empress oil spill, with the exception of lichens at Hoptang, which showed signs of necrosis.

2001 - Slide photographs from 1992 – 2000 were reviewed and abundance estimates from the photographs compared with abundance records from Crump 1992 & 1996 field data. Photograph quality was insufficient to allow accurate abundance estimates.

2001/02 – Digital imaging was tested to obtain pictures of permanent quadrats. Image quality was improved, however estimates of species abundance were still inaccurate due to difficulties with identification of species and individuals from the images. This method cannot replace collection of data in the field for quantitative assessment.

2003 – New quantitative methods were tested at the 6 original sites and 4 additional sites were established. The methods were as follows:

### **Littoral community monitoring methods 2003.**

Contractors provided expert advice and experience. It is recommended that local experts be contracted every survey year to provide skilled field support and continued monitoring advice.

Sites were chosen from the existing monitoring sites with the addition of Martins Haven, Wooltack point, Pig stone and The Spit NW of Pig stone bay.

At each site samples were taken from 4 heights on the shore:

Lower shore – 1.8m Above Chart Datum (ACD)

Middle shore – 4.2m ACD

Upper shore – 6.0m ACD

Splash zone ~ 9.0m ACD (selected sites only. To include Hoptang)

At each shore zone:

- Four 1 x 1m quadrats were placed in homogenous areas of inclined rock (avoiding rock pools and large fissures)
- Presence / absence recorded for all species using a 25 cell grid.
- Digital photographs were taken of the whole quadrat
- Limpets were counted in 5 randomly selected cells
- Close-up photographs of barnacles from 5 randomly selected cells using a 5 x 5cm grid
- % cover of barnacle species estimated in 5 random 20 x 20cm cells
- % cover of lichen species recorded in 50 x 50cm quadrats at selected sites

Counting protocols:

- Aggregate rough winkle species
- Aggregate *Verrucaria spp* other than *V. mucosa*
- Only counted limpets > 10mm and aggregate to *Patella spp* (species are separated in the MarClim methodology)
- Presence/absence of barnacle *spp* in 1m quadrat; barnacles were identified to species level from close up photographs

### **Barnacle monitoring**

From each quadrat in the lower, middle and upper shore 5 photographs were taken using a 5 x 5cm quadrat from random locations within the quadrat on flat areas of bedrock. This provided a total of 20 samples from each shore zone. Species counts were carried out for all individuals > 2mm. All photographs were taken at all sites to obtain a complete record for future use, however the number of sites analysed depended on the time involved in analysing the photographs.

### **Limpet monitoring**

At all shore levels counts of limpet species were made from 5 random cells (20 x 20cm) from within each quadrat giving a total of 20 cell counts.

In the middle shore only, the first 200 limpets were measured to the nearest mm. In areas of low density at least 100 limpets were measured.

### **MarClim methodology**

The MarClim project (Plymouth Marine Laboratory) offers an opportunity to compare the Skomer shores to the rest of the UK and contribute to the assessment of the effects of global warming.

The MarClim methodology was used at Martin's haven, North Haven and South haven (see Mieszkowska *et. al.* 2002). This involved recording abundances for a selected list of edge of range species, counting barnacles in 5 x 5cm quadrats and limpets in 50 x 50cm quadrats. Timed searches were conducted for *Osilinius lineatus* and *Gibbula umbilicalis* and individuals measured to the nearest mm.

The data were passed on to the MarClim team and used to add detail to the MNR's littoral monitoring.

## Results from 2003 field work

### Mean % cover of barnacles

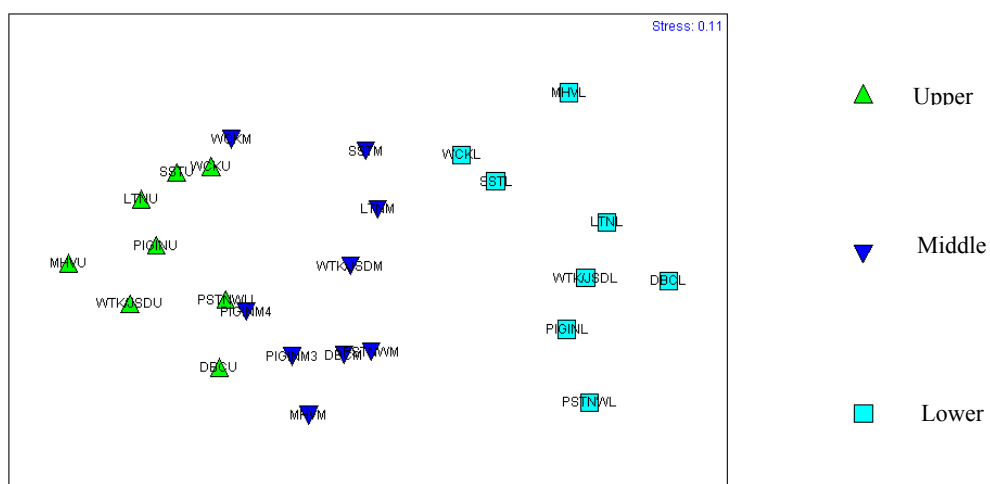
SITE	ZONE		
	Upper	Middle 4m	Middle 3m
Pig Stone inside	40.5	83.75	61.5
Pig stone NW	30.75	27.75	
Double cliff	57	15.75	
MHV	6.95	48.25	
Wooltack point / Jack sound	32.25	57.25	
South Stream	50.75	46	
Lantern	46.5	69.75	
Wick	51.25	74.75	

### Limpet summary

SITE	Mean count	Mean count	Mean count	mean size (mm)
	Upper	Middle 4m	Middle 3m	
Wooltack point / Jack sound	0.6	12.05		
Pig Stone inside	5.8	13.55	8.5	
Martin's haven	0.25	13.95		15.7
Lantern	0.9	11.75		11.8
South stream	0.05	7.3		17.
The Wick	0.1	5		16.0
Pig Stone NW	12.05	11.85		
Double cliff	12.45	12.75		

### MDS plot (primer) of quadrat data collected in 2003

*littoral 2003 all zones PA trans*



## **B: LITTORAL COMMUNITIES MACRO SCALE – VIEWPOINT PHOTOGRAPHS (CMS code: RB03/01)**

### **OBJECTIVES**

Document gross changes in shores and shore communities by means of viewpoint photography; identify shore or parameters requiring further or specific monitoring.

### **SITES**

Martins Haven, North Haven, South Haven Deer Park beaches: Jeffrey's Haven, Pebbly beach, Boulder beach, Renny's Slip, Lantern, Amy's Reach, Matthews Wick

### **METHODS**

A photograph is taken each year for each viewpoint. A colour photocopy of each view is used to assist relocation and ensure identical photographs are taken, these are stored in the Viewpoint monitoring handbook.

### **RESULTS**

1987 – ongoing. Viewpoint photographs showing various shores around the Reserve from a distance have been taken on an annual basis.

2001- Daguet reviewed a time series set of viewpoint photographs taken from around the whole reserve. By using simple image analysis techniques it was possible to estimate the widths of biological zones on some of the shores. This may prove useful in assessing gross scale changes on the shores.

### **LITTORAL COMMUNITIES AND ASSEMBLAGES**

#### **TARGETS**

To maintain a the range of littoral communities around the Reserve

#### **CURRENT STATUS**

Good detailed information available from the wide range of monitoring projects carried out over the years.

The littoral habitats around the Reserve appear healthy and stable.

#### **RECOMMENDATIONS**

Continue the new methods with a full review in 2008.

Contract in field support on an annual basis.

#### **REFERENCES**

Adams 1979, Bunker *et al* 1983, Hiscock, K 1990, Crump 1993, Crump 1996, Hudson 1995,

Skomer Littoral Monitoring Manual. Burton, Daguet, Lock & Newman 2001.

N. Mieszkowska, M., R. Leaper, A. Southward, S. Hawkins & M. Burrows. 2002. MARCLIM monitoring network: provisional sampling strategy and standard operating procedure.

## **SPONGE ASSEMBLAGES (CMS code: RM13/01)**

**STATUS** Ongoing. Annual sampling of stereo photograph quadrats (1993-ongoing).

Species list surveyed every 5 years (current survey 2002/3).

### **PROJECT RATIONALE**

Skomer MNR's sponge communities have been identified as rich and diverse with over 80 species. Six are nationally scarce species and eight near their limit of distribution.

Sponges are filter feeders and therefore reliant on water quality which makes them susceptible to changes in sediment deposition. They are therefore useful biotic indicators of changes in suspended sediment and surface sedimentation rates, the cause of which might include dredge spoil dumping.

### **OBJECTIVES**

To monitor the sponge assemblages in the MNR.

To identify natural and anthropogenic fluctuations.

To identify the presence of rare, scarce and edge of range species in the MNR.

### **SITES**

- Thorn Rock (transects & species survey)

### **METHODS**

**Transects:** Four fixed transects are located at Thorn Rock. Photographs are taken from fixed positions along the transects using a stereo camera set up on a 50 x 70cm frame.

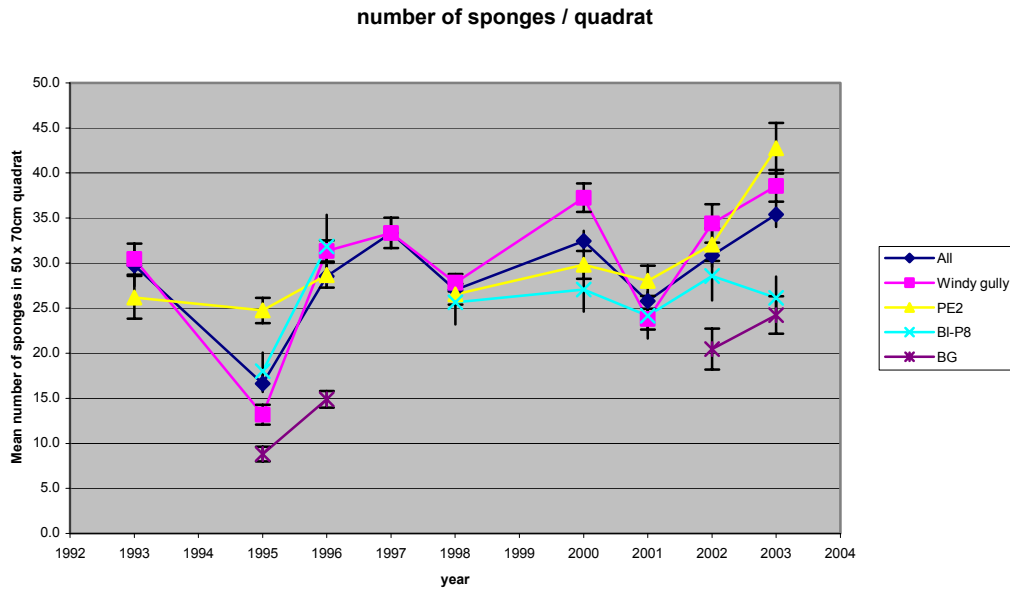
The slides are analysed using a stereo viewer to count the abundance of sponge species and morphology types.

**Species survey:** All sponge species identified in 16 50 x 70cm quadrats. Species photographs taken in the field and samples taken, where necessary, for spicule preparations.

### **RESULTS**

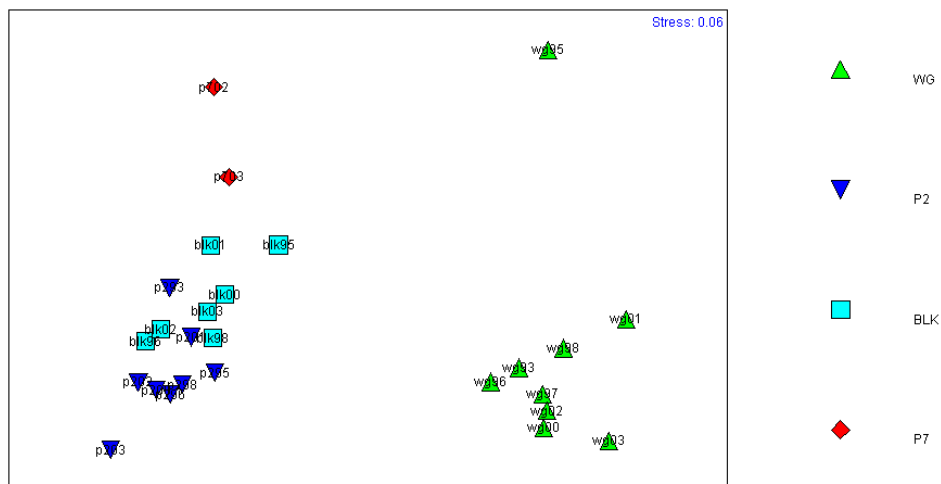
Data gathered from Thorn Rock sponge transects:

Year	No of photographic samples	Transects
1993	24	Windy Gully
1995	77	Windy Gully, piton B – P8, piton B – P7, P2 – P8
1996	72	Windy Gully, piton B – P8, piton B – P7, P2 – P8
1997	20	Windy Gully
1998	60	Windy Gully, piton B – P8, P2 – P8
2000	63	Windy Gully, piton B – P8, P2 – P8
2001	62	Windy Gully, piton B – P8, P2 – P8
2002	81	Windy Gully, piton B – P8, piton B – P7, P2 – P8
2003	79	Windy Gully, piton B – P8, piton B – P7, P2 – P8 (Species survey for Windy Gully & , piton B – P8)



Bell & Barnes (2001) describe a morphology method for assessing the diversity of sponge communities. This method has proved very useful in analysing the stereo slides. The results are suitable for multivariate analysis using the Primer statistical software package (Clarke & Warwick 2001). A paper summarising the results is in preparation for intended publication in 2004.

**1993 - 2003 all sites (morphology only)**



A species survey was begun in September 2002 and was completed in the 2003 field season. Quadrats were selected from 2 transects (Windy Gully & BLK PB – P8). 58 different species were recorded of which 5 encrusting species have yet to be identified. The species data was compared with morphology data aggregated from the species data and with morphology counts done from stereo photographs.



The species data confirms that there are different sponge assemblages at Windy Gully & BLK PB – P8 as suggested by the morphology data. However, there were some differences between the species data and the photographic morphology data:

- 45% of the sponge species are not seen in the photographs
- Most sponge species not observed are encrusting and small
- The effect encrusting and papillate sponges (the 2 morphologies which are most often hidden in the photographs) have on the overall results was tested by removing the data for encrusting and papillate sponges. The resulting similarity matrix was compared with the matrix for the complete data set. The results showed that the two matrices were very similar (Rho 0.924 RELATE function in Primer), therefore the loss of detail using the photographic method may not have an effect on the overall results.
- Wafting away surface sediment before the photographs are taken and using a smaller quadrat would increase the number of sponges visible in the photographs but this would affect the continuity in the time series.
- The species data took a long time to collect and analyse (1 hour+ per quadrat & several hours of lab work) and is not a time efficient way to monitor large areas of seabed.

9 out of the 13 species identified in Picton & Morrow (1993) as species of conservation value (*Antho inconstans*, *Antho involvens*, *Aximella damicornis*, *Axinella dissimilis*, *Tethyspira spinosa*, *Raspaciona aculeate*, *Halicnemis patera*, *Homaxinella subdola* & *Hymeraphia stellifera*) were recorded in 2002-3.

## **TARGETS**

- To monitor changes in the sponge assemblages and identify natural and anthropogenic fluctuations.
- To maintain the current species richness and diversity as well as the presence of rare/scarce species and species nearing their distribution limit.

## **CURRENT STATUS**

The abundance of sponges has increased in the last 2 years and the species survey shows high diversity with some new species to add to the Skomer MNR records.

## **RECOMMENDATIONS**

Explore the use of Bell & Barnes (2001) morphology method to monitor the community structure and to identify natural fluctuations. Targeted species work could be used to give additional information to the morphology data.

## **REFERENCES**

Picton & Morrow 1993, Bell & Barnes 2001, Clarke & Warwick 2001.

## SEDIMENT INFAUNA COMMUNITIES (CMS code: RM03/04)

**STATUS** Ongoing. Survey every 5 years (next survey 2008).

### PROJECT RATIONALE

Despite the relatively high number of surveys carried out in Skomer MNR much remains unknown about the sediment communities. Sediments accumulate pollutants and toxins and sediment communities have been shown to respond to these pollutants.

### OBJECTIVES

To assess species richness and diversity and to sample for inorganic pollutants.

### SITES

Nineteen sites in Skomer MNR were sampled in the first survey in 1993. This was reduced to 10 sites in subsequent surveys i.e. 8 on the north side of Skomer and 2 in South Haven.

### METHODS

Two replicate samples were taken at each site using a 0.1m<sup>2</sup> day grab, and processed and preserved on site. The retained samples were then identified and enumerated by a specialist contractor. A third sample was analysed for sediment grain size and hydrocarbon content.

### RESULTS

Surveys were completed in 1993, 1996, 1998 and 2003. The aim of the survey in 1996 was to assess the effect of the Sea Empress oil spill. The average number of individuals, species richness and taxonomic diversity was significantly lower in 1996 than 1993, 1998 and 2003.

Table showing average species richness (S), average number of individuals (N) and average taxonomic diversity (Delta\*).

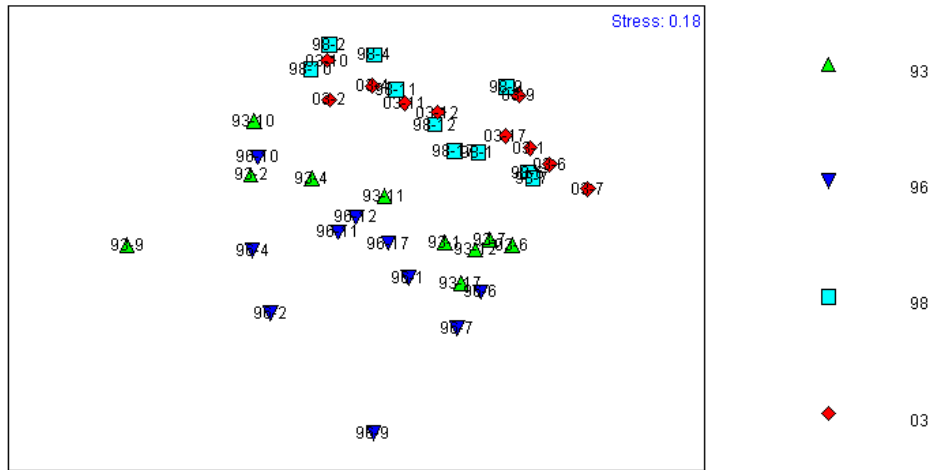
Year	S	N	Delta*
1993	83.4	678.1	87.91582
1996	69.4	173.9667	85.59287
1998	119.8	689.7	88.83397
2003	135.1	775.2	88.38269

Some 'notable' species from the latest survey are:

Golfingiida: *Thysanocardia procera* (Möbius, 1875), Bonelliida: *Maxmuelleria lankesteri* (Herdman, 1898), Serpulids: *Apomatus similis* Marion & Bobretzky, (1875), *Filograna implexa* Berkeley, (1827 in Sars, 1851) & *Josephella maranzelleri* Caullery & Mesnil, 1896). Mysid: *Gastrosaccus sanctus* (van Beneden, 1861). Amphipod: *Maera grossimana* (Montagu, 1808). Isopod: *Anthura gracilis* (Montagu 1808). Gastropod: *Melanella alba* (da Costa, 1778).

Multi-dimensional scaling (MDS) plot using PRIMER showing the separation of samples from 1993, 96, 98 and 2003 datasets.

*93-2003 infauna 2rt trans species data*



The MDS Primer plot shows that both 1993 and 1996 differ from 1998/2003. The sediment grain analysis for 1993 showed higher levels of fine mud compared to the other years, whilst sediment grain analysis results for 1996, 1998 and 2003 were similar.

### TARGETS

Targets are yet to be set. The community has shown an ability to recover from the 1996 state so this could be used as a minimum favourable condition, this should be used with caution however to allow for potentially large natural fluctuations in communities. No single attribute (richness, abundance etc) can be used to set a reliable target for the infaunal community. Instead an overview of all the information (richness, abundance, taxonomic diversity and multidimensional statistical techniques) should be used to assess the health of the community.

**CURRENT STATUS:** The last two surveys have shown the infaunal community to be healthy and species rich. The similarity between 1998 and 2003 is encouraging as it suggests that the community has recovered from 1996 levels (relative low numbers of species and individuals) and is stabilizing.

### RECOMMENDATIONS

Due for re-survey 2008. Publish results and put the results into context with similar surveys from the surrounding area.

### REFERENCES

Rostron 1994, Rostron 1996, Barfield 1999.

## MONITORING *EUNICELLA VERRUCOSA* IN SKOMER MNR

**STATUS** Ongoing. Annual sampling.

### PROJECT RATIONALE

The pink sea fan *Eunicella verrucosa* (Pallas) is a Lusitanian anthozoan soft coral nearing the northern limit of its distribution in North Pembrokeshire. It is a UK Biodiversity Action Plan Species on Schedule 5 of the Wildlife and Countryside Act 1981. Sea fans are slow growing; erect species susceptible to permanent damage. Recovery and reproduction rates are thought to be very slow.

### OBJECTIVES

To monitor numbers and condition of the recorded sea fans in Skomer MNR and to expand the monitored population.  
To review monitoring methods.

### SITES

- Bernie's Rocks (East and West)
- Bull Hole
- The Pool
- North Wall East
- Sandy Sea Fan Gully
- Thorn Rock
- Way Bench
- Rye Rocks
- South Middleholm

### METHODS

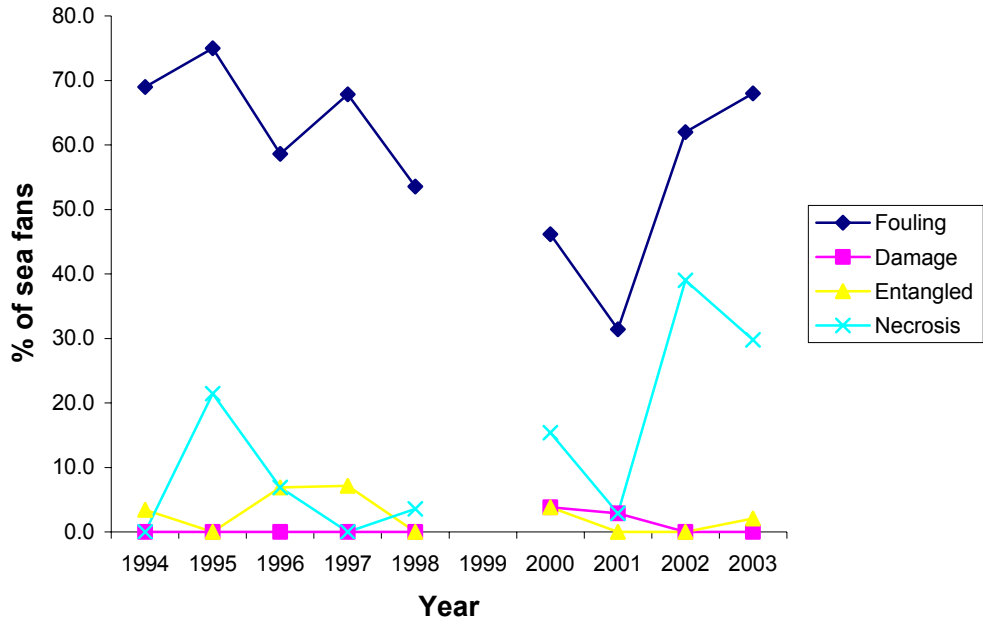
Photographic monitoring using a single camera on a 50 x 70 cm frame with a black grid board as a background. Both sides of the sea fan are photographed and each fan is visually inspected for damage, fouling by epibiota, entanglement with man-made materials, necrosis (loss of living tissue) and the nudibranch *Tritonia nilsodhneri* Marcus, 1983 and *Simnia patula* (Pennant, 1777). The images are scanned into Mapinfo to allow a visual, yearly comparison of colonies.

### RESULTS

#### Sampling effort

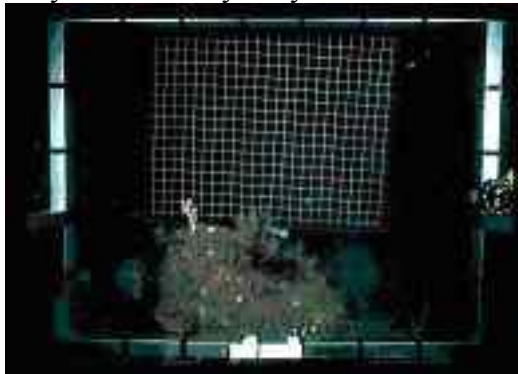
Year	Number Recorded	No of fans analysed	Missing or lost sea fans
1994	33	29	0
1995	32	28	Way 9
1996	33	29	0
1997	37	28	0
1998	37	28	0
1999	4	0	0
2000	55	26	0
2001	54	35	Trk1
2002	74	64	0
2003	102	94	0

*Condition of sea fans in the Skomer MNR observed from photographs*



*Apparent growth and decline of colonies*

Waybench colony Way11



**1995**



**2003**

Waybench colony Way4



**1994**



**2003**

During 2003 a total of 28 additional colonies were located and mapped at Bull Hole and two new sites, Rye Rocks and South Middleholm. From yearly visual comparisons of colonies 17% (12 of 72 colonies) of the monitored population were identified as showing no apparent growth.

### TARGETS

- **Sea fan numbers:** No loss of individuals. Evidence of recruitment
- **Sea fan size:** Observe increase in the size of individual colonies
- **Condition:** Limits to be set, but no significant increase in necrosis, damage or entanglement. Look for signs of recovery from previous records of necrosis, damage or entanglement. Monitor levels of epibionts and *Tritonia nilsodhneri*

### CURRENT STATUS

- **Numbers:** 2 losses in 9 years; one unknown colony found detached at Rye Rocks in 2003
- **Fan size:** evidence of increase in size for large proportion of individuals
- **Condition:** two records of entanglement in 2003, increase in epibiota and fluctuations in damage and necrosis records between 1994 and 2003

### RECOMMENDATIONS

- Continue annual photographic monitoring programme
- Use photographs to identify colonies in decline or not growing
- Measure colony height and width *in situ* to estimate size frequency distribution of monitored population
- Complete field records for each colony, recording damage, entanglement, necrosis, levels of epibionts and numbers of *Tritonia nilsodhneri*
- Map new sites to increase the number of colonies monitored on the south side of the Reserve
- Search for new recruitments at established sites
- Monitor sea temperature and suspended turbidity levels to provide background data for the biological monitoring
- Support research work on the biology of sea fans (e.g. Species Challenge Fund)
- Observe persistence of biotic fouling/entanglement e.g. Greater spotted dogfish eggs
- Differentiate between drift algae and epibionts in field records.

## ***ALCYONIUM GLOMERATUM* POPULATION (CMS code: RM23/03)**

**STATUS** Ongoing. Annual sampling.

### **PROJECT RATIONALE**

*Alcyonium glomeratum* (red sea fingers) is a Lusitanian species nearing its northern limit of distribution. Colonies are long-lived and possible indicators of climate change.

### **OBJECTIVES**

To monitor colony size and to look for damage and disease.

### **SITES**

- North Wall (2 sites)
- Thorn Rock
- Rye Rocks (established 2003)
- Sandy Sea Fan Gully

### **METHODS**

North Wall stereo site: three quadrats (50 x 40cm) photographed in stereo

North Wall “Al glom” wall: A series of five transects (50 x 70cm quadrats) were tested at North Wall.

The Thorn Rock site consists of three fixed position quadrats (50 x 70cm).

Sandy Sea Fan Gully consists of two fixed transects on a vertical wall.

The colonies were “wafted” before photographing to make them retract in an attempt to control the variability in colony size. Percentage frequency counts from a 5 x 5cm grid were taken using GIS techniques.

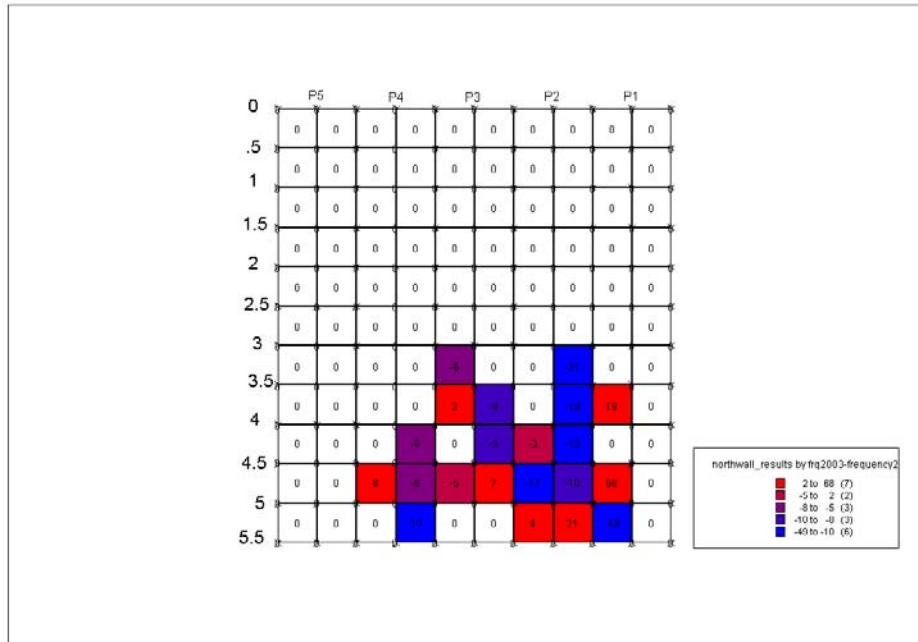
### **RESULTS**

The three quadrats from the North Wall stereo site have a steady abundance of *A. glomeratum* of approximately 50% since 1984. Quadrat 2 and 3 show some evidence of an increase in abundance.

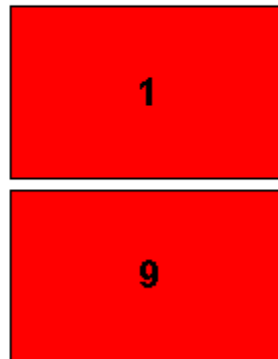
2002 was the first sampling event for the North Wall “*A. glom*” wall and Thorn Rock. These were repeated in the 2003 season and an additional site was established at Rye rocks. There are now several small colonies along the transects as well as larger ones.

## Difference in frequency of *A. glomeratum* between 2003 and 2002

### “Al Glom Wall” site

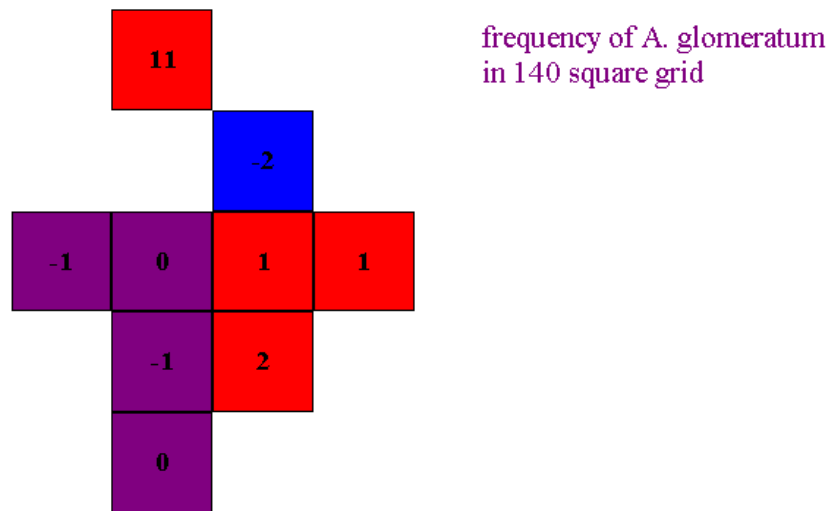


### Thorn Rock mooring results 2002 - 2003





### Sandy Sea Fan Gully results. 2002 - 03



#### TARGETS

To maintain the current colony sizes and to monitor levels of damage / disease.

#### CURRENT STATUS

The colonies in the North Wall stereo quadrats have shown no evidence of damage or disease and the population appears stable.

The North Wall and the Thorn Rock sites need further surveillance to assess their status.

#### RECOMMENDATIONS

Continue with monitoring.

**PARAZOANTHUS AXINELLAE POPULATION  
(CMS code: RM23/05)**

**STATUS** Ongoing, annual sampling.

**PROJECT RATIONALE**

The population of *Parazoanthus axinellae* (yellow trumpet anemone) is an important feature of Skomer MNR. *P. axinellae* is a Lusitanian (south-western) species nearing the edge of its range and may act as an indicator of climatic change.

**OBJECTIVES**

Monitor *P. axinellae* colonies for changes in polyp density and colony area.

**SITES**

- Sandy Sea Fan Gully
- Thorn Rock (3 colonies)
- Way Bench (2 colonies)

**METHODS**

Density estimates: Close up photographs are taken and polyps are counted using GIS image analysis techniques.

Area of the colony: A series of transects are placed through the colonies. Photographs are taken using a 50 x 70cm framer. The images are analysed by overlaying a 5 x 5cm grid and recording presence/absence of *P. axinellae* within the grid squares.

See Burton, Lock & Newman 2002 for details.

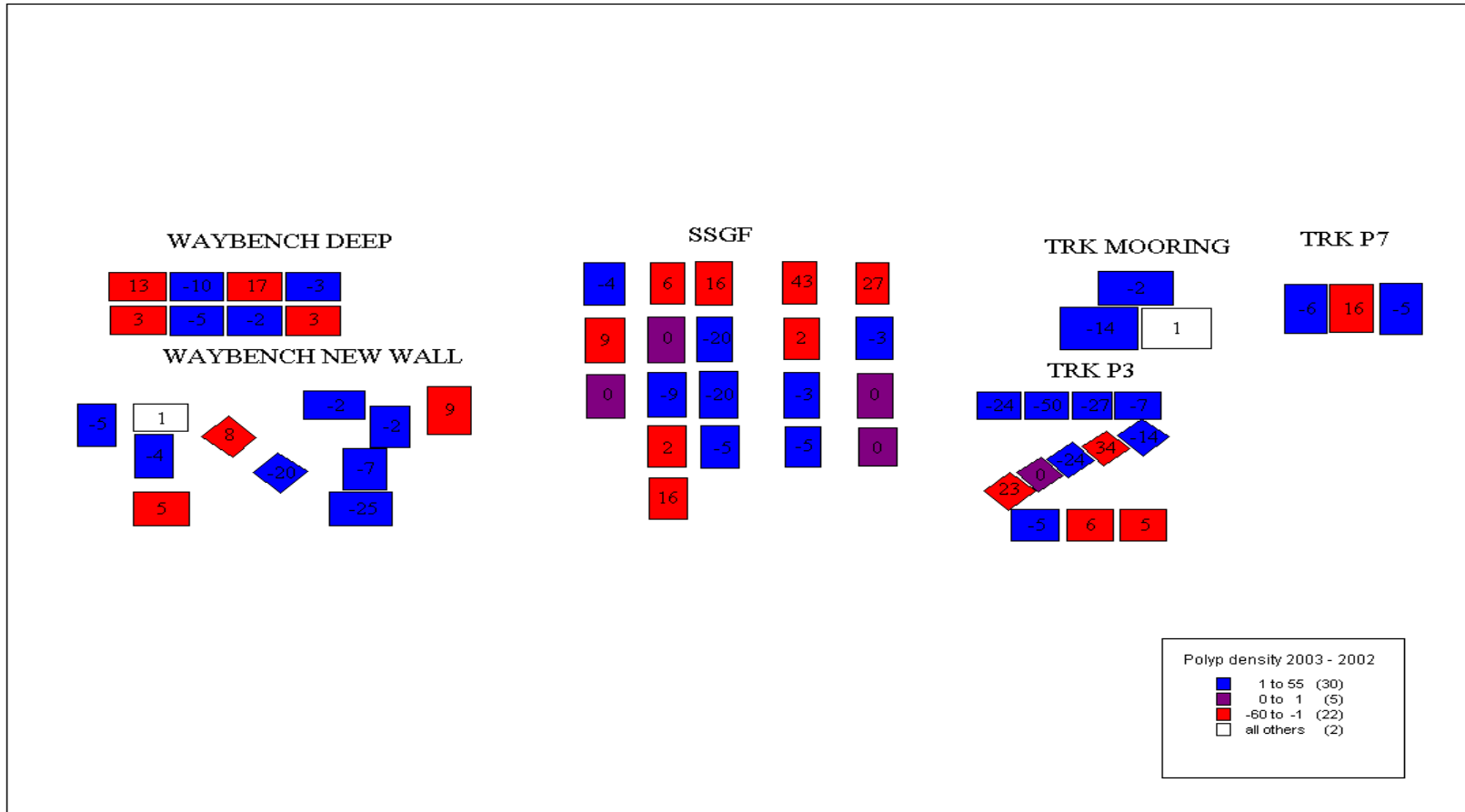
**RESULTS**

<b>Colony area</b>	
<b>Site</b>	<b>Index of Area</b>
<i>Sandy Sea Fan Gully</i>	5 transects (20 samples)
<i>Waybench – New Wall</i>	11 re-locatable samples
<i>Waybench – Deep Wall</i>	2 transects (8 samples)
<i>Thorn Rock – Piton 7</i>	3 re-locatable samples
<i>Thorn Rock - Mooring</i>	3 re-locatable samples
<i>Thorn Rock – Piton 3</i>	3 transects (12 samples)

<b>Density</b>			
<b>Site</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>
<i>Sandy Sea Fan Gully</i>	25 samples	16 samples	32 samples
<i>Waybench – New Wall</i>	None	16 samples	34 samples
<i>Waybench – Deep Wall</i>	None	16 samples	30 samples
<i>Thorn Rock – Piton 7</i>	None	None	None
<i>Thorn Rock - Mooring</i>	None	None	None
<i>Thorn Rock – Piton 3</i>	17 samples	17 samples	24 samples

# RESULTS OF COLONY AREA TRANSECTS FOR 2002 & 2003

Changes in frequency between 2002 & 2003



## Density estimate results (number of polyps / 0.03255 m<sup>2</sup>)

Site	Statistic	2001	2002	2003
<i>Sandy Sea Fan Gully</i>	Mean	117.96	<b>146.19**</b>	<b>77.25**</b>
	STDEV (s)	57.37	36.87	50.61
	n	25	16	32
Thorn Rock – <i>Piton 7</i>	Mean	188.18	<b>143.5**</b>	<b>94.875**</b>
	STDEV (s)	70.85	72.37	75.12
	n	17	18	24
Waybench – <i>New Wall</i>	Mean		167.69	<b>75.38**</b>
	STDEV (s)		73.71	67.54
	n		16	34
Waybench – <i>Deep Wall</i>	Mean		133.5	<b>45.1**</b>
	STDEV (s)		60.92	41.87
	n		16	30

\*\* = Mean significantly different to previous year (P < 0.01 t-test)

### TARGETS

Monitor the colonies to establish levels of acceptable change.

### CURRENT STATUS

The 2003 field season incorporated the recommendations suggested in 2002 by increasing the number of density samples and adopting a repeated measures design for density sampling.

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**PENTAPORA FOLIACEA (ROSS CORAL) POPULATION  
(CMS code: RM63/01)**

**STATUS** Ongoing. Annual survey.

**PROJECT RATIONALE**

Colonies of the bryozoan; *Pentapora foliacea* are fragile structures thought to be moderately slow growing, and long lived. They are important microhabitats for mobile species and are regarded as useful indicators of anthropogenic activity such as mobile fishing gear and anchoring.

**OBJECTIVES**

To monitor the numbers and growth rate of Ross coral colonies.  
To monitor the amount of damage occurring to the colonies.

**SITES**

- North of the Neck (2002)
- North wall (1984 – 2002)
- Way bench (1993/4 restarted 2002)
- Bernie’s Rocks (2 sites 1995 onwards)
- South of Middleholm (2003)

**METHODS**

Photographs are taken using a single or stereo camera set up on a frame. Gilbert (1998) tested various image analysis methods for assessing growth rate but concluded that a 3D method would be most suitable. Colonies can be put into size classes using base area (cm<sup>2</sup>) however this is only an approximate measure of colony size.

**RESULTS**

Number of colonies at each site:

SITE	1993	1994	1995	1997	1998	2000	2002	2003
North of the Neck							11	14 (2 lost 5 new)
North wall							0	
Way bench	53	?					17	17 (3 lost 3 new)
Bernie’s Rocks – deep			17	8	2	0	0	2
Bernie’s Rocks - shallow		10	14	9	4	8	10*	13*
South of Middleholm								12

\* Increased area of survey

Mean base area (cm <sup>2</sup> )	2002	2003
Waybench	279.7	377.7
North of the Neck	29.5	15.5

The results from 2003 show an increase in the number of Ross coral colonies. A detailed search at Bernie's Rocks showed several new colonies. The average size of colonies also increased at Waybench. By contrast, colony size decreased at North of the Neck however this was due to the loss of a large colony.

A new site was established on the South side of the island (South of Middleholm).

### **TARGETS**

Evidence of colony growth. No significant colony losses attributable to anthropogenic impacts on the seabed.

### **CURRENT STATUS**

Large colonies show longevity whilst small colonies can be short lived especially in mobile environments. There is no evidence that the loss of colonies seen to date is correlated with changes in fishing activity.

### **RECOMMENDATIONS**

Needs continued surveillance to establish the longevity of the colonies and their response to damage. Further information needed on the biology of *Pentapora foliacea*.

### **REFERENCES**

Bunker & Mercer 1988, Bullimore 1987, Gilbert 1998.

## CUP CORAL POPULATIONS; *BALANOPHYLLIA REGIA* AND *CARYOPHYLLIA SMITHII* (CMS code: RM23/04)

**STATUS** Ongoing. Annual sampling.

### PROJECT RATIONALE

*Balanophyllia regia* is a Lusitanian species; Skomer MNR is close to the northern edge of its range in the UK.

*Caryophyllia smithii* is a common feature of the sub-littoral benthic community of western Britain.

Cup corals are slow growing filter feeders, which are susceptible to changes in water quality and planktonic food supply.

### OBJECTIVES

To monitor the population for changes in densities and to look for evidence of recruitment.

### SITES

- Thorn Rock
- The Wick

### METHODS

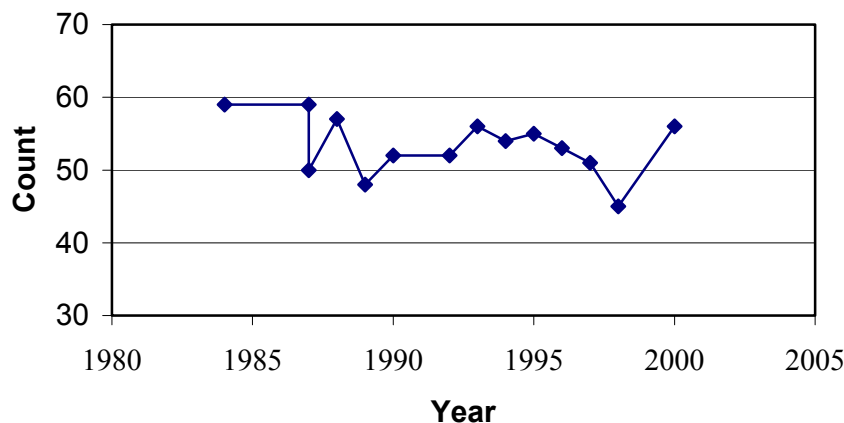
*Balanophyllia regia*: five fixed position quadrats at Thorn Rock have been photographed since 1985 and in 2002 three transects with 51 quadrats were established at The Wick. Photographs are taken using a 50 x 40 cm quadrat and counts are carried out using GIS techniques (see Burton, Lock & Newman 2002).

*Caryophyllia smithii*: approximately 70 quadrats have been analysed on a yearly basis since 1993 from photographs taken for the sponge community project at Thorn Rock. Photographs are taken using a 50 x 70cm framer and counts are carried out by eye using a loupe.

### RESULTS

*Balanophyllia regia*: Individuals have been traced for 18 years. Evidence of recruitment has been observed, however surface sediments obscure small individuals.

#### Counts of *Balanophyllia regia* in 40 x 50cm quadrats at Thorn Rock



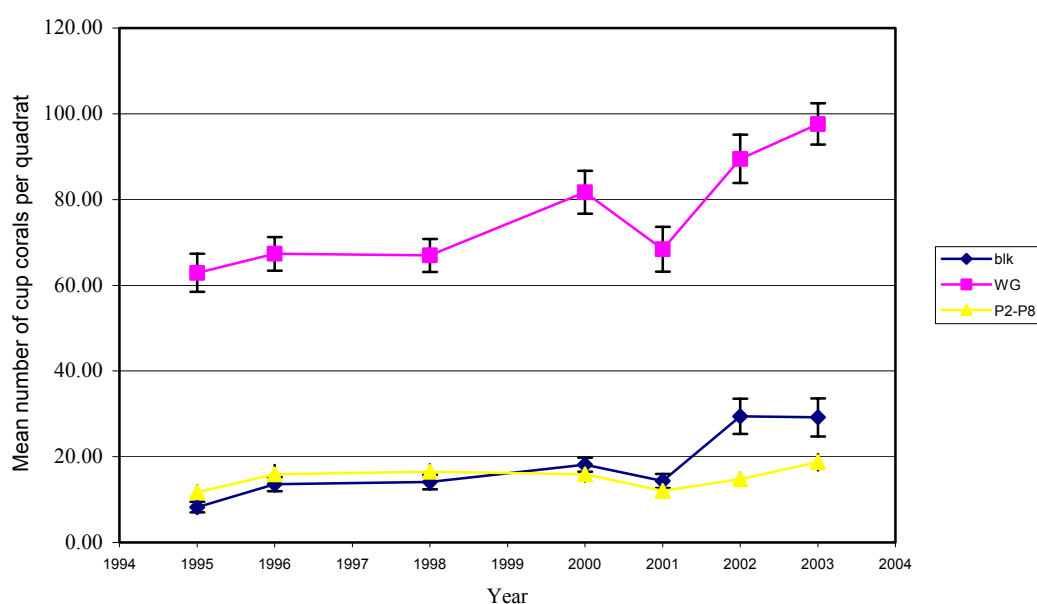
## Abundance of *Balanophyllia regia* in The Wick

Transect	2002		2003	
	Mean	S.D.	Mean	S.D.
A	40.5	26.3	50.4	43.1
B	64.6	36.3	71.9	39.3
C	53.1	33.4	49.9	42.5

No significant differences in densities were observed between 2002 and 2003 for transects A, B or C (two-sample t-Test).

## *Caryophyllia smithii*:

### Abundance of *C. smithii* from 3 sites at Thorn Rock 1995 – 2002



The changes in mean abundance observed may have been due to variable levels of surface sediment affecting the actual numbers visible during recording.

## TARGETS

- Maintain the current abundance levels.
- Observe evidence of recruitment.

## CURRENT STATUS

Ongoing. Variability in numbers is probably due to varying levels of surface sediment. The populations appear stable although there is little evidence of recruitment.

## RECOMMENDATIONS

Records of surface sediment levels may help determine whether reduced abundance of cup corals is significant or due to recording inconsistencies.

Review photographs to test the possibility of tracing individuals from year to year.



## ATLANTIC GREY SEAL (*HALICHOERUS GRYPUS*) POPULATION (CMS code: RA03/01)

**STATUS** Ongoing. Annual survey.

### PROJECT RATIONALE

Grey seals are a protected species of conservation importance, which live and breed in the Skomer MNR. The West Wales population is the largest in SW Britain and a feature of the Pembrokeshire Islands SAC.

### OBJECTIVES

To monitor the number of seal pups born in the MNR and the survival rate of those pups as an indication of the state of the whole population.

### SITES

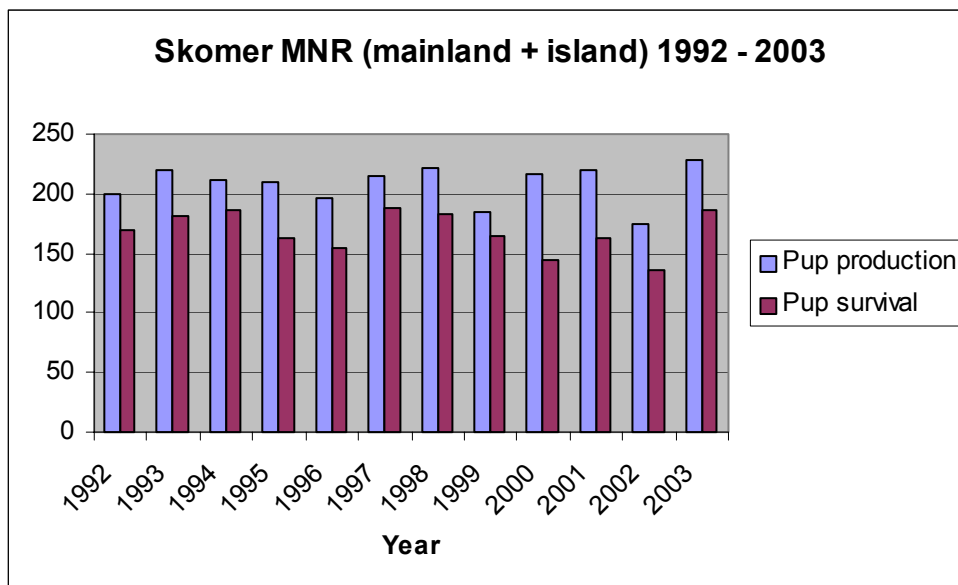
All pupping beaches and caves in the MNR.

### METHODS

The pups are recorded from birth through to their first moult using the “Smith 5 fold classification system” (Poole 1996). Reason for death is recorded if possible. Additional behavioural observations are recorded for the Island seals. Full method described in ‘Grey Seal Monitoring Handbook’ Poole 1996.

### RESULTS

Regular recording began in 1974 and surveys have been completed annually since 1983. From 1992 onwards a standard protocol has been adopted to record the pupping success on both the island and the mainland and an annual seal report was produced each year.



1998 – provision of information about seal watching and current pup numbers at sites around the Marloes Peninsula was commenced at the MNR Visitor Centre.

2002 – Methods to study seal disturbance were tested and this work continued into 2003 to gather more data. An MNR ‘seal watching’ leaflet was produced and distributed at the National Trust car park at Martins Haven. The leaflet included information about how to behave whilst watching seals.

### **TARGETS**

- Number of pups born greater than 190 (170 in any 4 year period, provided numbers recover to over 190 in the following year)
- Percentage survival of pups greater than 70% (67% in any 4 year period, provided survival recovers to over 72% in the following year)

### **CURRENT STATUS**

Pup numbers reached an all time high of 228 with an 82% survival rate in 2003. This follows last year’s relatively low numbers. The mainland beaches made a much larger contribution to the MNR total than normal.

### **RECOMMENDATIONS**

1. To continue annual survey following the ‘Grey Seal Monitoring Handbook’ Poole 1996.
2. To continue the seal disturbance study following methods developed in 2002.
3. Provide visitors with information about Atlantic grey seals both in the Visitor Centre and through the distribution of the ‘seal watching’ leaflet developed in 2002.

### **REFERENCES**

Information on grey seal pupping, behaviour and haul-outs on Skomer Island is documented in a series of reports dating from 1976 (Davis & Davis 1976; Alexander & Alexander 1985; Hellawell, 1987, 1988; Sutcliffe, 1989; Orsman, 1990, 1991; Poole, 1992 - 1999; Field, 2000; Pillsworth, 2001, Duffield, 2002 & Matthews 2003).

Less information is available for the mainland and is on pup production only until 1992. (Anderson 1977; Cullen 1978; MNR records 1992-2000).

Poole 1996. Grey Seal Monitoring Handbook.

## **ECHINODERM POPULATIONS: *ECHINUS ESCULENTUS*, *MARTHASTERIAS GLACIALIS*, *CROSSASTER PAPPOSUS* AND *LUIDIA CILIARIS* . (CMS code: RM73/01)**

### **STATUS**

The first survey since 1979. Survey to be repeated every 4/5 years.

### **PROJECT RATIONALE**

*Echinus esculentus* is an omnivorous grazer and a biological structuring factor of primary importance. During the 1970s divers targeted the Skomer MNR population for the curio trade and large numbers were removed. Bishop (1982) reported that mean densities of *E. esculentus* in Skomer MNR were not significantly different from densities in a commercially exploited population. The 2003 survey aims to establish the current status of the population. The starfish, *Marthasterias glacialis*, *Crossaster papposus* and *Luidia ciliaris* are easily identifiable and information on their distribution and abundance would be of interest.

### **OBJECTIVES**

1. To determine the density and distribution of *E. esculentus*
2. To determine *E. esculentus* population dynamics
3. To determine the density and distribution of *M. glacialis*, *C. papposus* and *L. ciliaris*.
4. To develop a method appropriate for a volunteer diving project.
5. To estimate numbers of *E. esculentus* affected by the urchin “balding” disease observed in the past.

### **SITES**

Skomer Island and the North Marloes Peninsula.

### **METHODS**

The number of *E. esculentus*, *M. glacialis*, *C. papposus* and *L. ciliaris* were recorded 1m either side of 30m transects. In addition, the widest diameter of each urchin was measured using callipers and the distance on the tape measure recorded. The method was designed for volunteer divers and is described in Lock & Luddington (2004).

### **RESULTS**

The 2003 Echinoderm survey was the first since 1979. The results will be used as a baseline for future surveillance.

Example distribution map generated by MapInfo GIS:

### Density ( $100 \text{ m}^{-2}$ ) and distribution of *E. esculentus* in Skomer MNR 2003

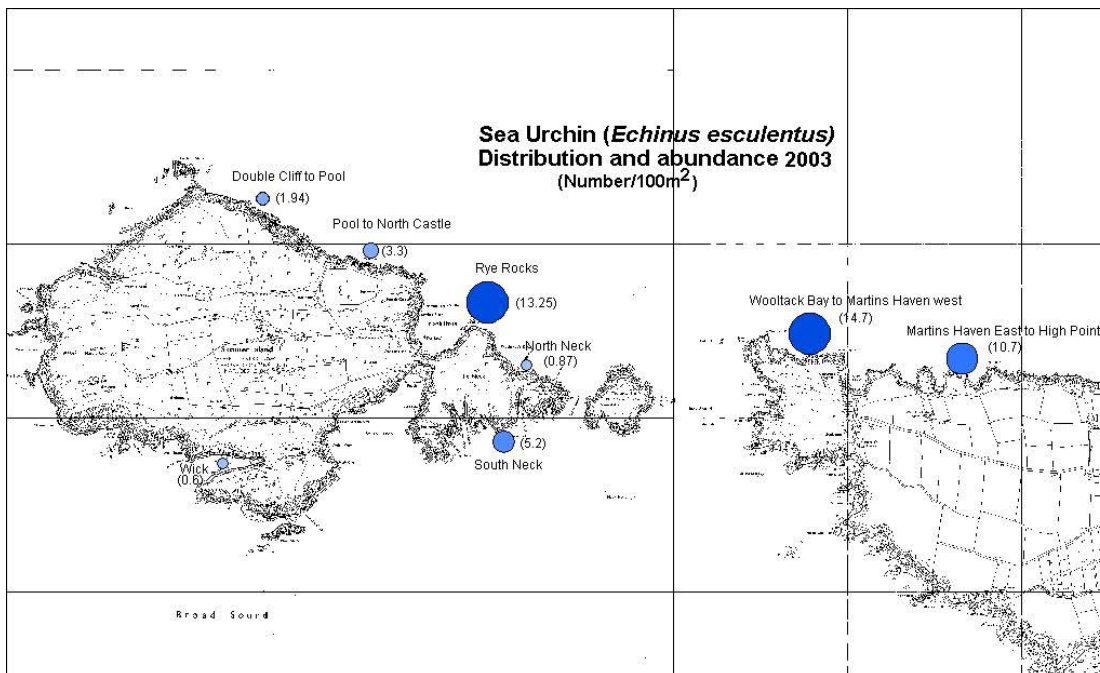


Figure 3.3 shows the density of *E. esculentus* per  $100 \text{ m}^2$  recorded at different sites

#### TARGETS

None set at present.

#### CURRENT STATUS

Baseline survey completed.

#### RECOMMENDATIONS

Continue with volunteer survey methodology as established in 2003 to produce a time series of comparable data.

Surveys to be repeated every 4/5 years; next survey 2008.

Subsequent surveys will concentrate on specific sites with an increase in effort if possible.

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Lock & Luddington, 2004.

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## **APPENDICES**

### **APPENDIX 1**

#### **STUDENT PROJECTS**

#### **DISTRIBUTION AND POPULATION DYNAMICS OF COMMERCIAL CRUSTACEAN SPECIES IN SKOMER MNR**

**Ben Fothergill, University of Plymouth**

#### **INTRODUCTION**

Potting is the main commercial fishing activity carried out in Skomer MNR (beam trawling and dredging are prohibited) and fishing effort has been recorded since 1989. Four fishing vessels are responsible for the majority of potting effort and collectively they exploit a large proportion of the MNR. For example, in 2002 52 % of the MNR was potted and average potting effort was 32 pots/km<sup>2</sup>/visit (Skomer MNR 2002 CCW West Area Report No. 19). Despite this consistent fishing effort, no previous study has attempted to record the distribution and population dynamics of commercial crustacean species in Skomer MNR.

#### **OBJECTIVES**

To identify crustacean species caught by pots in Skomer MNR. Obtain size frequency distribution information for species caught and identify site differences in catch numbers.

#### **SITES**

Site A (North side of mainland)

Site B (South side of Skomer)

Site C (North side of Skomer)

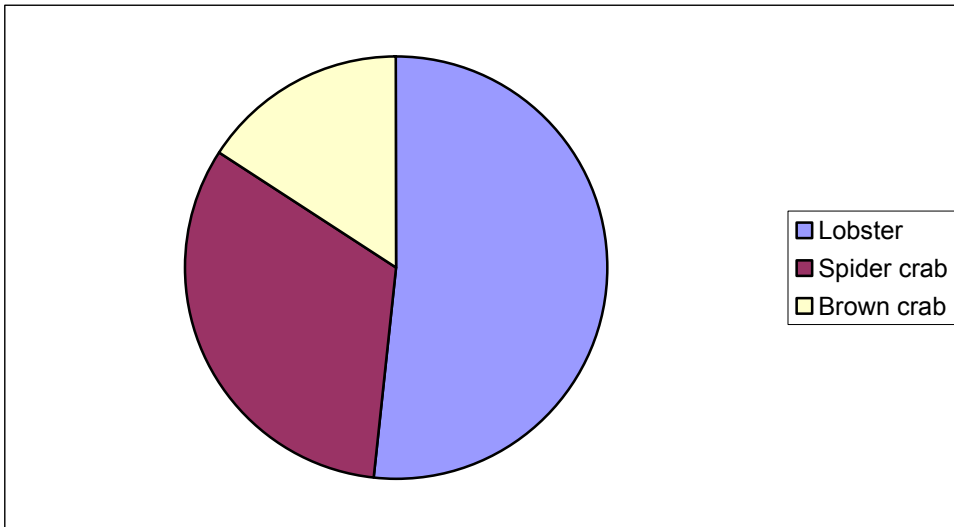
#### **METHOD**

Two single pots were set at each site and hauled every 3-4 days between 12<sup>th</sup> August and 24<sup>th</sup> September 2003. The carapace length of *Homarus gammarus* (Common lobster) *Cancer pagurus* (Edible or brown crab) and *Maja squinado* (Common spider crab) was measured to the nearest mm. In addition, *H. gammarus* and *C. pagurus* were tagged by securing a small cable tie to one limb; individuals were identified by which limb was tagged and colour of cable tie. Animals were quickly released back to the same sites.

#### **RESULTS**

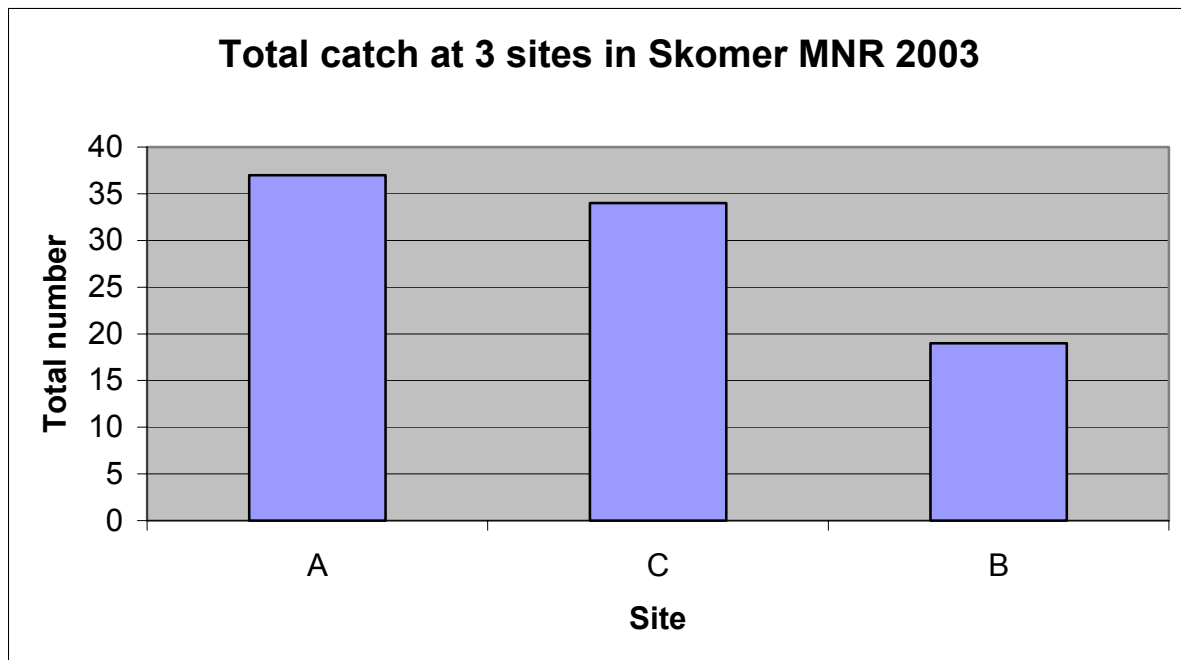
Three commercial species made up the total catch. Common lobster comprised 51 % of the catch whilst Common spider crab and Brown crab comprised 32 % and 15.5 % respectively (Figure 1).

**Figure 1. Total catch (%) of *H. gammarus*, *M. squinado* and *C. pagurus* in Skomer MNR between 12<sup>th</sup> August and 24<sup>th</sup> September 2003.**

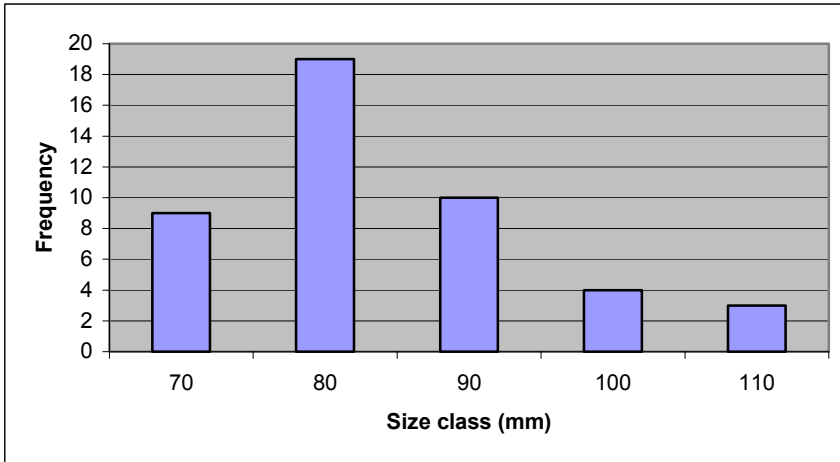


Total number of individuals caught was 37 at Site A 34 at Site C and only 19 at Site B (Figure 2). The size frequency distributions for each species are approximately normal (Figure 3). The legal size limit for *H. gammarus* and *C. pagurus* is 90 mm and 140 mm respectively; 38 % of *H. gammarus* and 34 % of *C. pagurus* caught were above the legal size limit.

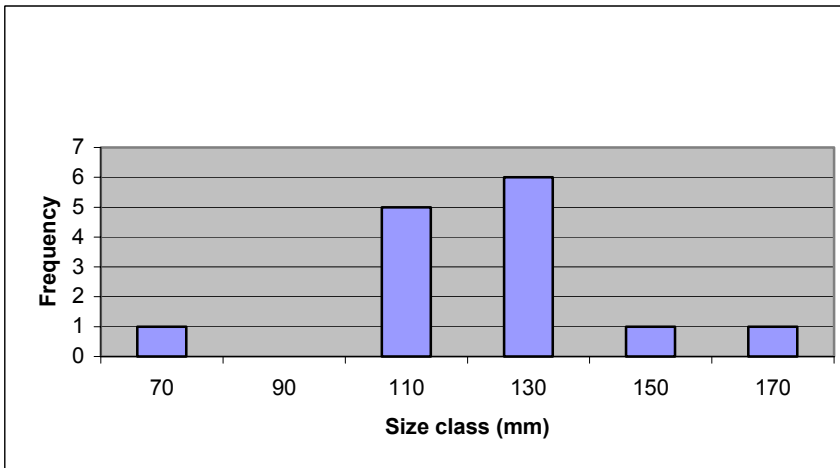
**Figure 2. Total catch of *H. gammarus*, *C. pagurus* and *M. squinado* at Sites A, B and C in Skomer MNR between 12<sup>th</sup> August and 24<sup>th</sup> September 2003.**



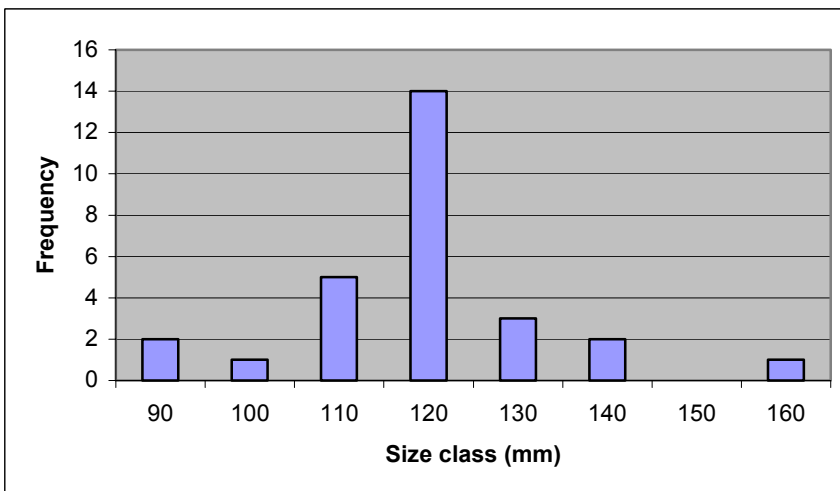
**Figure 3. Size frequency distribution of a) *Homarus gammarus* b) *Cancer pagurus* c) *Maja squinado* caught in Skomer MNR between 12<sup>th</sup> August and 24<sup>th</sup> September 2003.**  
**a) *Homarus gammarus***



**b) *Cancer pagurus***



**c) *Maja squinado***



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