

Cyngor Cefn Gwlad Cymru
Countryside Council for Wales



Skomer Marine Nature Reserve
Project Status Report 2004/5
Report CCW/WW/04/5

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P. Newman. March 2005**



SYNOPSIS

The third project status report produced by the Skomer Marine Nature Reserve summarises the progress and status of monitoring projects in the Skomer MNR in 2004. A summary of all established projects in the MNR is provided in a table format. For each project that was worked on in the 2004 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. (2005). Skomer Marine Nature Reserve project status report 2004/05. CCW West Area Report 29

CRYNODEB

Mae'r trydydd 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 2004, 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. (2005). Skomer Marine Nature Reserve project status report 2004/05. Adroddiad 29, Ardal y Gorllewin, Cyngor Cefn Gwlad Cymru.

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1 INTRODUCTION

This is the third project status report produced by the Skomer Marine Nature Reserve. It summarises the progress and status of monitoring projects in the Skomer MNR in 2004. The project status table in section 2 provides a summary of all established projects in the MNR in 2004. 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 2004 field season:

- The scallop volunteer project was successfully run involving over 50 volunteers. The survey repeated the sites established in the 2000 survey and extended the project to 4 new sites.
- *Tritonia nilsodhneri* and *Simnia patula* have both been recorded in 2004 during the *Eunicella verrucosa* project. Previous records suggest that this is the first confirmed record of *S. patula* on *E. verrucosa*. *T. nilsodhneri* has not been recorded since 1996 (W. Sanderson *pers comm*). The sightings all came from the North coast of Skomer Island (North wall, The Pool & Bernies Rocks) egg cases of *Tritonia nilsodhneri* were seen at North Wall (East).
- Contractors and MNR staff completed the sediment epifauna communities project fieldwork in September. The samples were analysed by a contractor and a report will follow in 2005.
- A Pembrokeshire College student tested methods and started adult seal identification work using sketches, photos and video at mainland seal sites.

2 SKOMER MNR PROJECTS STATUS SUMMARY TABLE

	Brief description	Year sets	Sampling frequency	Report	Data summary
PHYSICAL					
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 - ongoing	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	No
ACTIVITY					
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 SMNR annual reports	Yes-Skomer MNR office
Tankers in St Brides bay	Number and names of tankers and movements	1994 - ongoing	Daily	No	Yes-Skomer MNR office
BIOLOGICAL					
Littoral communities:					
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 – 2002	Annual	Adams 1979/ Bunker 1983/ Crump 1993/96 Hudson 1995.	Yes-Skomer MNR office
	9 sites established in 2003 including 3 Marclim sites. Site marking completed in 2004.	2003 - ongoing	Annual	Burton & Crump 2004	Yes-Skomer MNR office

	Brief description	Year sets	Sampling frequency	Report	Data summary
Sub littoral communities:					
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 2005	Hiscock, S 1983 & 1986 Scott 1994 Brodie & Bunker 1999/2000	
Sponge assemblages	Time series mono-photo/digitised. Species recording.	1994 - ongoing 2002/3	Annual Every 5 years, next survey planned 2006/7	Bunker <i>et al</i> 1992	Yes-Skomer MNR office
Infaunal sediment	Surveys and reports completed	1993/1996/ 1998/ 2003	Every 5 years Next survey planned 2008	Rostron 1994 & 1996 Barfield 1998 & 2003	Yes-Skomer MNR office
Epifaunal sediment	Survey and report completed	1995/ 2001 & 2004	Every 5 years Next survey planned 2009	Rostron 1996 Moore 2002 Moore 2004 in production	Yes-Skomer MNR office
Flora:					
<i>Zostera marina</i>	Extent of NHV bed & density distribution.	1997/2002 (boundary maps for 2000, 2002 & 2004)	Every 4 years Next survey planned 2006	Jones & Hodgson 1980 & 1981, Jones <i>et al</i> 1983, Lock 1998 & 2003	Yes-Skomer MNR office
Fauna:					
<i>Eunicella verrucosa</i>	101 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) North wall East, Thorn rock & Rye rocks.	1984- ongoing 2002 new transects	Annual	Bullimore 1986 & 1987	Yes-Skomer MNR office

	Brief description	Year sets	Sampling frequency	Report	Data summary
<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 @ thorn rock 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- 2000 Survey completed, 7 sites 2004.	1979/80, 1979-82 2000 2004	Every 4 years Next survey planned 2008	Bullimore 1985 Jones 1979 & 1980 Lock 2002 Luddington <i>et al</i> 2004	
Nudibranch species	Various surveys MNR survey completed.	1975-1991 2002	Every 4 years Next survey planned 2006	Bunker <i>et al</i> 1993, Luddington 2002	
Territorial fish	Survey methods developed. Survey completed.	1997 2001/2002	Every 4 years Next survey planned 2005	Lock 1998	Yes-Skomer MNR office
Atlantic Grey seal	Surveys and reports. Seal disturbance study.	1976- ongoing 2002 & 2003	Annual	Grey seal breeding census, Skomer Island 1992-2004, Skomer MNR annual reports. Lock <i>et al</i> 2004.	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 years Next survey planned 2007	Luddington, Lock <i>et al</i> 2004	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 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
- Inside of Pig Stone. New 2003
- Jack sound / Wooltack. New 2003
- Martins Haven. New 2003
- Hopgang (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 Hopgang (Crump, 1996). The littoral shores around Skomer showed no significant changes after the Sea Empress oil spill, with the exception of lichens at Hopgang, 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.

2004 – Methods established in 2003 were continued. All site marking was completed and all results collected.

Littoral community monitoring methods 2004

(see Crump & Burton 2004 for full details)

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 Hopgang)

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)
- Aggregate barnacle species for cell frequency counts (note: the barnacle species found in each 1m quadrat are recorded as being present and barnacles are 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. 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. So far only the Marclim sites have been analysed.

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.

Shore Clingfish (*Lepadogaster lepadogaster*)

Timed searches were conducted at Martins Haven (East and West of the jetty) and at North Haven. Five , 5 minute searches were completed at each site and the number of clingfish found recorded. These searches were carried out in boulder areas in the lower shore where it was known that clingfish were present.

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 & 2004 field work

Mean % cover of barnacles

Mean % cover of barnacles	2003	2003	2004	2004	Upper	Middle
SITE	Upper	Middle	Upper	Middle	difference	2004-2003
Pig Stone inside	40.5	83.75	46.75	81	6.25	-2.75
Double cliff	57	15.75	18.8	31.55	-38.2	15.8
MHV	6.95	48.25	5.25	70.25	-1.7	22
Wooltack point / Jack sound	32.25	57.25	32	64.75	-0.25	7.5
South Stream	50.75	46	47.75	56.75	-3	10.75
Lantern	46.5	69.75	34.35	45.75	-12.15	-24
Wick	51.25	74.75	47.5	84.25	-3.75	9.5

Limpet summary

Counts of limpets from 5 20 x 20cm quadrats

SITE	Mean count 2003		Mean count 2004		Difference 2004 - 2003	
	Upper	Middle	Upper	Middle	Upper	Middle
Wooltack point / Jack sound	0.6	12.05	0.6	8.45	0	-3.6
Pig Stone inside	5.8	13.55	0.6	7.05	-5.2	-6.5
Martin's haven	0.25	13.95	0.1	11.85	-0.15	-2.1
Lantern	0.9	11.75	1.05	8.95	0.15	-2.8
South stream	0.05	7.3	0.2	6.35	0.15	-0.95
The Wick	0.1	5	0.1	4.3	0	-0.7
Double cliff	12.45	12.75	8.85	6.35	-3.6	-6.4

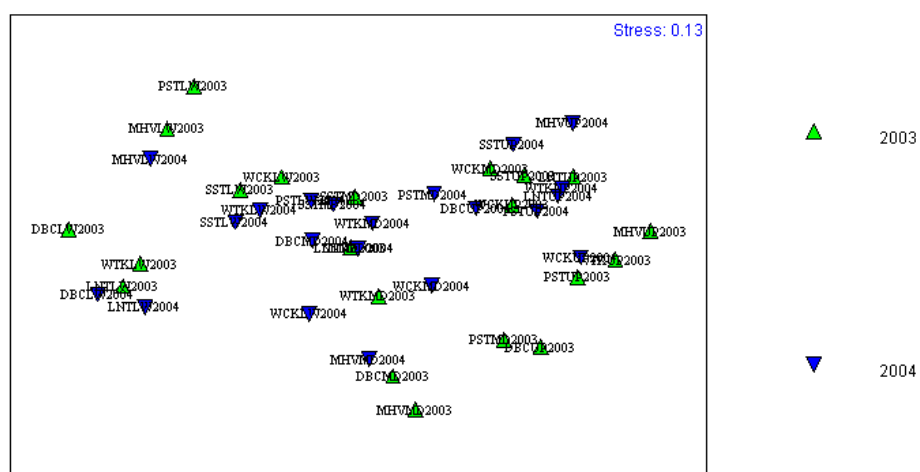
Size of limpets from middle shore(mm)

SITE	2003	2004
	Mean size mm	Mean size mm
Martin's haven	15.7	16.5
Lantern	11.87	18.55
South stream	17.8	21.95
The Wick	16.02	18.75

The trend across all sites is for the abundance to drop slightly and the mean size to increase.

MDS plot of quadrat data for 2003 and 2004 (PA transformation)

Quadrat data for 2003 & 2004



Comparison of 2003 & 2004 quadrat data.

Species	2003 Av.Frequency	2004 Av.Frequency
Barnacle cover (% cover)	32.41	41.66
Melaraphe neritoides	14.68	17.17
Patella spp. (adults)	14.00	17.08
Littorina 'saxatilis'	15.94	19.27
Lithothamnion sp.	4.58	10.76
Verrucaria "maura"	6.73	7.08
Diatom slime/ cyanobacteria	0.02	9.94
Mytilus edulis	7.61	7.67
Enteromorpha spp.	3.56	7.12
Osmundea pinnatifida	4.85	5.82
Corallina spp.	3.11	6.64
Fucus vesiculosus var lin	4.19	5.15
Chthamalus montagui	7.49	0.71
Lichina pygmaea	2.73	3.88
Pelvetia canaliculata	3.14	3.17
Hildenbrandia spp.	3.26	4.67
Ectocarpaceae indet.	2.06	5.18

**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 – 2004. 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 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.

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

Crump R.G. & Burton. M 2004, Skomer Marine Nature Reserve Littoral monitoring: Development of methods. CCW West Area Report 27.

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 (next survey due 2007/8).

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.

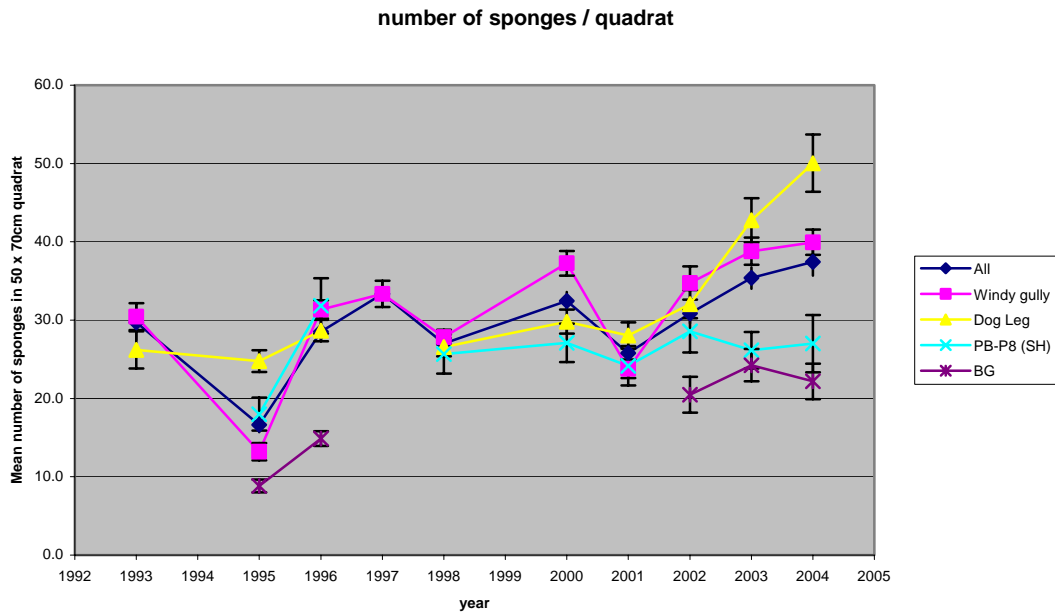
The slides are analysed using a stereo viewer to count the abundance of sponge species and morphology types.

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:

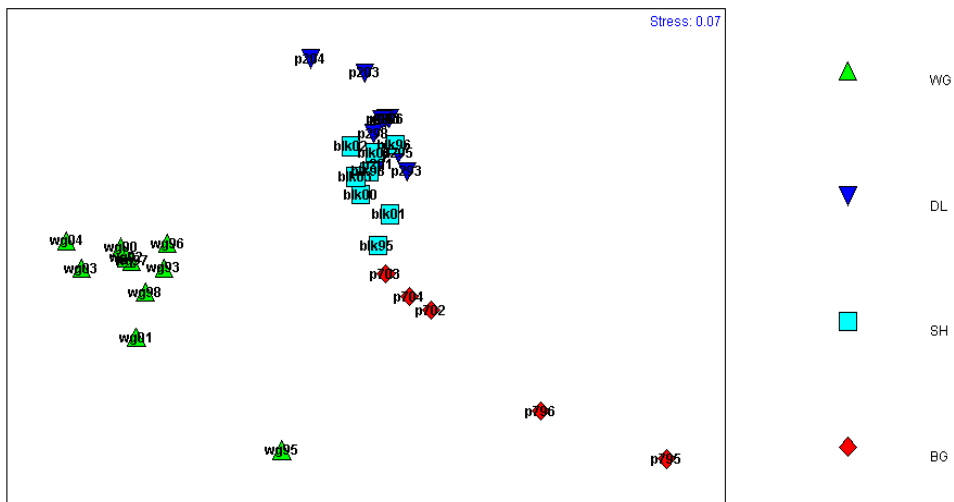
Year	No of samples	Transects
1993	24	Windy Gully
1995	77	Windy Gully, piton B – P8, piton B – P7, P2 – P8
1996	72	Windy Gully, piton B – P8, piton B – P7, P2 – P8
1997	20	Windy Gully
1998	60	Windy Gully, piton B – P8, P2 – P8
2000	63	Windy Gully, piton B – P8, P2 – P8
2001	62	Windy Gully, piton B – P8, 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)
2004	80	Windy Gully, piton B – P8, piton B – P7, P2 – 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).

MDS plot of the sponge communities (morphology data only) at all Thorn Rock

WG – Windy gully, DL – Dogleg, SH – Spongy hillocks BG – Broad gully



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 3 years and the species survey (2003) 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.

MONITORING *EUNICELLA VERRRUCOSA* 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 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.

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
- West Hook

METHODS

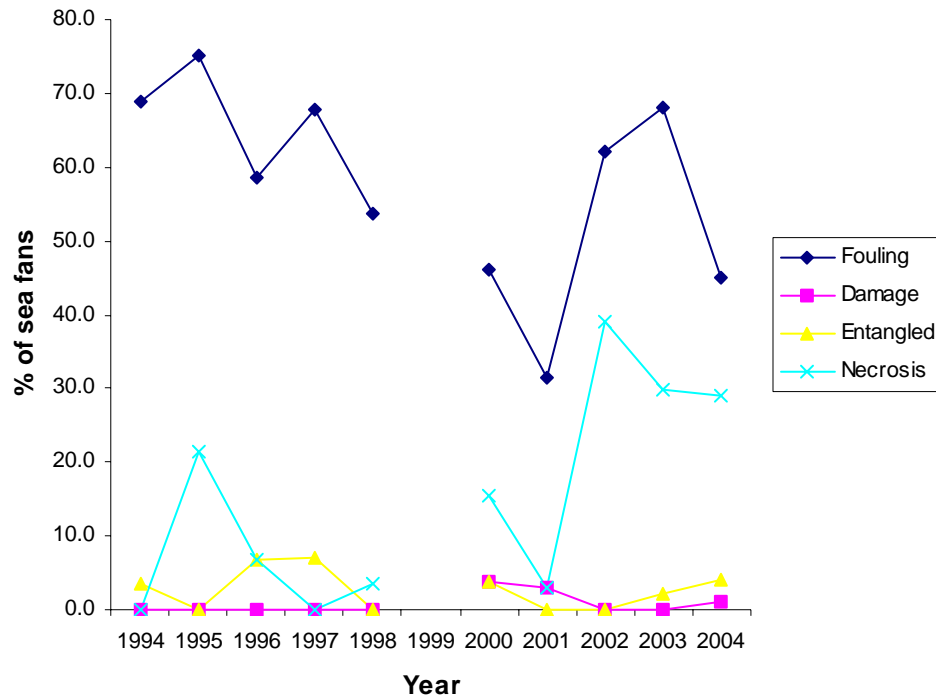
Photographic monitoring using a single camera on a 50 x 70 cm frame with a black grid board as a background. Both sides of the sea fan are photographed and each fan is visually inspected for damage, fouling by epibiota, entanglement with man-made materials, necrosis (loss of living tissue) and the nudibranch *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 & Way 12
2002	74	64	0
2003	102	94	0
2004	105	101	Bho23

Condition of sea fans in the Skomer MNR observed from photographs



CURRENT STATUS

- **Numbers:** 4 losses in 11 years (1994-2004); one unknown colony found detached at Rye Rocks in 2003 and two unknown colonies found detached at RRK and WHK during 2004.
- **Condition:** 5 records of entanglement in 2004. The increase in epibiota fouling seen in 2002 and 2003 now seems to be declining. The number of sea fans with necrotic areas has stabilized and so far there is no evidence that small areas of necrosis have a terminal effect on a sea fan.
- ***Tritonia nilsodhneri* and *Simnia patula*** have both been recorded in 2004. Previous records suggest that this is the first confirmed record of *S. patula* on *E. verrucosa*. *T. nilsodhneri* has not been recorded since 1996 (W. Sanderson *pers comm*). The sightings all came from the North coast of Skomer Island (North wall, The Pool & Bernies Rocks) egg cases of *Tritonia nilsodhneri* were seen at North Wall (East).

RECOMMENDATIONS

- Continue annual photographic monitoring programme
- Complete field records for each colony, recording damage, entanglement, necrosis, levels of epibionts and numbers of *Tritonia nilsodhneri*
- 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.
- Revisit methods for growth estimates at selected colonies.

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 area 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 photographed 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.

Rye Rocks consists of a single transect marking seven quadrat (50 x 70cm) positions.

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.

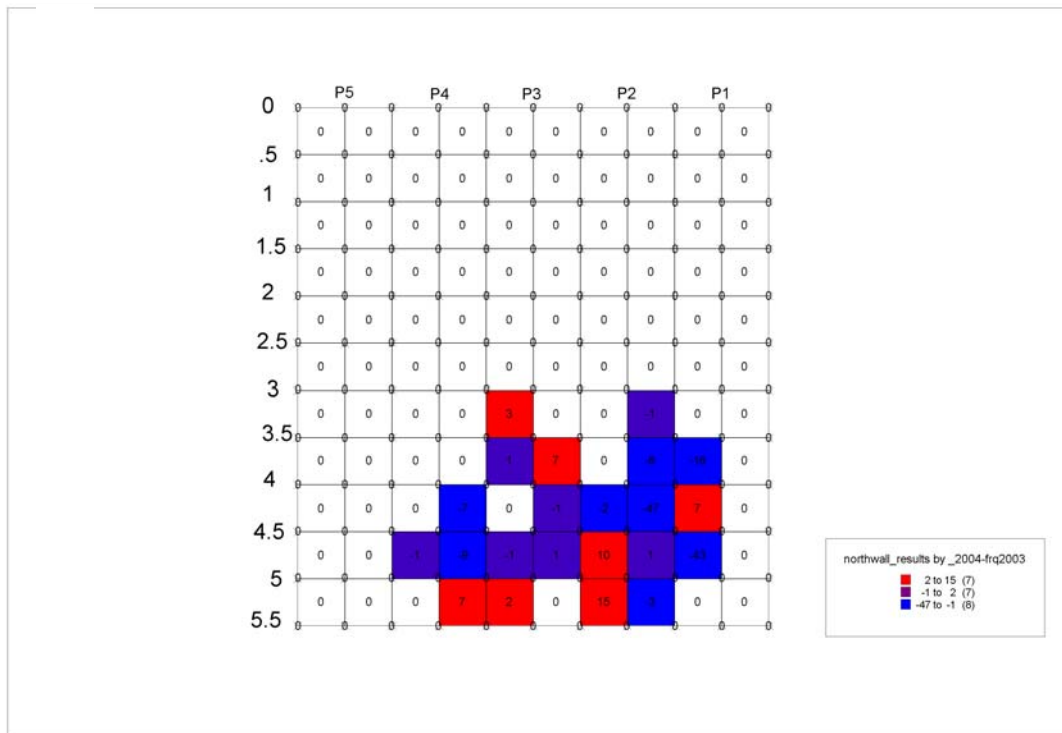
RESULTS

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.

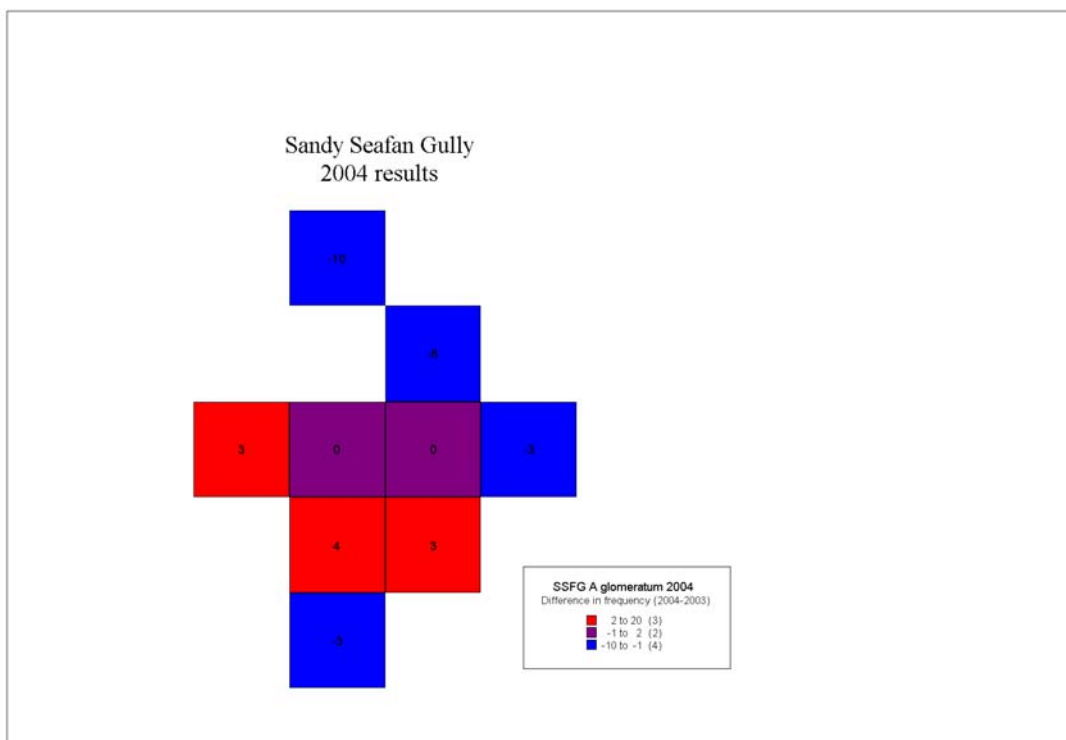
2002 was the first sampling event for the North Wall “*A. glom*” wall, Thorn Rock and Sandy Sea Fan Gully.

These were repeated in the 2003 & 2004 seasons and an additional site was established at Rye rocks. There are now several small colonies along the transects as well as larger colonies.

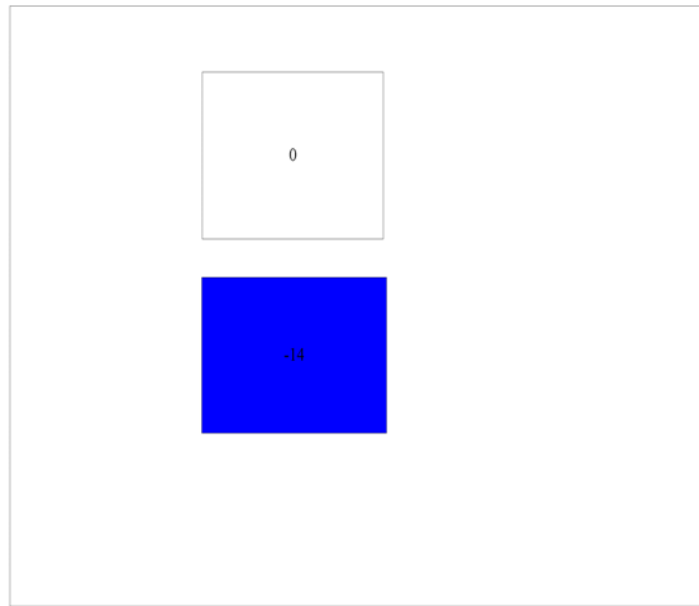
**Difference in frequency of *A. glomeratum* between 2003 & 2004:
North Wall site**



**Difference in frequency of *A. glomeratum* between 2003 & 2004:
Sandy Seafan gully site**



**Difference in frequency of *A. glomeratum* between 2003 & 2004:
Thorn rock mooring**



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, Sandy Sea Fan Gully 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.

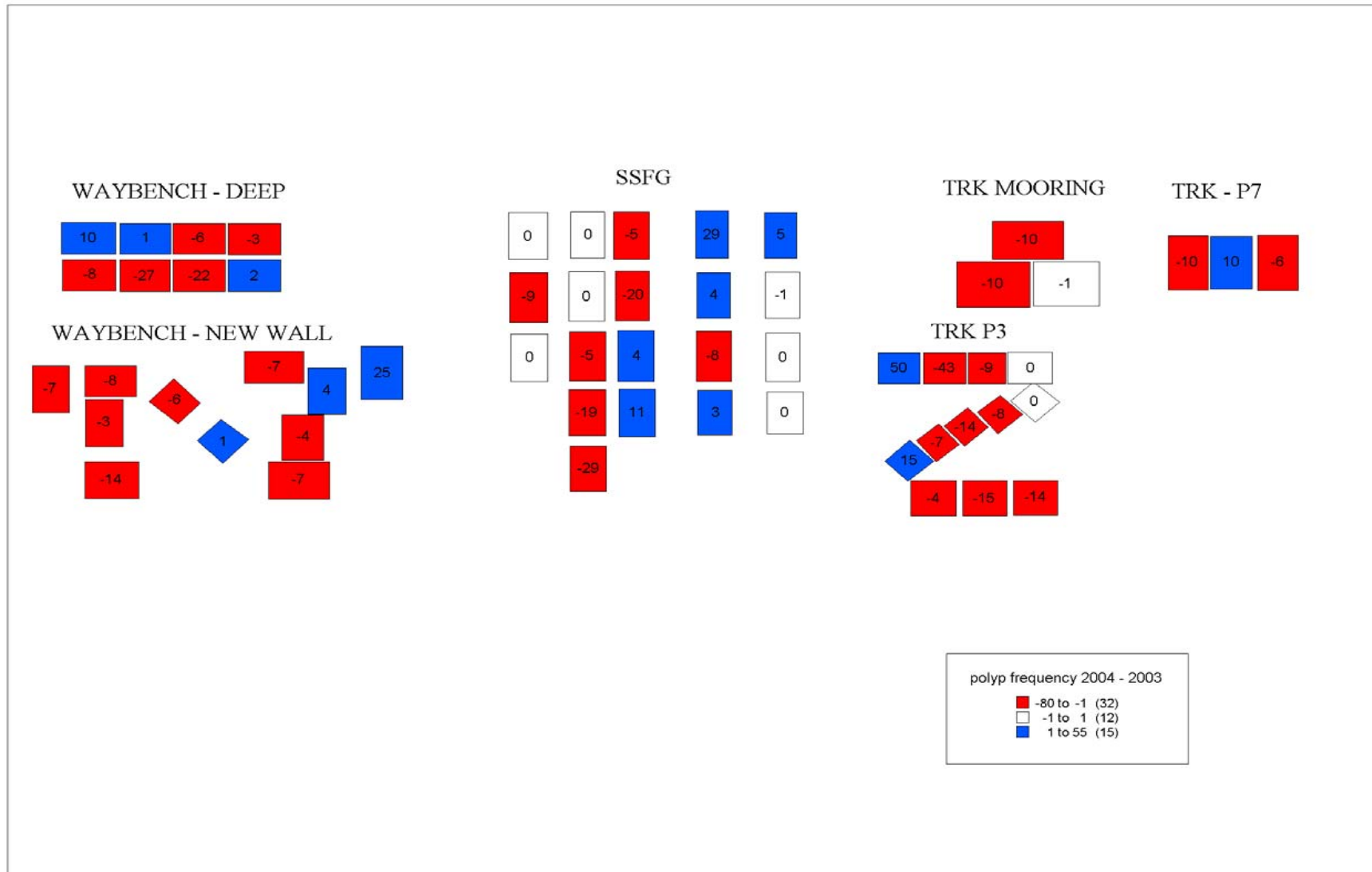
See Burton, Lock & Newman 2002 for details.

RESULTS

Colony area		Density
Site	Index of Area	Close up photographs
<i>Sandy Sea Fan Gully</i>	5 transects (20 samples)	Yes
<i>Waybench – New Wall</i>	11 re-locatable samples	Yes
<i>Waybench – Deep Wall</i>	2 transects (8 samples)	Yes
<i>Thorn Rock – Piton 7</i>	3 re-locatable samples	Not needed
<i>Thorn Rock – Mooring</i>	3 re-locatable samples	Not needed
<i>Thorn Rock – Piton 3</i>	3 transects (12 samples)	Yes

RESULTS OF COLONY AREA TRANSECTS FOR 2004

Changes in frequency between 2003 and 2004 (red shows a loss in frequency blue shows an increase)



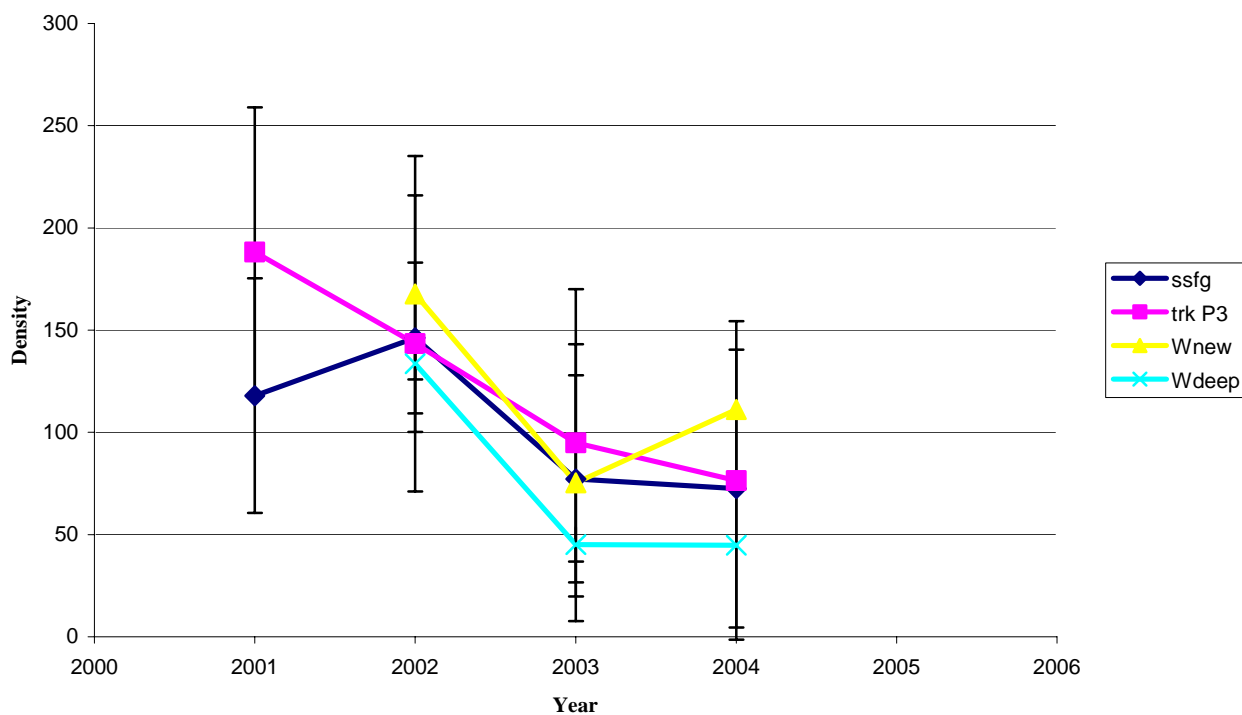
Density estimate results (number of polyps / 0.03255 m²)

Site	Statistic	2001	2002	2003	2004
<i>Sandy Sea Fan Gully</i>	Mean	117.96	146.19**	77.25**	72.50
	STDEV (s)	57.37	36.87	50.61	67.90
	n	25	16	32	32
<i>Thorn Rock – Piton 3</i>	Mean	188.18	143.5**	94.875**	76.45
	STDEV (s)	70.85	72.37	75.12	77.94
	n	17	18	24	33
<i>Waybench – New Wall</i>	Mean		167.69	75.38**	111.13*
	STDEV (s)		73.71	67.54	67.65
	n		16	34	31
<i>Waybench – Deep Wall</i>	Mean		133.5	45.1**	44.83
	STDEV (s)		60.92	41.87	50.26
	n		16	30	36

* = Mean significantly different to previous year (P<0.05 t-test)

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

Density of polyps 2001 - 2004



CURRENT STATUS

With only 3 complete years of data it is too early to draw any firm conclusions from the project. The frequency results do suggest that there has been a decrease in colony sizes in 2004 compared to 2003. The density method used in 2003 was repeated again in 2004 and the results suggest that polyp density has remained stable.

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Hughes R.N. Cancino J.N. (1985).
Jackson JBC. (1977).
Lindenbaum, C. *et al* (2002).
Manuel R.L. (1988).
Newman P & Lock K (2000)

***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 damaging anthropogenic activity such as 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 (cm²) 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	2004
North of the Neck							11	14 (2 lost 5 new)	14 (2 lost 2 new)
Way bench	53	?					17	17 (3 lost 3 new)	14 (5 lost 2 new)
Bernie's Rocks – deep			17	8	2	0	0	2	9
Bernie's Rocks - shallow		10	14	9	4	8	10*	13*	25
South of Middleholm								12	19 (2 lost 9 new)

* Increased area of survey

Mean base area (cm ²)	2002	2003	2004
Waybench	279.7	377.7	360.9
North of the Neck	29.5	15.5	44.6

Results from the 2004 season show an increase in colony number at Bernie's Rocks and South of Middleholm. Waybench lost the majority of the large colony 1 along with other small colonies.

TARGETS

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

CURRENT STATUS

The loss of large colonies is presumably due to damage whilst small colonies can be short lived especially in mobile environments.

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*. Workers from Aberystwyth university are reviewing the analysis methods and will look at the time series data sets.

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

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

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.

OBJECTIVES

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

SITES

- Thorn Rock
- The Wick

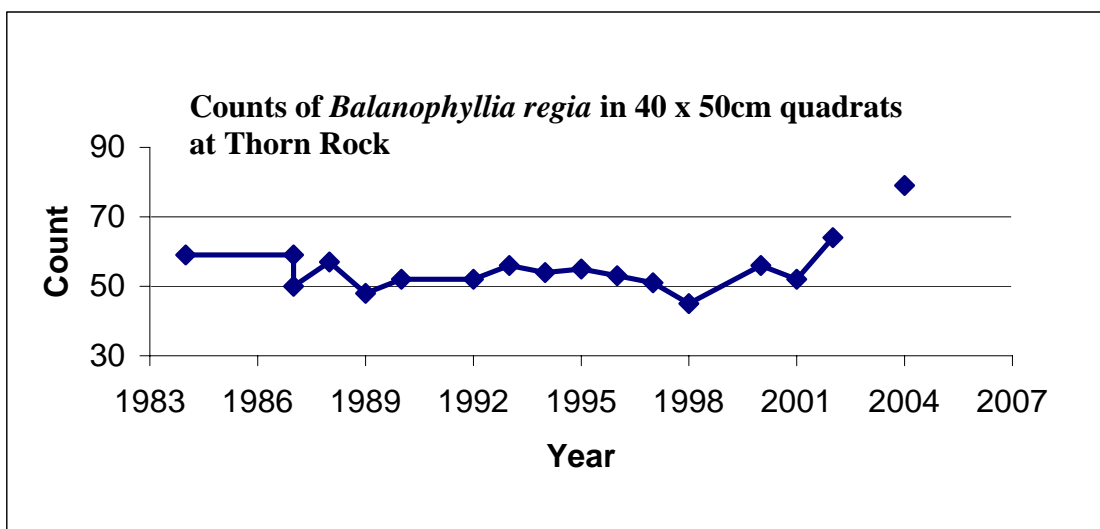
METHODS

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. Some evidence of recruitment has been observed, however surface sediments obscure small individuals.



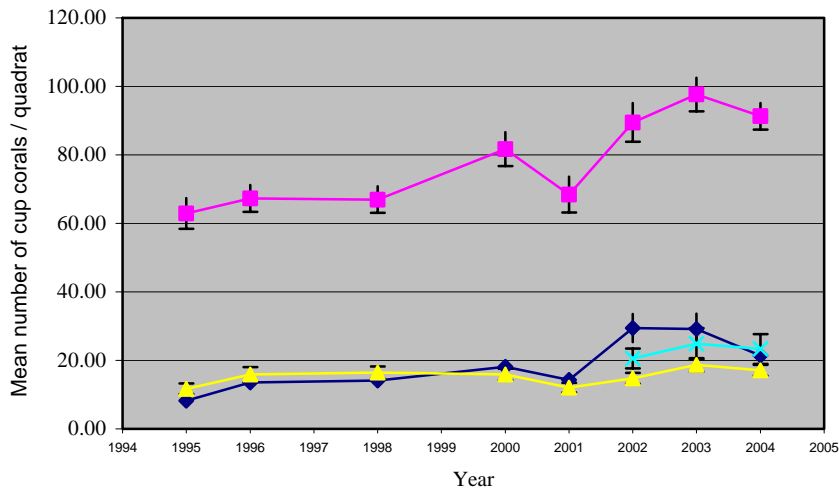
Abundance of *Balanophyllia regia* in The Wick

Transect	2002		2003		2004	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
A	40.5	26.3	50.4	43.1	55	47.2
B	64.6	36.3	71.9	39.3	95.3	40.1
C	53.1	33.4	49.9	42.5	59.6	57.7

The average number of cup corals has increased but there are no significant differences in densities observed between 2003 and 2004 for transects A, B or C (two-sample t-Test). It was noted in the field that there was very little silt on the bedrock.

Caryophyllia smithii:

Abundance of *C. smithii* from 3 sites at Thorn Rock 1995 – 2004



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

CURRENT STATUS

Ongoing. Variability in numbers is partly due to varying levels of surface sediment. The populations appear stable although there is no firm 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.

ZOSTERA MARINA POPULATION (CMS code: RF23/01)

STATUS Ongoing. Surveyed every 5 years, (next survey 2007). Favourable.

PROJECT RATIONALE

Zostera marina is the only flowering plant within the British Isles that grows and produces seed entirely submerged by seawater. *Zostera* populations are highly productive habitats and they provide an important stabilising function for the mobile marine sediments. The maintenance of *Zostera* populations directly influences the associated algal & invertebrate communities that it supports, which are an important source of food for birds.

Zostera marina is one of three seagrass species which are listed as nationally scarce and are included as a key habitat for conservation in the UK Biodiversity Action Plan 1994.

OBJECTIVES

1. To map the boundaries of the *Zostera marina* bed.
2. To determine and identify changes in its distribution and abundance.
3. Record conspicuous organisms associated with the *Zostera* population.

SITES North Haven

METHODS

Permanent markers define the corners of a survey plot of 60 x 60 m² in North Haven and lead lines marked every 5m are laid for the survey duration. Within the plot area transects are completed every 5m. Every 5 metres along each transects *Zostera* shoot counts are taken in 6 25 x 25 cm² quadrats. The transects are continued outside the survey plot where *Zostera* is present. Quadrat counts are completed along these transects at 5 metres until no more *Zostera* is found.

A boat based GPS unit was used to electronically record the boundary of the *Zostera* bed as divers with a surface marker buoy (SMB) swam the edge of the *Zostera* bed.

For detailed methodology see Lock 2003.

RESULTS

The first mapping studies were completed in 1979, 1980 and 1981 by divers swimming on compass bearings and taking abundance readings at 20m intervals. The results were sparse and patchy and comparison between years was difficult.

1982 A detailed method was devised based on a fixed grid area and used a defined abundance scale this method formed the basis of the survey completed in 1997.

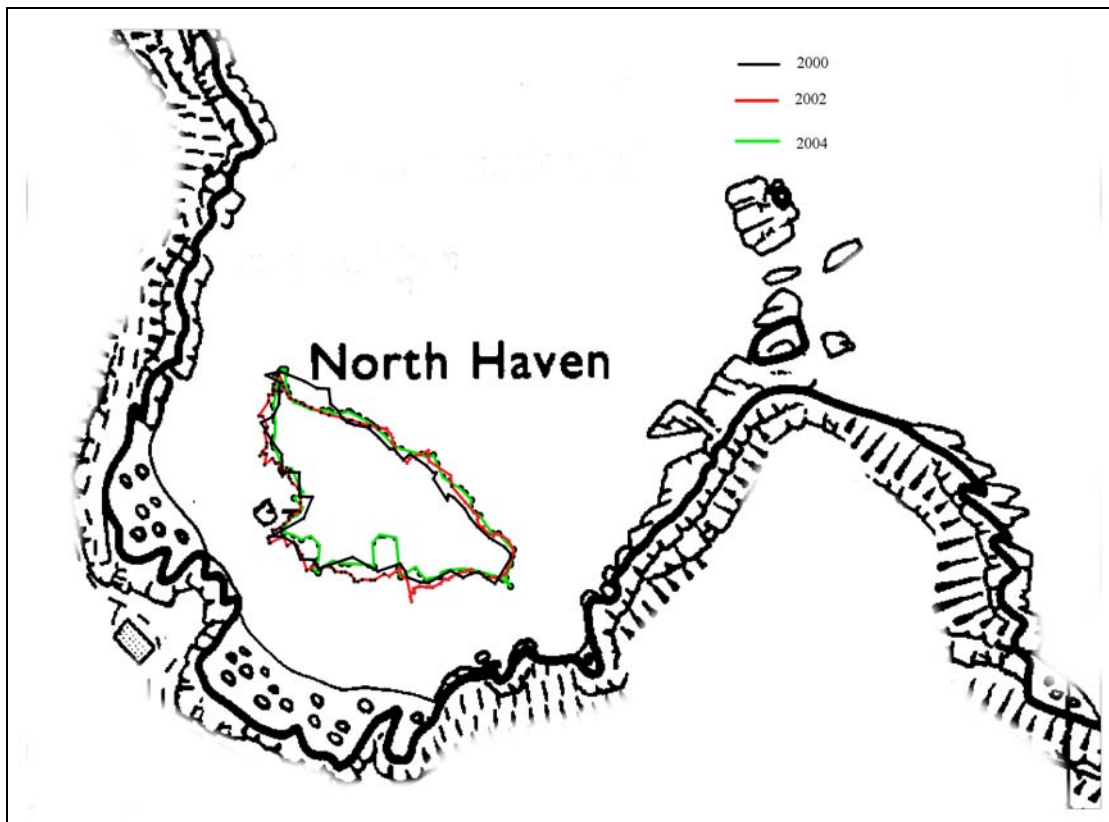
1997 Permanent plot markers established and methods developed for *Zostera* shoot density and boundary maps, this method was repeated in 2002 and maps compared.

1997 A student project was completed by Joanne Trigg: Temporal changes in distribution and abundance of *Zostera marina* and possible effects on benthic community structure.

2002 A study on the epiflora in *Zostera* beds in Wales, including North Haven was completed (Edwards et al 2003).

2000, 2002, 2004 GPS maps were completed to provide *Z.marina* bed boundary maps and area calculations completed.

***Z.marina* bed boundary map, North Haven, 2000, 2002 & 2004**
(2000 – black line, 2002 – red line, 2004 – green line)



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Zostera bed area has been calculated for 1982, 1997, 2000, 2002 & 2004 as shown in Table. The area calculations have been made either from the abundance and distribution maps or from the GPS maps.

***Zostera* bed area 1982, 1997, 2000, 2002 & 2004**

Year	Area (m ²)	Method
1982	5475	Distribution and abundance map
1997	6771	Distribution and abundance map
2000	6979	Map derived from GPS
2002	7652	Map derived from GPS
	6700	Distribution and abundance map
2004	6781	Map derived from GPS

The areas from the distribution and abundance maps is very thorough and more reliable than the GPS maps for area calculations. The maps produced using GPS should be used with caution for area calculations, but are useful for a simple comparison in the extent and position of the *Zostera* bed every two years as an indicator of gross change. The 2004 map gives an estimated area of 6781m², this matches well to the estimated areas from the distribution and abundance maps completed in 1997 and 2000.

TARGETS

The population of *Zostera marina* in North Haven is to remain in favourable condition where:

1. The extent of the *Zostera* population is 6700m² with a lower level of acceptable change (LAC) of 5500m². In 2004 the calculated extent is 6781m² and is therefore in favourable condition.
2. The mean density of the *Zostera* population bed is 36 shoots/m² with a lower LAC of 36 shoots/m². In 2002 the mean density is 54 shoots/m² and is therefore in favourable condition.

CURRENT STATUS

Favourable.

RECOMMENDATIONS

1. Future mapping should continue to follow the methods and using the permanent markers established in 1997.
2. A complete distribution and abundance mapping survey should be repeated at five-year intervals and a boundary map continue to be completed every 2 years to record changes in the extent and position of the *Zostera* bed.
3. Continue to maintain the buoyed 'no anchorage zone' in North Haven and visitor moorings as currently identified in the Skomer MNR Management Plan 2000.
4. Record all recreational and fishing activities that may have a potential impact on the *Zostera* population.
5. Conduct a detailed bathymetric map of North Haven to identify the area the *Zostera* bed is limited to by depth.
6. Record conspicuous organisms associated with the *Zostera* population.

REFERENCES

Jones and Hodgson 1980 & 1981, Jones & Jones 1983, Lock 1997, Trigg 1998, Lock 2003, Edwards, Bunker, Maggs & Johnson 2003.

***PECTEN MAXIMUS* (SCALLOP) POPULATION (CMS code: RM53/01)**

STATUS Ongoing. Volunteer survey every 4 years (next survey 2008).

PROJECT RATIONALE

The scallop population in the northeast of the Reserve is of conservation value because of its small size and its remoteness from any substantial population. Scallops were collected commercially and recreationally in the area of the Reserve until 1990. In 1990 the South Wales Sea Fisheries Committee (SWSFC) introduced a byelaw prohibiting scallop collecting by any means. The population of scallops needs to be monitored in order to assess the effectiveness of this byelaw.

OBJECTIVES

To estimate the density of scallops within suitable habitats in the Reserve and to assess the age structure in the population.

SITES

2000 survey established 3 sites: Low point, Martins Haven, North of the Neck.

2004 survey added 4 further sites: High Point, West Hook, East Hook, Junkos Reef

METHODS

The 1979-82 and 1985 surveys used slightly different methods. In 2000 a standard method was developed suitable for volunteer diving teams and which could be repeated in subsequent surveys.

Scallops are collected by divers from a two metre band, one metre either side of 50m transects (100m²). The scallops are brought to the surface, their growth rings measured, shells marked with notches for identification and then returned to the site.

This is repeated for several transects over several sites of suitable habitat.

Full methods detailed in Lock & Newman 2002.

RESULTS

1979 / 80 (Jones & Hodgson) small survey. No density estimates. Age class data suggests strong recruitment in 1973-75 and then a decline for 1976-1980.

Bullimore 1985a summarises the available data for 1979 – 1982. Scallop survey was completed at North Marloes Peninsula sites and North of the Neck, densities of 0.01m⁻² (1/100 m⁻²) were estimated for all sites.

2000 survey was completed using a small team of 8 volunteer divers and 3 fixed sites were established. The results suggest an increase in density to 0.04 m⁻² (4/100 m⁻²) compared to 1985 with a maximum density of 0.10m⁻² (10/100 m⁻²) at Low Point. The age class data suggested strong recruitment in 1992 – 94, 2 years after the SWSFC byelaw was introduced.

2002 A joint collaborative SWSFC/ MNR scallop poster, explaining the byelaw, was produced in 2002. This was distributed to local dive clubs and dive shops and has been posted at local slipways.

2004 survey was completed with a large team of 50 volunteer divers. Sites established in 2000 were resurveyed and a further 4 sites established. The total area surveyed was 10,632 m² and

1312 individuals were measured. Mean density for the whole MNR in 2004 was 0.12 m^{-2} , which represented a 3-fold increase since 2000 (0.04 m^{-2}).

TABLE 3.1 Estimated densities of *P. maximus* populations at all sites 2004

Site	Area surveyed m^2	No. scallops collected	Density m^{-2}	Density 100 m^{-2}
North of the Neck	3600	423	0.12	11.8
Martins Haven	1880	57	0.03	3
Low Point	1600	278	0.17	17.4
High Point	1000	170	0.17	17
East Hook	1200	32	0.03	3
West Hook	892	267	0.30	30
Junkos Reef	460	85	0.18	18
ALL SITES	10632	1312	0.12	12.3

2000 and 2004 *P. maximus* population densities can be compared for 3 sites. At all 3 sites density was greater in 2004 than 2000.

Estimated densities of *P. maximus* populations at 3 sites in 2000

Site	Area surveyed (m^2)	No. <i>P. maximus</i> collected	Density m^{-2}	Density 100 m^{-2}
North of the Neck	800	54	0.07	6.8
Martins Haven	1800	18	0.01	1.0
Low Point	800	83	0.10	10.4
ALL SITES	3400	155	0.04	4.5

Estimated densities of *P. maximus* populations at 3 sites in 2004

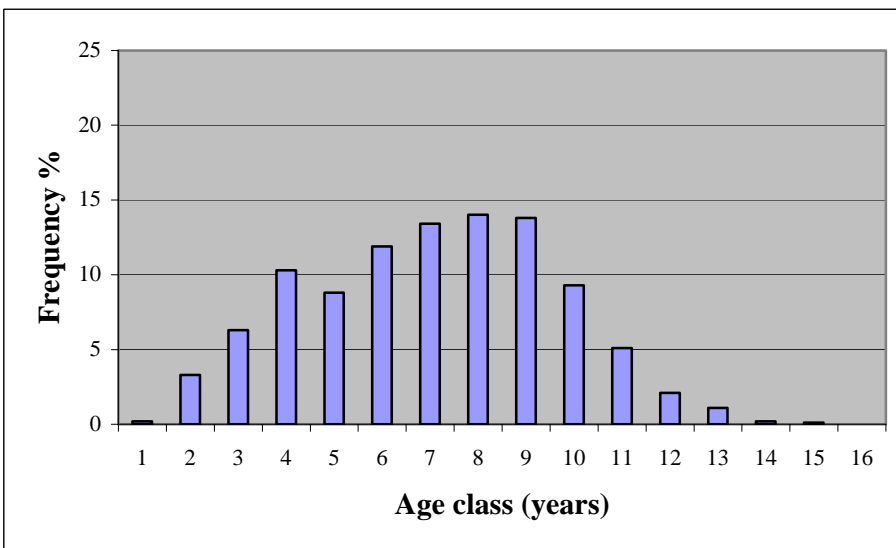
Site	Area surveyed (m^2)	No. <i>P. maximus</i> collected	Density m^{-2}	Density 100 m^{-2}
North of the Neck	3600	423	0.12	11.8
Martins Haven	1880	57	0.03	3.0
Low Point	1600	278	0.17	17.4
ALL SITES	7080	758	0.11	10.7

The age of *P. maximus* showed a spread of age classes from 1- 15 years in 2000 and 2004 (Figure 3.1 and 3.7). The modal size class in 2000 was 7 years with a frequency of 42 %, compared with 8 years in 2004 with a frequency of 14 %. Overall frequencies in each size class were lower in 2004 than 2000.

Age frequency distribution of *P. maximus* in Skomer MNR 2000



Age frequency distribution of *P. maximus* in Skomer MNR 2004



TARGETS

To maintain or increase the scallop population density.

CURRENT STATUS

Standard method developed for future surveys.

RECOMMENDATIONS

Future surveys should continue to follow the methods established in the 2000 survey and be repeated every four years (next survey 2008).

REFERENCES Jones & Hodgson 1979 & 1980, Bullimore 1985a, Lock & Newman 2002. Luddington, Newman, Lock & Burton 2004.

SEDIMENT EPIFAUNA COMMUNITIES, MACRO AND MEGA-FAUNA AT THE SEDIMENT INTERFACE (CMS code: RM03/03)

STATUS Ongoing. Surveyed every 5 years, (next survey 2009).

PROJECT RATIONALE

Studies of the sediment benthos around Skomer are limited but have shown the region to be species rich. A lot of the species are poorly understood and some of the larger species are presumed to be rare (burrowing anemones).

OBJECTIVES

To monitor this poorly understood community looking for changes in the community structure over time.

SITES

- Low point
- North of the Neck

METHODS

Three transects have been established at each site.

Records of large mobile species were made by counts from within a 2 metre wide strip off the seabed adjacent to the transects. Detailed insitu counts from 0.25m² quadrats were used to record the surface fauna.

The shallow infauna was sampled using a suction sampler from a 0.1m² area down to a depth of 20cm.

RESULTS

1995 – used as a base line survey.

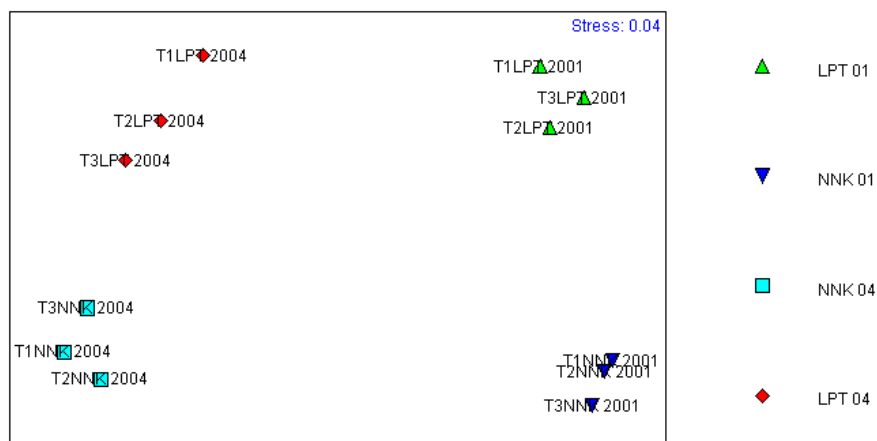
2001 – Methodology changed to increase the quantitative sampling effort. The results are not comparable with the 1995 survey.

Both surveys show the areas to be species rich (265 taxa). No rare/scarce species (Sanderson 1996) were recorded.

2004 – Repeat of 2001 methodology. Only preliminary results are available at the time of writing.

Skomer transect survey comparisons:

	2001	2004
Polychaetes	105	136
Crustacea	56	55
Molluscs	40	47
Echinoderms	6	10
Others	10	21
Total nos. individuals	7775	5902

MDS plot of Suction sample results averaged to transect.**TARGETS**

To be set.

RECOMMENDATIONS

Continue survey every 5 years following method established in 2001, next survey 2006. Monitor sea temperature and suspended turbidity levels to provide background data for the biological monitoring.

REFERENCES

Rostron 1996, Moore 2002 & Moore 2004 (in press)

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 Marine SAC.

OBJECTIVES

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

SITES

All pupping beaches and caves in the MNR.

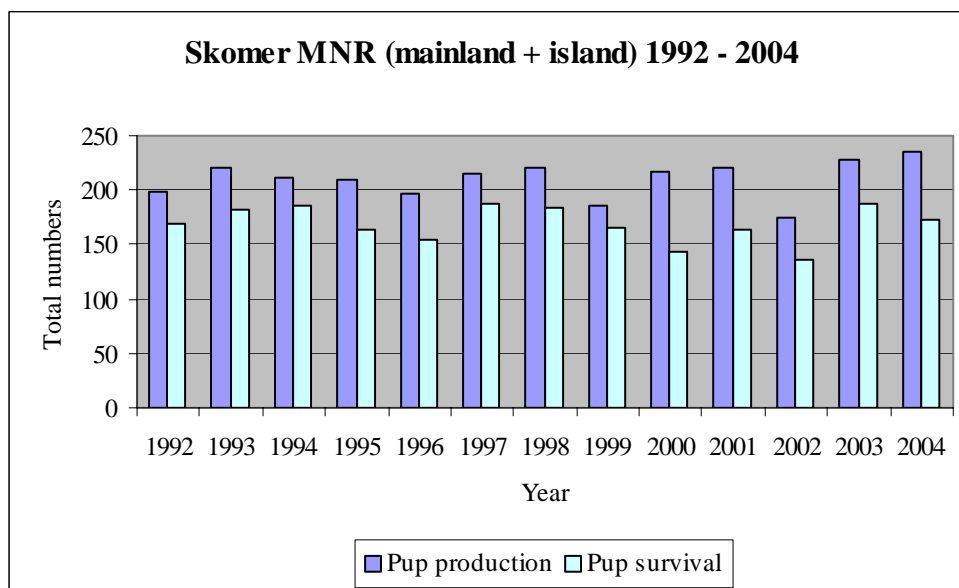
METHODS

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 on Skomer Island 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 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 at mainland sites were tested and a further survey in 2003 by placement students from Pembrokeshire College, (Bettridge 2002, Pegg 2003). A trial 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. The 2003 survey completed a questionnaire on the usefulness of the leaflet. The leaflet was a success and was published officially ready for the 2004 season and a full report on the seal disturbance study was completed, Lock 2004.

2004 A project to identify individual seals was started for mainland sites by a placement student from Pembrokeshire College, this followed methods in the 'Grey Seal Monitoring Handbook' Poole 1996 and tested photo and video methods.

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

2004 pup numbers reached an all time high of 235, but survival rate was low at 73.2%, this is 7.3% lower than average for the last thirteen years. The low survival was probably influenced by several periods of bad weather that almost certainly caused some separation and injury within the pup population. In 2004 the most prolific period was week 38 (13th – 19th September) when 47 pups were born.

RECOMMENDATIONS

1. To continue annual survey following the 'Grey Seal Monitoring Handbook' Poole 1996.
2. To continue recording seal disturbance at mainland and island sites.
2. To continue the adult seal identification project following methods developed in 2004.
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; Hellowell, 1987, 1988; Sutcliffe, 1989; Orsman, 1990, 1991; Poole, 1992 - 1999; Field, 2000; Pillsworth, 2001, Duffield, 2002, Matthews 2003 & 2004). Less information is available for the mainland and is on pup production only until 1992. (Anderson 1977; Cullen 1978; MNR records 1992-2004). Poole 1996. Grey Seal Monitoring Handbook.

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