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Skomer Marine Nature Reserve
Pecten maximus, King scallop survey 2004

CCW Regional Report
CCW/WW/04/2

L.R. Luddington, P. Newman, K. Lock, M. Burton

2004

CONTENTS

CRYNODEB

Nod yr arolwg presennol oedd sefydlu statws presennol Cragen Aberffro (*P. maximus)* yng Ngwarchodfa Natur Forol Ynys Sgomer ac roedd yn ailadrodd arolwg a wnaed yn 2000 gyda 4 safle newydd wedi eu hychwanegu. Fe nofiodd tîm o dros 50 o blymwyr gwirfoddol drawsluniau ar hyd gwely'r môr gan gasglu unrhyw *P. maximus* y daethpwyd ar eu traws. Mesurwyd hyd, lled a chylchoedd tyfiant pob un unigol. Cafodd pob un ei farcio wedyn a'u dychwelyd i'r safle y casglwyd hwy ohono.

Yr ardal gyfan a arolygwyd oedd 10,632 m2 a chafodd 1312 o unigolion eu mesur. Trwch cymedrig y Warchodfa Natur Forol gyfan yn 2004 oedd 0.12 m^{-2}, a oedd yn cynrychioli cynnydd triphlyg ers 2000. Yn yr un modd, roedd y dosbarth modd oedran a maint wedi cynyddu yn 2004 o'i gymharu â 2000. Roedd y trwch a'r dosbarth modd oedran a maint yn amrywio rhwng safleoedd. Roedd Martins Haven yn dangos trwch isel a phrinder unigolion dros 6 oed o'i gymharu â safleoedd eraill; mae Martins Haven hefyd yn safle poblogaidd iawn gyda rhai sy'n plymio wrth y lan o ran adloniant.

Roedd lled cylch tyfiant y flwyddyn gyntaf yn dangos lledaeniad amlder o faint cyffredin tebyg i 2000. Mae cymharu gydag astudiaethau eraill yn awgrymu bod y lledaeniad hwn yn cynrychioli digwyddiad epilio blynyddol unigol.

Mae'r canlyniadau'n awgrymu adferiad parhaus o'r boblogaeth ers i ecsbloetio ddod i ben yn 1990.

Teitl: Arolwg *Pecten maximus* (Cragen Aberffro) Gwarchodfa Natur Forol Ynys Sgomer 2004. Adroddiad Rhanbarthol Cyngor Cefn Gwlad Cymru CCW/WW/04/2
Luddington, L.R. Newman, P. Lock, K. Burton, M. (2004)

3 SYNOPSIS

The present survey aimed to establish the current status of *P. maximus* in Skomer MNR and was a repeat of the survey carried out in 2000 with the addition of 4 new sites. A team of 50+ volunteer divers swam transects along the seabed collecting any *P. maximus* encountered. Length, width and growth bands of each individual were measured. Each was then marked and returned to the site from which they were collected.

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. Similarly, the modal age and size class increased in 2004 compared with 2000. Both the density and modal age and size class varied between sites. Martins Haven showed a low density and paucity of individuals over 6 years old compared with other sites; Martins Haven is also a very popular site with recreational shore divers.

The width of the first year growth band showed a normal size frequency distribution similar to 2000. Comparison with other studies suggests this distribution represents a single annual spawning event.

The results suggest a continued recovery of the population since cessation of exploitation in 1990.

Title: Luddington, L.R. Newman, P. Lock, K. Burton, M. (2004) Skomer Marine Nature Reserve *Pecten maximus*, King scallop survey 2004. CCW Regional Report CCW/WW/04/2

1 INTRODUCTION

Pecten maximus (Linnaeus, 1758) the King scallop is found in Skomer Marine Nature Reserve (MNR) at sites to the north of the Neck of Skomer and along the north coast of the Marloes Peninsula. The *P. maximus* population in Skomer MNR has been protected since July 1990 upon designation of the Marine Nature Reserve. South Wales Sea Fisheries Committee (SWSFC) byelaws (no. 30 & 30a) prohibit the use of dredges and beam trawls as well as the removal of *P. maximus* from the MNR by any means (see Appendix I for SWSFC byelaws). Bullimore (1985) reviewed *P. maximus* survey data from 1979 to 1982 and 1984 in Skomer MNR to assess the status of the population at that time. These surveys estimated extent of habitat suitable for *P. maximus* in Skomer MNR, *P. maximus* density, age frequency distribution and first year growth bands and annual growth rates for individuals (Lock, 2001). Repeat surveys attempt to monitor recovery of the population since MNR designation in 1990. The survey of *P. maximus* in 2000 was carried out by a team of volunteer divers guided by MNR staff and established the field method and three of the survey sites used in the present survey.

1.1 SURVEY OBJECTIVES

The survey aimed to establish the current status of the *P. maximus* population in Skomer MNR and compare the results to previous surveys. The objectives were:

1. To determine the density of *P. maximus* at selected sites
2. To determine *P. maximus* population dynamics: age distribution and size distribution and growth rates
3. To compare results with previous surveys

2 METHOD

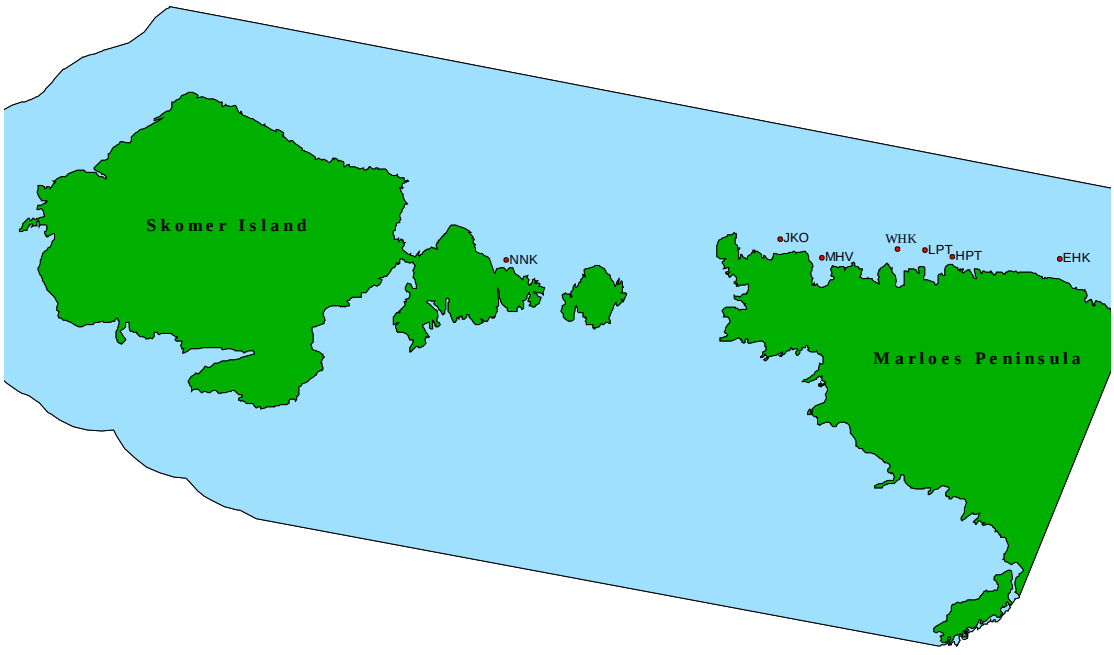
2.1 SITE SELECTION

During the Skomer MNR *P. maximus* survey in 2000 Geographical Positioning System (GPS) positions for 3 permanent sites were established at Martins Haven (MHV), Low Point (LPT) and North of the Neck (NNK). In 2004 a further 4 sites were established as a result of reconnoitre dives to assess their suitability as *P. maximus* survey sites. Each site was marked using GPS and a buoyed sinker. All 7 sites are shown in Figure 2.1.

2.2 DIVING FIELD METHOD

In 2000 a method suitable for volunteer divers was established as described in detail in Lock (2001) and was used in the present survey. At each of the 7 sites pairs of divers swam a measured distance along the seabed on a compass bearing. Any *P. maximus* encountered were collected in a bag and taken to the surface. The length, width and growth bands of each individual were measured.

FIGURE 2.1 *P. maximus* survey sites Skomer MNR 2004. NNK= North Neck, JKO= Junkos Reef, MHV= Martins Haven, WHK= West Hook, LPT= Low Point, HPT= High Point, EHK= East Hook.



4 RESULTS

4.1 DENSITY & DISTRIBUTION

The survey was carried out over two weekends 19th & 20th June and 17th & 18th July with a total of 50+ divers completing 41 transects. A total of 10,632 m^2 of seabed was surveyed at the 7 pre-selected sites and 1312 *P. maximus* collected and measured (Table 3.1). Some sites were surveyed more extensively than others, for example 3600 m^2 of seabed was surveyed at North of the Neck compared with only 460 m^2 at Junkos Reef (Table 3.1). *P. maximus* densities varied between sites with a maximum of 0.30 m^{-2} at West Hook and a minimum of 0.03 m^{-2} at both East Hook and Martins Haven resulting in a mean density for all sites of 0.12 m^{-2} or 12.3 per 100m^2 (Table 3.1).

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**

4.2 AGE FREQUENCY DISTRIBUTION

The age frequency distribution of *P. maximus* in Skomer MNR is shown in Figure 3.1. The age range of *P. maximus* sampled from Skomer MNR in 2004 was 1-15 years whilst the modal age was 9 years. The age frequency distributions of *P. maximus* at the three sites established in 2000 are shown in Figures 3.2-3.4. The modal age class was 8 years at both NNK and LPT and 6 at MHV in 2004. The frequency of *P. maximus* over 6 years of age was much lower in MHV than at other sites (Figure 3.4).

FIGURE 3.1 Age frequency distribution of *P. maximus* in Skomer MNR 2004

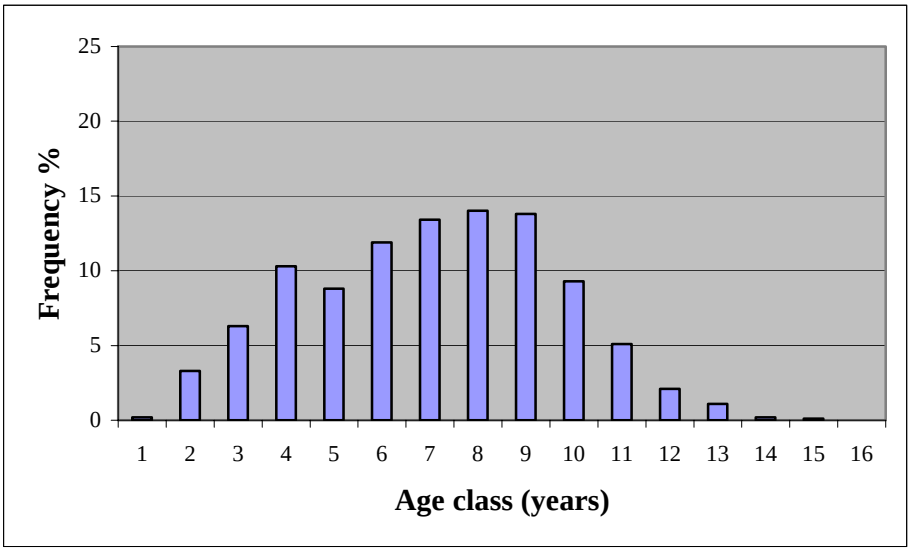


FIGURE 3.2 Age frequency distribution of *P. maximus* at NNK 2004

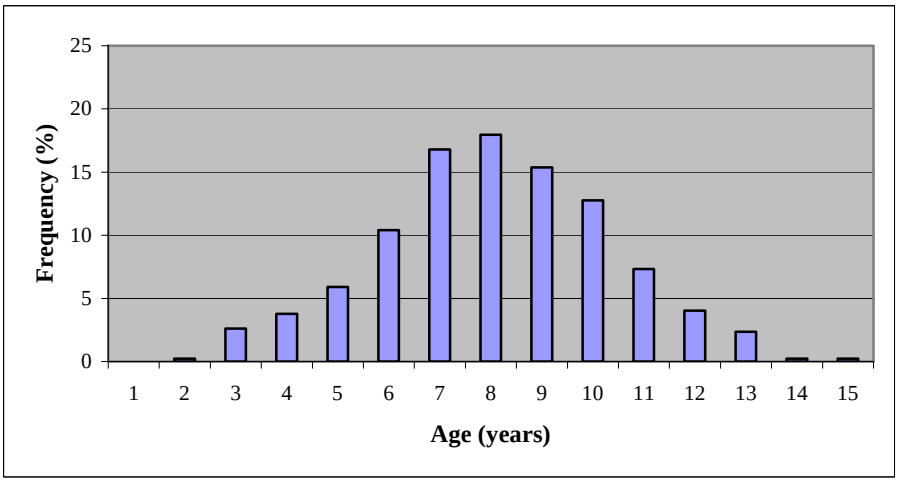


FIGURE 3.3 Age frequency distribution of *P. maximus* at LPT 2004

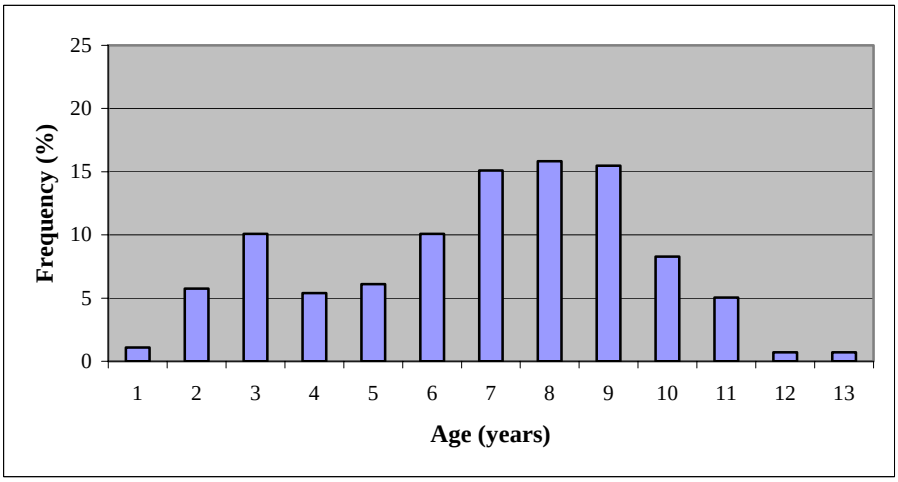
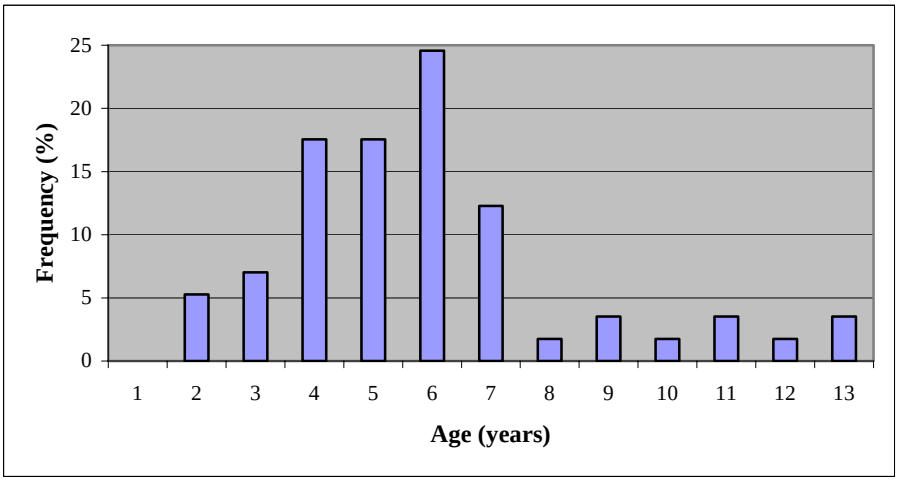


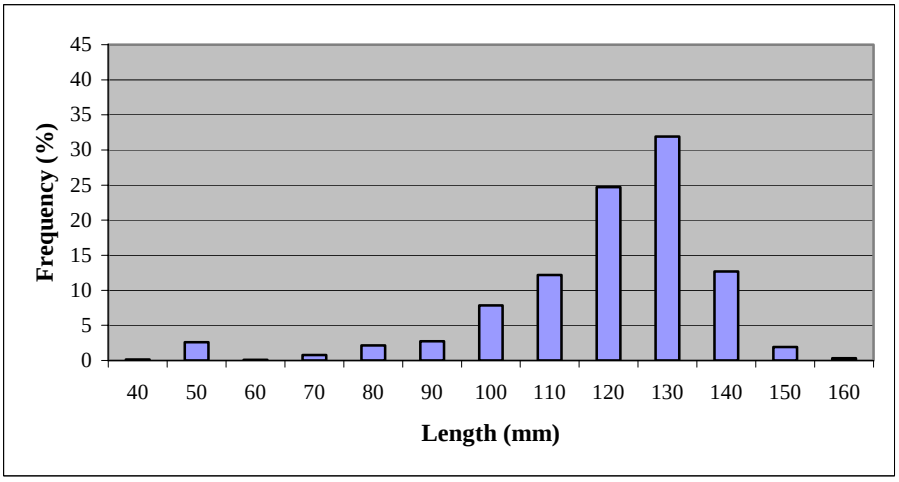
FIGURE 3.4 Age frequency distribution of *P. maximus* at MHV 2004



4.3 SIZE

The size frequency distribution of *P. maximus* in Skomer MNR is approximately normal with a negative skew (Figure 3.5). The mean size of *P. maximus* in Skomer MNR was 115 mm and the mode 130mm.

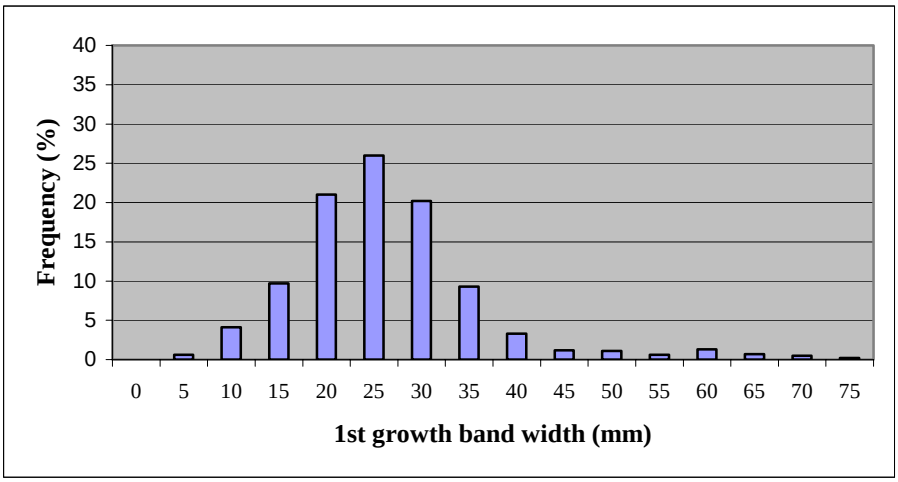
FIGURE 3.5 Size frequency distribution of *P. maximus* in Skomer MNR 2004



4.4 GROWTH

The first year growth band of *P. maximus* in Skomer MNR shows a normal distribution (Figure 3.6). Both the modal size class and mean were 25 mm.

FIGURE 3.6 Frequency distribution of 1st year growth band width in Skomer MNR 2004



3.5 COMPARISON OF 2004 RESULTS WITH PREVIOUS SURVEYS

3.5.1 Density & distribution

Tables 3.2 and 3.3 show the *P. maximus* population densities at three sites in Skomer MNR in 2004 and 2000 respectively. At all 3 sites density was greater in 2004 than 2000 and overall density increased 3-fold i.e.: 0.11 m^{-2} in 2004 compared with 0.04 m^{-2} in 2000.

TABLE 3.2 Estimated densities of *P. maximus* populations at 3 sites in 2004

Site	Area surveyed (m^2)	No. *P. maximus* 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**

TABLE 3.3 Estimated densities of *P. maximus* populations at 3 sites in 2000

Site	Area surveyed (m^2)	No. *P. maximus* 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	**4200**	**155**	**0.04**	**3.7**

3.5.2 Age

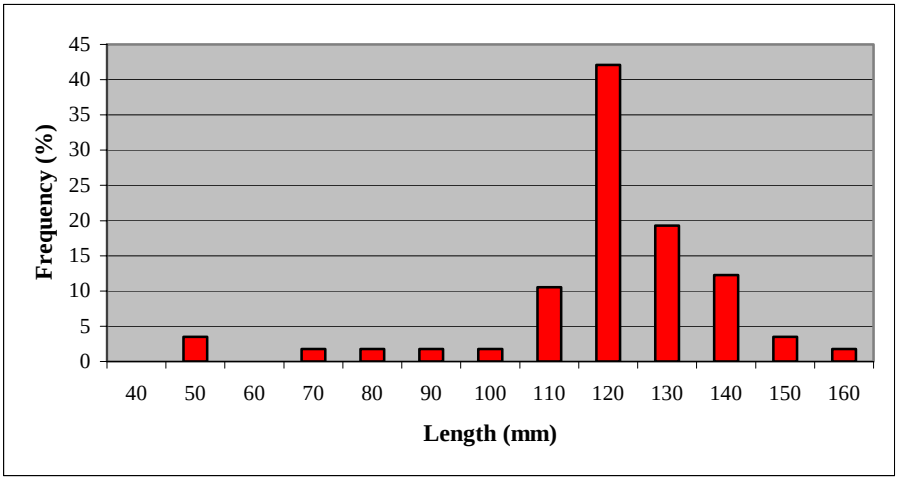
The age of *P.maximus* showed a spread of age classes from 1- 15 years in 2000 and 2004 (Figure 3.1 and 3.7). The modal size class in 2000 was 7 years with a frequency of 42 %, compared with 8 years in 2004 with a frequency of 14 %. Overall frequencies in each size class were lower in 2004 than 2000.

FIGURE 3.7 Age frequency distribution of *P. maximus* in Skomer MNR 2000

3.5.3 Size

The size frequency distributions of *P.maximus* were similar in 2004 and 2000 and showed approximately normal distributions (Figure 3.5 and 3.8). The mean length was the same in both 2000 and 2004 (116 mm) whilst the mode was higher in 2004 (130 mm) than 2000 (120 mm).

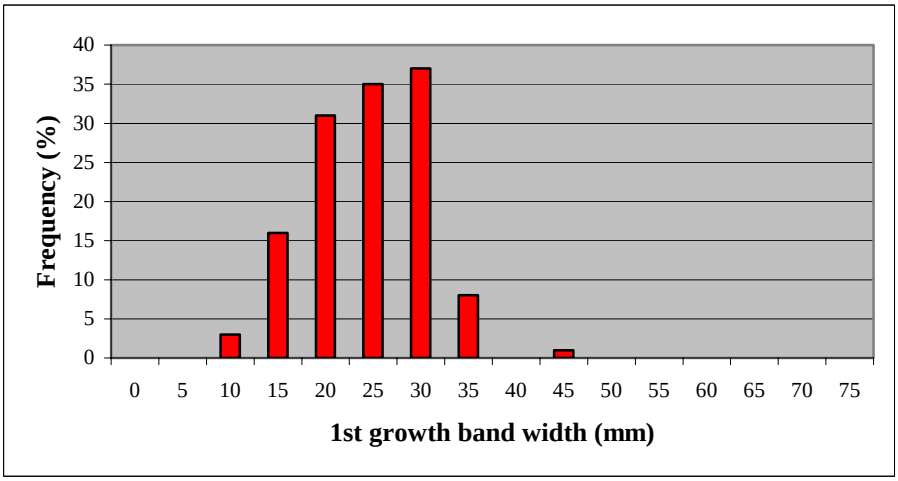
FIGURE 3.8 Size frequency distribution of *P. maximus* in Skomer MNR 2000



3.5.4 Growth

The first year growth band widths of *P. maximus* in both 2004 (Figure 3.6) and 2000 (Figure 3.9) showed an approximately normal distribution. However, the modal size classes differed, 30 mm in 2000 and 25 mm in 2004.

FIGURE 3.9 Frequency distribution of 1st year growth band width in Skomer MNR 2000



5 DISCUSSION

The *P. maximus* population in Skomer MNR 2004 showed continued recovery since the cessation of exploitation in 1990. There was an overall increase in *P. maximus* density and modal age and size classes since 2000 and growth showed a similar pattern to 2000.

5.1 DENSITY & DISTRIBUTION

In 2004 the total density of *P. maximus* for all 7 sites and the total for 3 sites established in 2000 in Skomer MNR showed a 3-fold increase since 2000. Similarly the density recorded in 2000 showed a 3-fold increase since the survey in 1984. The increase in *P. maximus* density suggests a continued recovery of the population from exploitation pre-1990. The North Marloes Peninsula and North Neck area continue to yield a high density of *P. maximus*. Similar to previous years, Martins Haven yielded a low density compared with other sites that may be explained by two factors. Firstly it is possible that the habitat is less suitable for *P. maximus*. Secondly, Martins Haven is a popular site with recreational shore divers and reports of divers removing *P. maximus* from this site continued in 2004.

4.2 AGE & SIZE

The modal age and size classes increased in 2004 compared with 2000, which might be expected from a population recovering from exploitation as individuals remain in the population for longer. Variation in age and size frequency between age classes may reflect variations in the success of recruitment. For example, spawning and settlement may be more successful some years than others due to variations in environmental conditions, suitable substratum, food availability and level of predation. In fact, Franklin *et al.* (1980) reported that one characteristic of *P. maximus* is extremely irregular spat settlement and/or survival, so that certain year classes may be absent from the population. Similarly, variations in modal age and size classes were observed between sites which may be due variations in the suitability of habitat for *P. maximus.* However, the low frequency of scallops over 6 years of age in MHV may suggest that older (larger) scallops were being removed from the population. The age frequency of *P. maximus* showed a normal distribution at all sites except MHV, which suggest non-exploited populations at all sites except MHV. The low density recorded both in 2000 and 2004 at MHV reinforces these results.

4.3 GROWTH

The normal size frequency distribution for the first year growth band in both 2004 and 2000 in Skomer MNR contrasted with the findings of other studies. For example, Mason (1957) reported a bimodal distribution for the first growth band of *P. maximus* in Manx waters. He concluded that the two peaks in frequency were the result of two spawning events in the Manx population, a spring spawning in April or May and an autumn spawning in late August or September. Franklin *et al.* (1980) reported that although spawning occurs in the warmer months (April-September) the actual timing differs from region to region and also from year to year. In some populations there appears to be short, sharp spawning periods in spring, mid-summer and/or autumn, but in others a definite spawning event is unclear (Franklin *et al.*, 1980). Hence, the normal distribution of first year growth band width in the Skomer MNR population suggests a single spawning event. Alternatively, additional smaller spawning events may not have been detected in the Skomer MNR population due to insufficient

sample size; Mason (1957) sampled more than 4000 *P.maximus* compared with only 1312 in 2004 and 155 in 2000 in Skomer MNR surveys.

Locating small *P. maximus* has proved difficult in previous studies hence it is unknown whether juvenile *P. maximus* (less than 2 years old) occupy the same areas as the adult population (Franklin *et al*., 1980). It is possible that juvenile *P. maximus* are recruited from nursery areas outside the MNR. Settlement and recruitment as well as the timing of spawning could be investigated with zooplankton studies and by deploying spat (scallops in their first year) collectors in the MNR. For example, spat collectors produced successful settlement of *P. maximus* in Lyme Bay during 2004 (Richard Stanford, Lyme Bay Reefs Project Officer, Pers. Comms).

5 RECOMMENDATIONS

- Repeat survey every 4-5 years to monitor population dynamics. Maintain or increase sample size by continued use of volunteer divers.

- Continue to inform divers using the MNR about the SWSFC byelaws and report any incident involving the collection of *P. maximus* in Skomer MNR to the SWSFC. Particular vigilance may be required at Martins Haven.

- Zooplankton studies could be carried out to investigate the presence of *P. maximus* larvae. Spat collectors could also be deployed to investigate the timing of spawning and recruitment in Skomer MNR.

- In light of the evidence suggesting a recovering population a project could be established to investigate migration of individuals to areas outside the MNR.

• ACKNOWLEDGEMENTS

The MNR staff would like to thank:

All the volunteer divers who assisted with the project who are too numerous to name individually this year!
Imperial College diving club
Craig from SeaKay/WWD for additional boats
Colin Trundle from SWSFC for his supervisory role!
Kerry Lewis for additional help with data entry

Pembrokeshire Dive Charters for boat charter

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Mason, J. (1957) The age and growth of the scallop, *Pecten maximus* (L.), in Manx waters. J. mar. biol. Ass U.K. 36, 473-492.

APPENDIX I

South Wales Sea Fisheries Committee Byelaws

Fishing within the MNR is governed by national legislation and by byelaws made by the South Wales Sea Fisheries Committee, which regulate matters such as the minimum permissible landing size for certain fish species, the prohibition of the deposition or discharge of substances detrimental to sea fish and sea fishing, etc.

Byelaws which, if this order is made, the South Wales Sea Fisheries Committee propose making under Section 5 of the Sea fisheries Regulation Act 1966.

Byelaw No. 30 Prohibited area for use of dredges and beam trawls.

No person shall use in fishing for sea fish any fishing dredge or any beam trawl within the area detailed below:-

from the northern point of Gateholm due north to the mainland,

from the southern point of Gateholm a straight line in a direction of 278 ^{o} (T) to position 2¾ cables due south (T) of the western extremity of the Mewstone,

thence 2¾ cables off the mainland shore of Skomer around the west coast of the Island to a position 2 cables due north (T) of the Garland Stone,

thence a straight line in a direction of 098^{o} (T) to a position 51 ^{o} 44.50'N, 05 ^{o} 13.00'W,

thence due south (T) to the mainland coast.

Byelaw No 30A Prohibited area for scallop fishing - Skomer Island

No person shall fish for take or land any scallop of the species *Pecten maximus* or of the species *Chlamys opercularis* from the area detailed below:-

from the northern point of Gateholm due north to the mainland from the southern point of Gateholm a straight line in a direction 278 ^{o} (T) to a position 2¾ cables due south (T) of the western extremity of the Mewstone, thence 2¾ cables off the mainland shore of Skomer around the west coast of the Island to position 2 cables due north (T) of the Garland Stone, thence a straight line in a direction of 098 ^{o} (T) to a position 51 ^{o} 44.50N, 05 ^{o} 13.00'W, thence due south (T) to the mainland coast.