ISLE OF MAY
NATIONAL NATURE RESERVE
ANNUAL REPORT 2015

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Isle of May research reports for 2015 season

INTRODUCTION

This is the annual report for the Isle of May National Nature Reserve (NNR), which is owned and managed by Scottish Natural Heritage (SNH). The island lies in the entrance of the Firth of Forth, about 8 km south of the Fife Coast. Its east side is characterized by a low-lying rocky coastline, whilst the west side is dominated by high cliffs.

The Isle of May NNR hosts internationally important numbers of breeding seabirds and grey seals. The subtidal reefs are also of international importance and the wintering wader populations are of national importance.

Every year, two SNH staff members are resident on the island, from March to November, and they are responsible for the general management of the island, which includes biological monitoring, visitor management, site management and general liaison with various interested parties.

The Centre for Ecology and Hydrology (CEH), The Sea Mammal Research Unit (SMRU) and the Isle of May Bird Observatory Trust (IOMBOT) also provide data for this report.

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RESERVE MANAGEMENT

1 BIOLOGICAL RECORDING

1.1 INTRODUCTION TO BREEDING SEABIRDS

SNH monitors breeding seabird populations as part of its management of the National Nature Reserve as well as to report on the Special Protection Area (SPA) qualifying species.

Further seabird monitoring is carried out by the Centre for Ecology and Hydrology (CEH), under contract to the Joint Nature Conservation Committee (JNCC). Data from this monitoring work is integral to JNCC's national system of long-term monitoring for seabird populations, as the island is one of four strategic monitoring sites in Great Britain. The other three sites are Skomer, Canna and Fair Isle.

SNH carries out the population monitoring of the cliff-nesting seabirds, gulls, eiders and terns. CEH monitors the breeding success, survival and food intake of the auks, shags, fulmar and kittiwakes. CEH also provides numerous other pieces of data invaluable to this report, such as the dates of first eggs/chicks; sightings of migrant birds; breeding seabird population counts in sensitive areas and casual observations of breeding passerines, shelduck and oystercatcher. In addition, CEH and other residents of Fluke Street provide valuable assistance throughout the season during group tasks, such as the tern count. The Isle of May Bird Observatory residents also provide data on migrant birds, cetaceans and lepidoptera.

The species accounts that follow use a combination of data from all these sources. CEH supplied the data on the productivity of the cliff-nesting birds and puffins, as well as the number of breeding auks in the Cornerstone plot.

1.2 POPULATION MONITORING OF CLIFF-NESTING SEABIRDS

1.2.1 Methods: All-island count (AIC) and monitoring plot counts

1.2.1.1 Sections and timings

The detailed AIC methodology for the five cliff-nesting bird species (guillemot, razorbill, kittiwake, fulmar and shag) is set out in the Isle of May Monitoring Handbook (SNH, 2001, revised 2002 and 2011). The island is divided into the same standardized count sections as have been used in previous years. All species are counted once during the AIC, including razorbill and guillemot, which have been counted twice in previous years. Also, 20 plots were counted five times each season to assess any changes in guillemot and razorbill population. It was decided last year that 20 razorbill plots were not sufficient and 10 more should be added. Mark Newell of CEH and David Steel picked 20 new razorbill plots and 10 of these were chosen at random. Therefore, in 2015, 30 plots were counted five times. In future years, this will allow the numbers within these plots to be compared with previous years.

The majority of the all-island count was carried out by Bex Outram. In sections that were sensitive, data was provided by Mark Newell of CEH to avoid additional disturbance. The AIC was completed between 3 and 10 June. Plot data was collected by David Steel between 2 and 13 June. Weather conditions at the times of counting are presented in Table 1.7.

1.2.1.2 Cornerstone plot counts

The counts of individual razorbill and guillemot during the AIC are converted to estimates of pair numbers. The number of both razorbill and guillemot pairs breeding at the Cornerstone plot is monitored by CEH. A count of each species was made at the Cornerstone plot at the beginning of every count session.

For each species, the number of pairs known to be breeding at Cornerstone (figures provided by CEH) was divided by the relevant Cornerstone count, for every count session. This provided a "k" value which represents the difference between the number of individuals counted and the number of pairs. By multiplying this "k-value" with the number of individual birds counted during a session, the number of pairs can be estimated for that session.

Keeping raw counts to within a few hours of a Cornerstone plot count allows for the variation in attendance between and during days to be accounted for.

1.2.2 Results of all-island count

The 2015 counts for each of the five cliff-nesting species on the Isle of May are shown in Table 1.1. The counts from previous years are also shown, for comparison. Table 1.2 shows how the counts for each of the five species relate to the different count sections over the island. How the breeding populations of the five species relate to last year is shown in Table 1.3.

Mark Newell (CEH) provided the actual pair numbers for razorbill and guillemot at the Cornerstone plot. These figures were used to convert individual auk numbers to pair estimates. Productivity estimates for all five cliff-nesting species, and puffins, were also provided by CEH, produced during their long-term studies of breeding seabirds on the island (See individual species accounts and also M. Newell *et al*., (2015)).

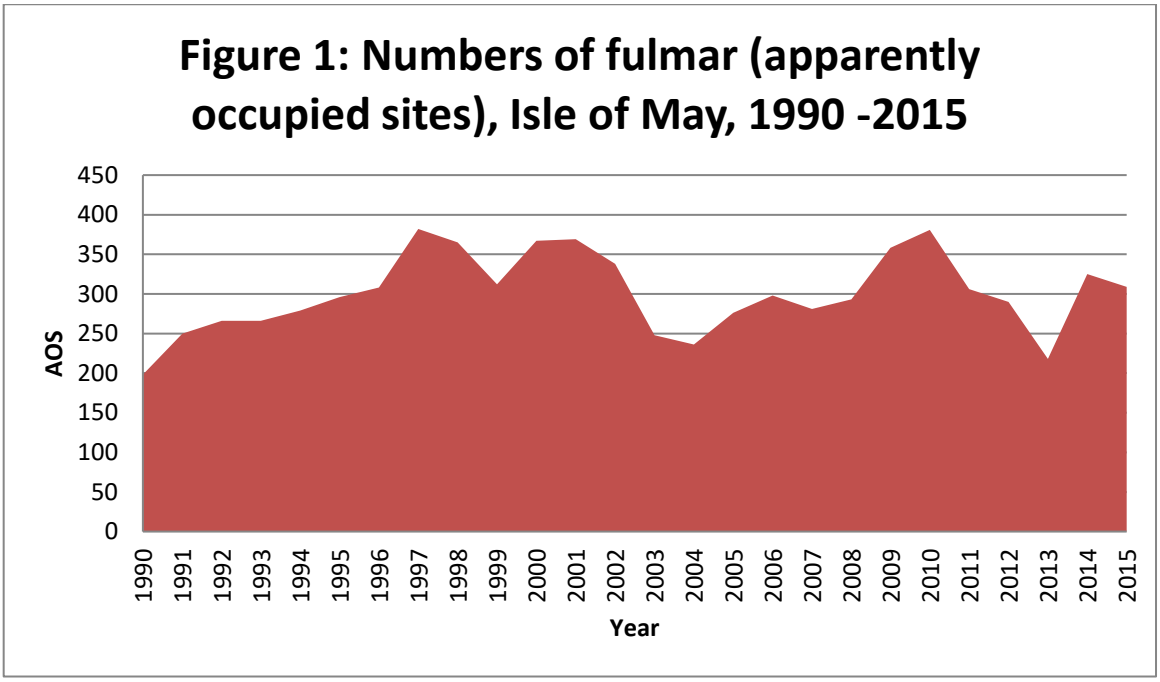
1.2.2.1 Fulmar (*Fulmarus glacialis*)

The number of Apparently Occupied Sites (AOS) was 309. This is a decrease of 4.9% from last year's count of 325 AOS. The population of nesting fulmar fluctuates from year to year but in 2013 there was a large decline, with 198 AOS (Figure 1) the lowest count since 1990.

The first egg was seen on 13 May. This was two days earlier than the previous two years.

Fulmar productivity for 2015 was 0.52 (CEH). This is lower than the previous year but still one of the highest figures in recent years.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Productivity	0.21	0.2	0.44	0.34	0.36	0.13	0.47	0.56	0.52



1.2.2.2 Shag (*Phalacrocorax aristotelis*)

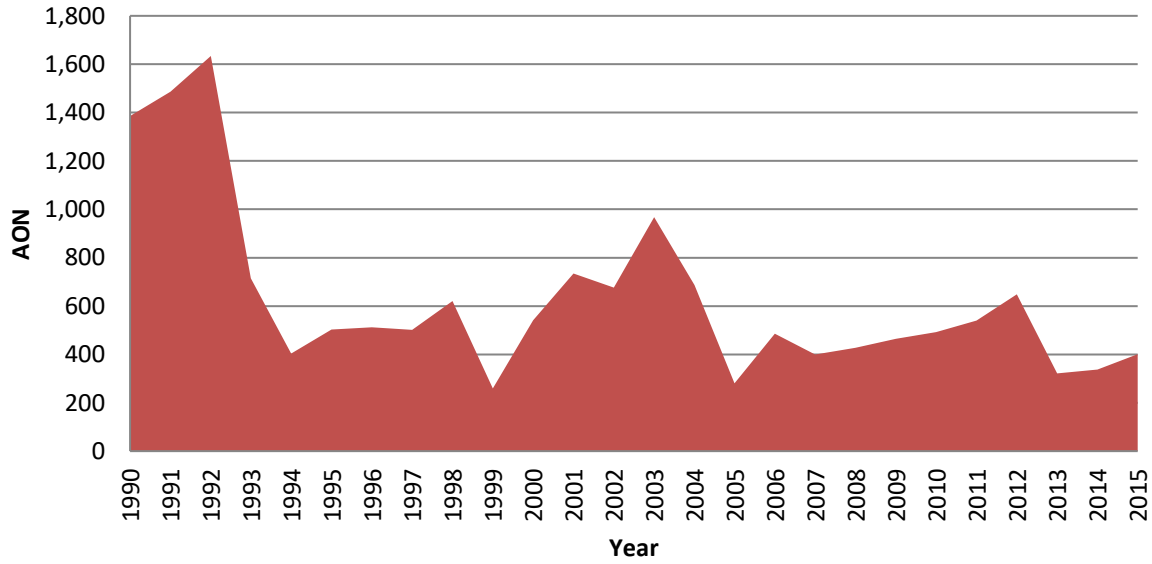
The number of Apparently Occupied Nests (AON) in 2015 was 401. This is a welcome increase, with a rise of 18% on last year's count of 338 AON.

The first shag egg was seen in February by CEH on the 14th. This pair had young by March but unfortunately failed. The majority of the shags started to breed and lay eggs in March.

The Isle of May shags have had a good breeding season in 2015, with productivity of 1.91 (monitored by CEH). This is the highest since 2010 and with the increased number of pairs, it is very positive.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Productivity	1.07	1.9	2.02	2.04	1.54	1.18	1.20	1.58	1.91

Figure 2: Numbers of breeding shag (apparently occupied nests), Isle of May, 1990 - 2015



1.2.2.3 Kittiwake (*Rissa tridactyla*)

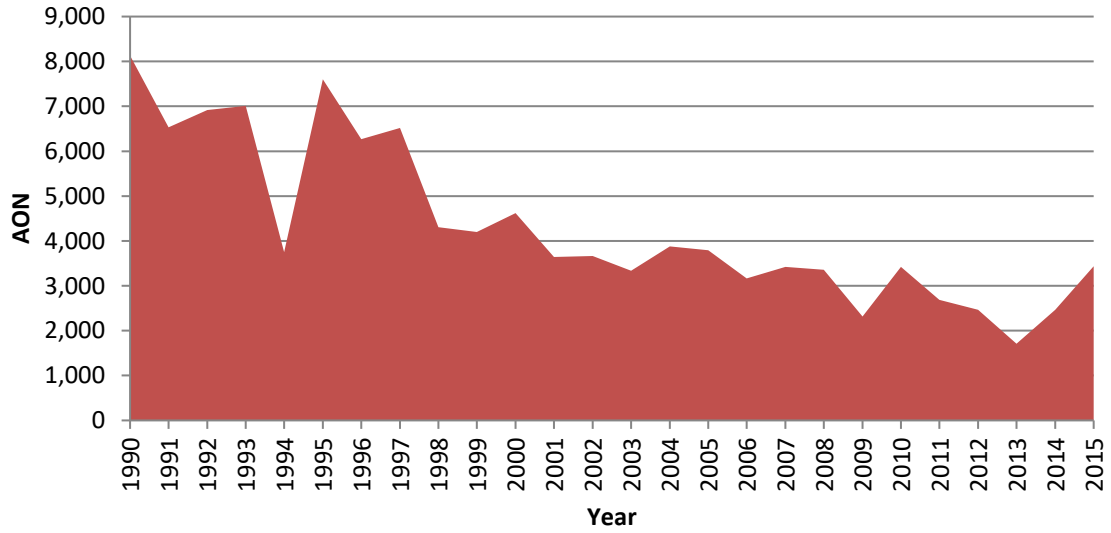
Kittiwake numbers have gone from strength to strength in the last two years. This year, the number of Apparently Occupied Nests (AON) was 3,433. This is an increase of 39% on last year's count of 2,464 AON, which was a 44% increase on the previous year (1,712 AON in 2013). This is an encouraging sign as kittiwakes have been in decline since 1995 (7,603 AON) and 2013 was an all-time low (see Figure 3).

The first egg was seen on 4 May, fifteen days earlier than 2014.

The average productivity per AON was 1.07 this season, another good breeding year for the kittiwakes, lower than 2014 but still high compared to recent years.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Productivity	0.24	0.23	0.7	0.29	0.87	0.98	0.41	1.17	1.07

Figure 3: Number of breeding kittiwake (apparently occupied nests), Isle of May, 1990 - 2015



1.2.2.4 Guillemot and razorbill (*Uria aalge* and *Alca torda*)

1.2.2.4.1 Guillemot (*Uria aalge*)

This year, the Cornerstone plot held 220 pairs (provided by Mark Newell, CEH). This is an increase of 26 pairs from 2014, and the highest count. The table below shows the number of pairs at the Cornerstone plot from previous years.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Count	198	191	198	201	205	195	193	194	220

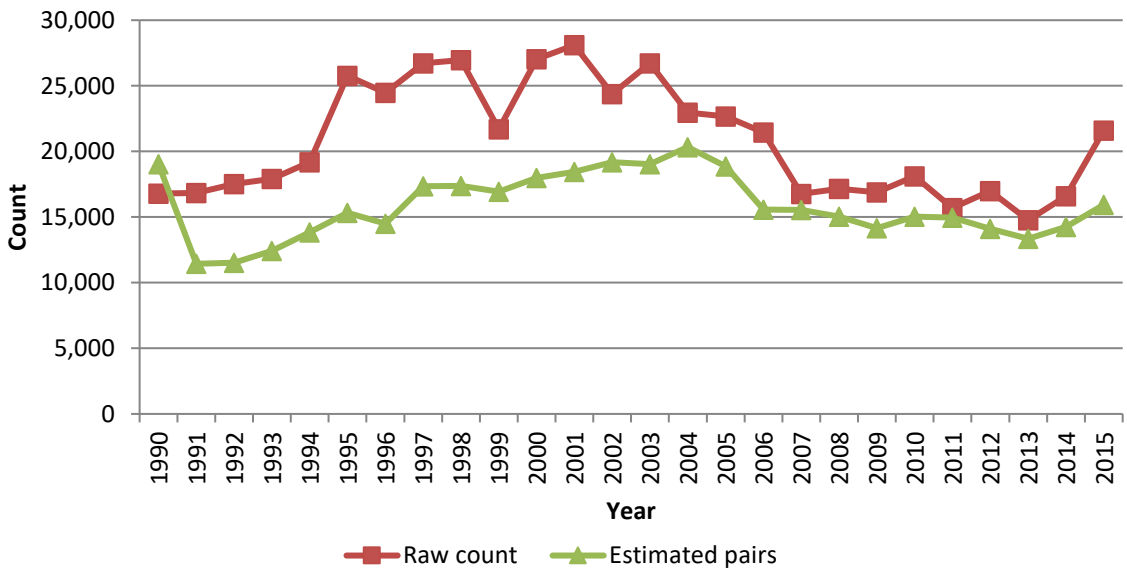
From the AIC, the number of individual guillemots is estimated at 21,598. This is a 30% increase on the 2014 count (16,602). Using the "k" value (see Table 1.4), this relates to 15,945 pairs, which represents a 12% increase from last year's 14,248 pairs. This is the highest count since 2005, when 18,858 pairs were recorded.

The first egg was seen on 18 April; this was slightly earlier than last year, when the first was seen on 23 April.

The guillemots had another average breeding year with a productivity of 0.78 chicks per guillemot pair (CEH), the highest since 2012.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Productivity	0.28	0.63	0.75	0.8	0.71	0.79	0.69	0.72	0.78

Figure 4: Counts of individuals and estimated pairs of guillemot on the Isle of May, 1990-2015



1.2.2.4.2 Razorbill (*Alca torda*)

This year, 81 pairs were recorded breeding at the Cornerstone plot (Mark Newell, CEH). This is an increase of nine pairs from last year's count and the highest total recorded. See below for all previous counts.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Count	71	64	67	62	69	72	74	72	81

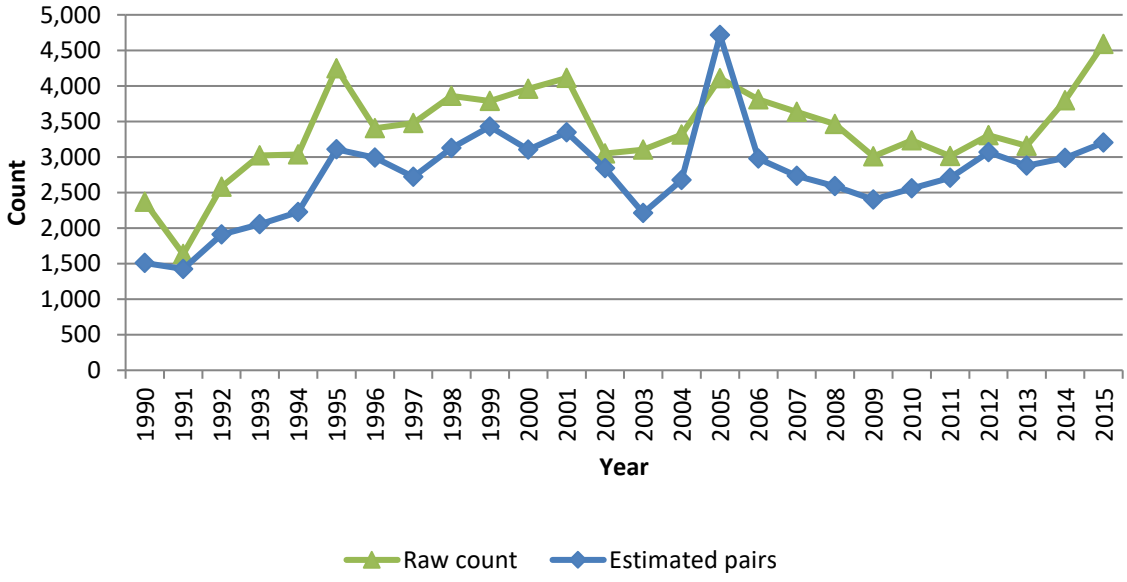
Based on the AIC, the estimated number of razorbill individuals is 4,590. This is an increase of 21% from last year's count of 3,796 individuals. Using the "k" value (see Table 1.4), this number of individuals relates to 3,202 pairs. Compared to last year, this is a 7% increase. The razorbill population is showing a steady increase after a large decline in 2002/2003 and 2009 (Figure 5).

The first egg was seen on 18 April. This is three days earlier than last year, when the first egg was spotted on 21 April.

The average productivity rate per razorbill pair was 0.60 (CEH). This has been a relatively good breeding year with the highest productivity since 2010.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Productivity	0.63	0.58	0.61	0.68	0.52	0.56	0.48	0.53	0.60

Figure 5: Counts of individuals and estimated pairs of razorbill on the Isle of May, 1990-2015



1.3 OTHER AUK SPECIES

1.3.1 Puffin (*Fratercula Arctica*)

No puffin count was carried out during 2014. A full puffin census was undertaken in 2013, with a result of 46,200 estimated pairs.

The first puffins carrying fish were seen on 23 May; this indicates that the first chicks had hatched. This was earlier than last year, when the first puffin carrying fish was on 6 June. The last puffin carrying fish was seen on 29 August; however, the majority of the colony had left earlier. Pufflings were seen around the island's waters through to the end of September.

Puffin productivity (monitored by CEH) was 0.75 this season. This is the highest productivity in recent times.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Productivity	0.29			0.74	0.72	0.57	0.7	0.68	0.75

1.4 GULLS

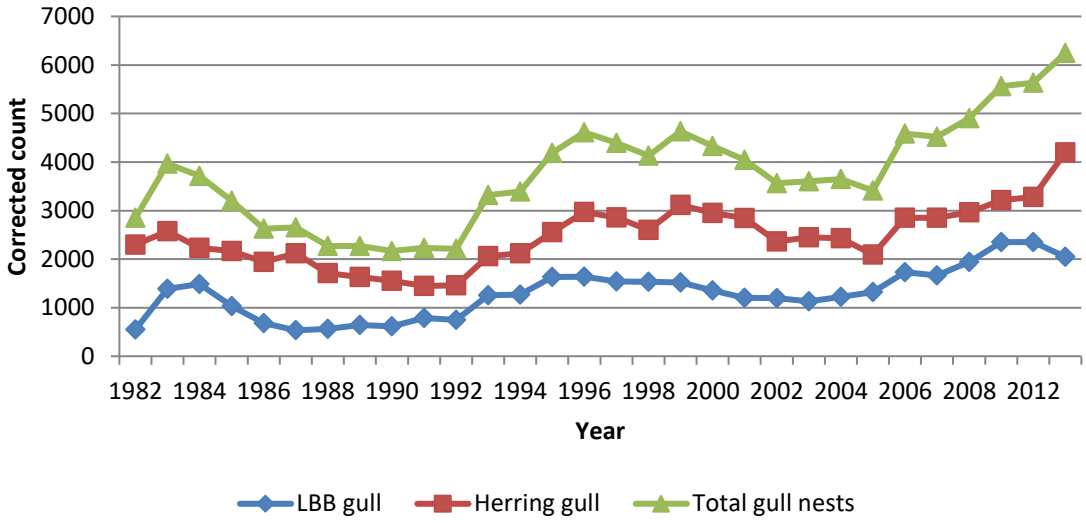
1.4.1 Herring and lesser black-backed gull (*Larus argentatus* and *Larus fuscus*)

The first incubating herring gull was one day later than last year, with the first egg seen on 22 April. The first lesser black-backed gull egg was seen on 5 May, also one day later than last year.

1.4.1.1 Nest count

There was no count of the gulls in 2015 as it is only conducted every two years. The totals at the last count, in 2014, were 4,200 herring gulls and 2,047 lesser black-backed gulls.

Figure 6: Estimated nest totals for herring and lesser black-backed gull, Isle of May, 2015



1.4.1.2 Productivity

Herring gull productivity monitoring was conducted this year in an area at the north of the island where only herring gulls nested. Number stones were placed next to each nest, making them identifiable. Numbers of eggs, chicks and fledged chicks were recorded. The overall productivity rate of this area was 0.65 (see table below).

This area was affected by the westerly storms in late May, with many of the nests being destroyed.

	Herring gull

A) Nests monitored	79
B) Breeding attempts	79
C) Number of eggs	148
D) Average clutch size	1.87
E) Hatched eggs	58
F) Hatching success	0.39
G) Number of fledged	51
H) Productivity	**0.65**

1.4.1.3 Chick diet

No information on gull chick diet was recorded this year.

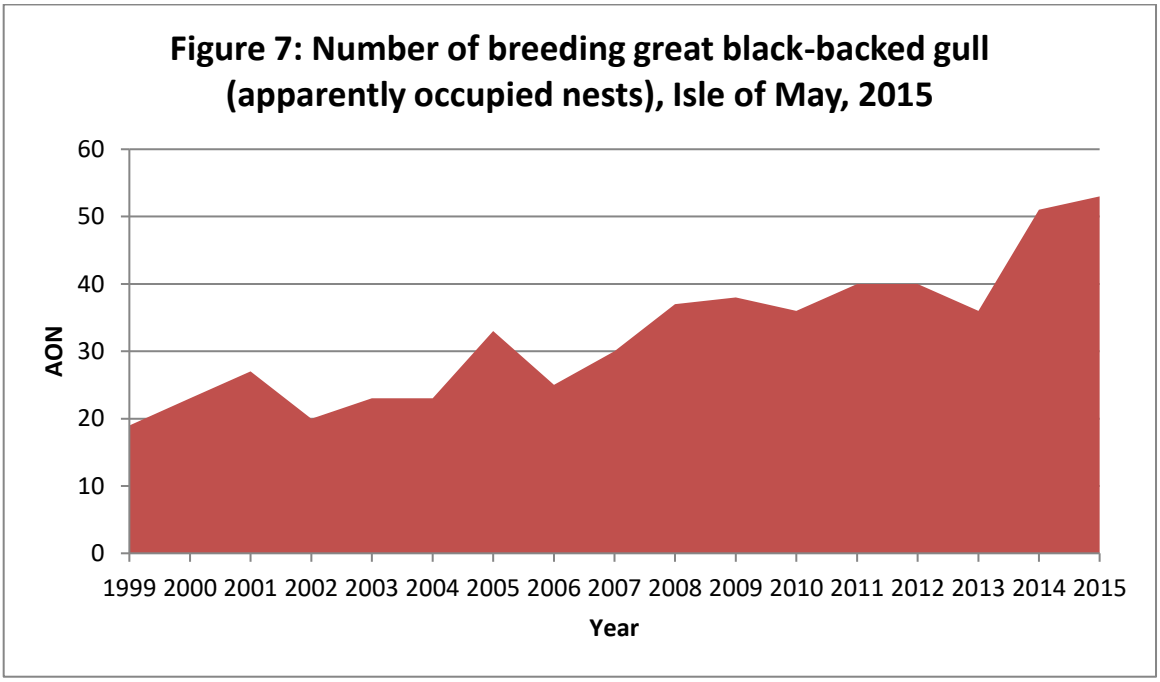
1.4.1.4 Gull management

The gull-free zones were maintained during 2015. These areas were North Plateau South to Lochside, East and West Braes, Beacon, St Andrew's Well, Cross Park and Tennis Courts. Fourteen nests found in these areas were destroyed.

Specialist gulls that predated within the tern breeding colony were identified through tern watches and were removed: an SNH marksman removed one lesser black-backed gull and four herring gulls.

1.4.2 Great black-backed gull (*Larus marinus*)

A total of 53 great black-backed gull nests were identified this year through a combination of observations of apparently occupied nests from SNH and CEH. The majority of these nests were on Rona (41). This is the highest count of great black-backed gulls, with an increase of two pairs from last year's count of 51.



The first great black-backed gull egg was seen on 18 April, one day earlier than last year. The first chick was seen on Rona on 19 May; this was two days earlier than 2014.

1.4.2.1 Productivity

This year, 28 nests were monitored, with a final productivity of 1.18. This is the lowest productivity recorded; some of the nests this season were affected by the weather, with one being washed away during a westerly storm.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Productivity	1.75	No count	1.57	No count	No count	1.6	1.38	1.34	1.18

To help gain a productivity rate, the majority of the chicks that hatched were ringed and 28 chicks were fitted with a yellow colour ring with a unique four-digit code. This was done with help from Derek Robertson from the Isle of May Bird Observatory. This system allowed us to keep track of the chicks as they began to leave the nest and would give us a more accurate productivity figure (see the table below).

	Rona great black-backed gull
A) Nests monitored	28
B) Breeding attempts	28
C) Number of eggs	75
D) Average clutch size	2.68
E) Hatched eggs	57
F) Hatching success	0.76
G) Number of fledged	33
H) Productivity	**1.18**

1.5 TERNS

Information has been taken from the Isle of May NNR Annual Tern Report 2015 (Crymble, 2015).

1.5.1 Roseate tern (*Sterna dougallii*)

No roseate terns attempted to breed this year. There were several sightings of roseate terns throughout May and June.

1.5.2 Sandwich tern (*Sterna sandvicensis*)

Sandwich terns were regularly seen over the island during the breeding season, including a pair displaying, and these landed in the Beacon colony but were soon chased off by the common terns.

1.5.3 Common and Arctic tern (*Sterna hirundo* and *Sterna paradisaea*)

1.5.3.1 Timing of breeding

The first Arctic tern egg was laid on 23 May in the Kirkhaven colony and soon after at the Beacon. The first common tern egg was seen on 26 May at the Beacon. The first egg was two days later than the previous year.

The first Arctic tern chick hatched on 13 June at Kirkhaven and the first common tern chick was on 14 June.

The first fledged chick was seen flying around the Mouse House field on 5 July; the last fledgling was seen on 18 August, with the majority of the terns leaving the island on 27 July.

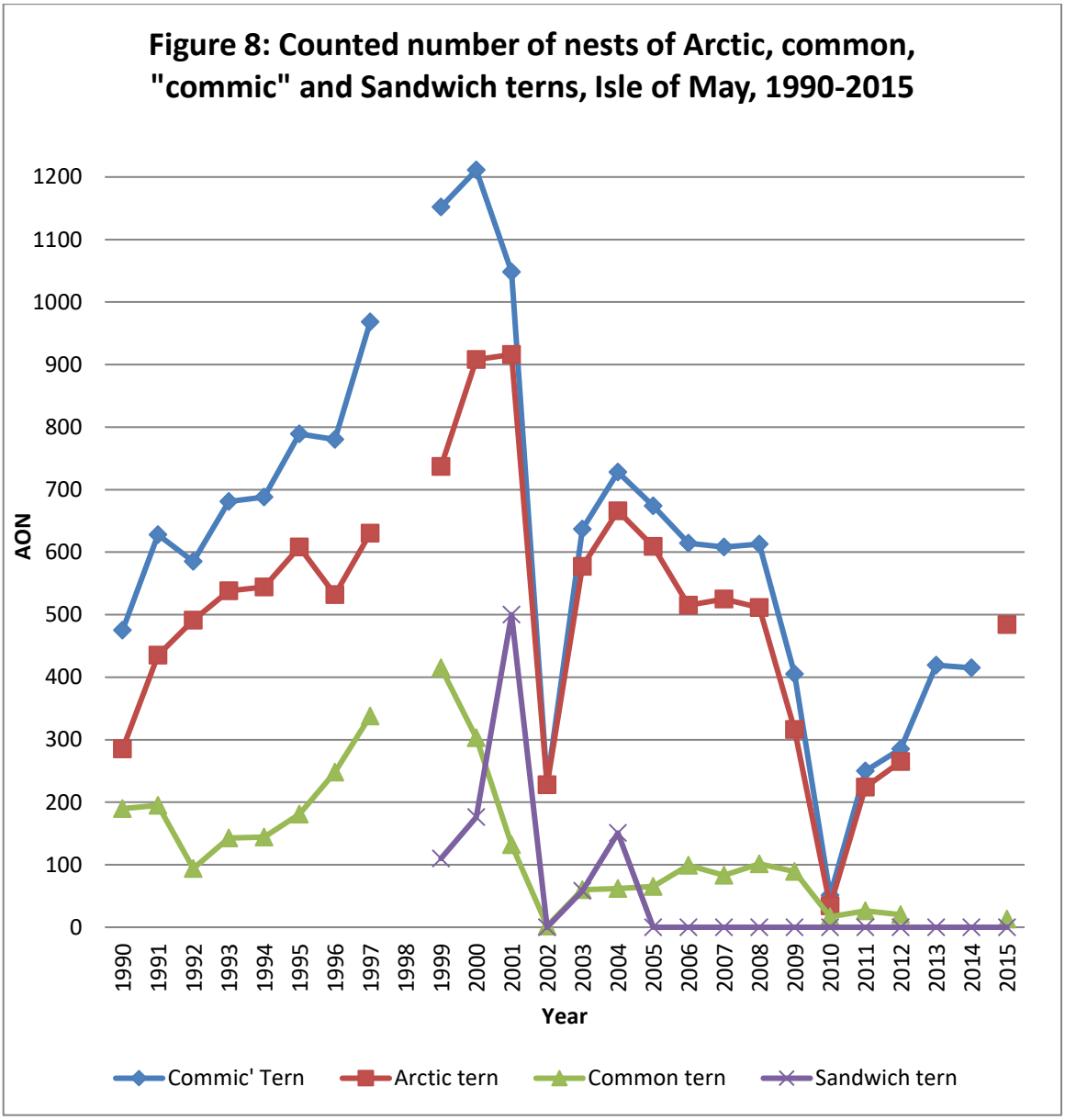
1.5.3.2 Breeding pairs

The nest count was completed on 14 June by SNH staff, volunteers and CEH staff, three weeks after the first egg was laid as this period is believed to be

when the peak number of terns are present in a colony. Only one census was conducted this year to limit the disturbance as it was difficult to see nests in the long vegetation. From this count, a total of 167 nests were present at the Beacon (154 Arctic tern and 13 common tern) and 330 at the Kirkhaven colony. This is an increase of 82 on last year's count of 415 "commic tern" nests. See Table 2.1 for the nest count results and clutch sizes.

Common terns only nested at the Beacon once again and from the tern watches it was found that they all nested together on a concrete foundation with a total of 13 pairs present.

Figure 8: Counted number of nests of Arctic, common, "commic" and Sandwich terns, Isle of May, 1990-2015



1.5.3.3 Breeding success

The breeding success of terns was calculated differently this year. With a large and stable colony, it was decided to have three monitoring plots, each monitored by a member of SNH staff and volunteers in order to produce an

average productivity figure for the colony. The chicks in these areas were ringed; this helped keep track of the number of chicks that fledged from each plot. This was then used to calculate a productivity figure. The table below shows the three different areas monitored and their productivity, and the overall productivity (average of these areas) that can be used to represent the whole colony.

	Visitor Centre	Jetty Triangle	Mouse House	Overall
A) Nests monitored	54	52	65	171
B) Breeding attempts	54	52	65	171
C) Number of eggs	124	73	139	336
D) Average clutch size	2.29	1.4	2.14	1.96
E) Hatched eggs	94	10	125	229
F) Hatching success	76	14	90	68
G) Number of fledged	44	3	54	101
H) Productivity	**0.81**	**0.06**	**0.83**	**0.59**

The average productivity rate per nesting pair was 0.59. As you can see from the table above, this productivity rate was brought down by the Jetty Triangle area which suffered from predation, mainly due to one pair of herring gulls that nested close to this area. This pair was also responsible for the wiping out of the 47 nests in another area, south of Logan's Road.

1.5.3.3.1 Predation by gulls

Tern watches were conducted at both the Beacon and Kirkhaven Colony; the majority of the watches were concentrated at Kirkhaven (73.75 hours) as no predation attempts were recorded at the Beacon (12.25 hours). During the watches, a total of 38 predation attempts were recorded, with 10 of those being successful. However, more successful attempts were noted when in the area during visitor hours and general observations. Five specialist gulls were identified that were predating the terns. Four herring gulls and one lesser black-backed gull were shot during the season. Once these were removed from the colony, predation decreased.

1.5.4 Feeding rates and prey composition

Feeding rates were monitored this year from 10 July as a long-term volunteer was collecting data for a third year dissertation. Seven nests were observed, and the data suggested that the feeding rates of the terns were not affected by visitors.

Average feeding rates of terns per hour

	Control	No visitors	Visitors
Average feeding rate / hour	5.64	4.65	4.90

1.5.5 Positive management for terns

1.5.5.1 Herbicide spraying

No herbicide spraying was used this year.

1.5.5.2 Visitor control for tern management

Clear branded signs were installed around the colonies once again this season. The Kirkhaven colony was roped off around the paths and the Mouse House field to create an obvious barrier between the nests and visitors. These areas kept changing throughout the season as new nests were created. Eventually, the whole of the Mouse House field had to be roped off and the picnic benches moved towards the Priory as chicks would run from the vegetation onto the paths to be fed by the adults. The Beacon colony only required signs as this colony is away from the visitor path network.

As the visitors arrive to the island, they are greeted by staff and volunteers and are given an introductory talk including how to behave once in the tern colony.

1.5.5.3 Garden canes, bunting and twine

Garden canes were put in and around the colonies to make entry by predating gulls more difficult. Bunting and chicken wire fences were erected in areas where gulls were walking into the colony and predating eggs and chicks. In areas of high predation of chicks, thin blue twine was strung across the top of the colony in the shape of a spider's web. This again deterred gulls from entering.

1.5.5.4 Tern shelters

Tern shelters were put beside nests to provide cover for chicks, including on the roof of the Visitor Centre as this had no cover.

1.5.5.5 Tern platforms

Tern platforms were weeded and new platforms created at the Beacon.

1.5.5.6 Tern buckets

One Arctic tern pair nested below the high tide mark in 2015. This nest was placed in a bucket and moved further up the beach when spring high tides were due. This pair went on to successfully fledge one chick.

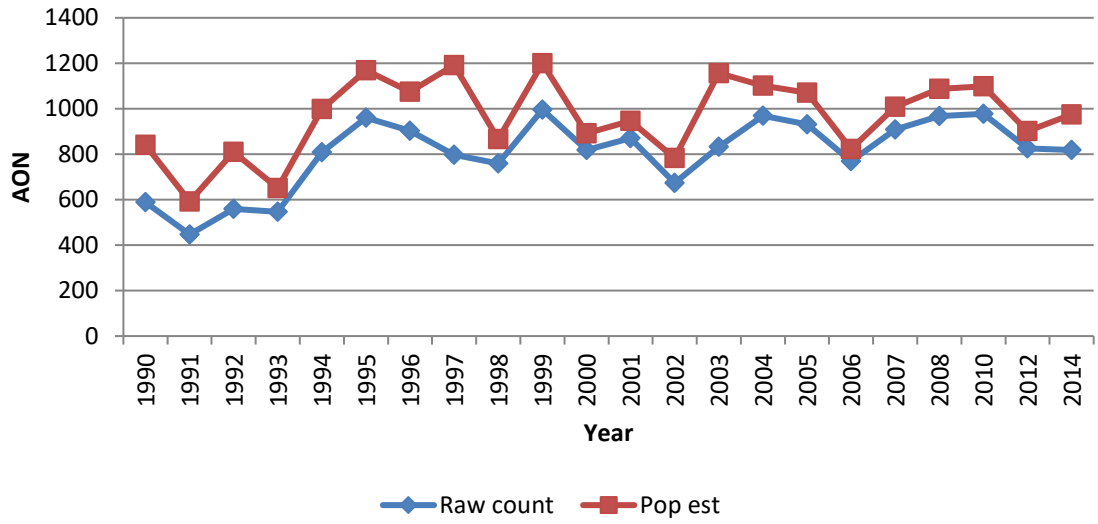
1.6 EIDER (*Somateria mollissima*)

The first sitting female was seen on 16 April, four days earlier than last year. The first brood of ducklings was seen on the Loch on 13 May. This, however, was not the first female that was sitting so presumably the first nest date would have been earlier than 16 April.

1.6.1 Nest count

There was no eider count this year as this is completed at the same time as the gull count. The number of females sitting recorded at the last count, in 2014, was 975.

Figure 9: Nest counts and corrected estimates of breeding eider, Isle of May, 2015



1.6.2 Hatching success

Hatching success was not monitored this year.

1.6.3 Eider management

No management specific to eiders was undertaken this year. Visitor paths were kept clear and the females often used these to take ducklings down to the sea or to the Loch. Visitors were briefed on arrival to avoid these females and take a different route around the island.

1.7 OTHER BREEDING BIRDS

These are observations of numbers from around the island from SNH staff and volunteers, CEH and members of the Isle of May Bird Observatory.

1.7.1 Manx shearwater (*Puffinus puffinus*)

Work by David Thorne *et al*., of the Bird Observatory Trust, identified nest activity on the island and identified one occupied burrow. A camera trap was set up at the burrow's entrance and caught activity through into September, which suggests that there was a chick present but not confirmed.

1.7.2 Shelduck (*Tadorna tadorna*)

An estimated three to four pairs of shelduck were noted this year. One pair was seen with 8-9 ducklings at the Main Light early in the morning on 25 May.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Pairs	3 - 4	5	6	6	4 - 8	6	4	3-4	3-4

1.7.3 Mallard (*Anas platyrhynchos*)

There were no records of breeding on the May this year. Females were not present during the spring and no broods were seen on the Loch, an area where females usually take the ducklings once they have first left the nest.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Pairs	2	0	0	0	0	0	2	3	0

1.7.4 Oystercatcher (*Haematopus ostralegus*)

Nineteen pairs of oystercatchers bred on the island this year, one less than the previous year. Although no monitoring was conducted on these nests, several were seen to have successfully fledged chicks.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Pairs	19	19	17	17	14	16	9	20	19

1.7.5 Feral pigeon (*Columba livia* (domest.))

No specific counts were made of feral pigeons on the island. They appear to nest on the island in burrows and rock cervices.

1.7.6 Swallow (*Hirundo rustica*)

There has been an increase in the number of swallows this year, with six pairs nesting in various buildings in Fluke Street, the Bath House and Byres 4. All were successful in fledging young, with the first fledgers on 20 July, from the Bath House. One pair went on to have a second brood and successfully fledged four chicks and was seen into October.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015

Pairs	0	0	0	0	0	2	3	3	6

1.7.7 Rock pipit (*Anthus petrosus*)

This year, approximately 24 pairs bred on the island, the same number as last year.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Pairs	8-9	9-10	12-14	15	13	23	18	24	24

1.7.8 Pied wagtail (*Motacilla alba*)

Approximately 12 pairs were seen to have set up territories and bred on the island this year. This is down on last year and down six pairs from the peak count of 18 in 2012.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Pairs	8	9	11	12	13	18	14	13	12

1.7.9 Carrion crow (*Corvus corone*)

A pair was noted for much of the spring. A nest was found early in the spring along the west cliffs, but nothing came of it.

1.7.10 Peregrine falcon (*Falco peregrinus*)

One pair was seen in early spring, displaying around the island. However, no nest was found and both the adults were seen leaving the island together on 21 April and headed to the mainland and beyond. Presumably this is the same pair that has bred for several years, with the last successful attempt in 2010 when they reared and fledged three chicks. No adults were seen after this date until the autumn.

1.7.11 Wren (*Troglodytes troglodytes*)

Birds were in territory throughout the spring and a pair successfully nested behind Fluke Street, raising two broods. The first brood fledged on 29 June with at least five chicks (four were ringed). The second brood fledged on 14 August.

This is the first pair of wrens to breed on the island successfully since 1997 (IOMBO Annual Report, 1997).

1.7.12 Dunnock (*Prunella modularis*)

Dunnock were regularly seen and heard singing at the beginning of the season, and were found carrying nest material around the Low Trap. They then became quite elusive and eventually a nest was located in the Low Light bushes on 7 July containing three chicks and one egg; all four chicks were ringed on 10 July. These then fledged on 25 July and were seen in the summer and into autumn.

This is the first pair to breed since 1961, and before this there have been few breeding records.

1.7.13 Blackbird (*Turdus merula*)

Blackbirds were present through spring but were fairly elusive. They were seen regularly in the Low Light bushes and eventually a nest was found on 20 May with four eggs. All four chicks were ringed on 1 June. They remained elusive once fledged so it was difficult to say exactly how many fledged. The adults were again seen with three fledglings on 14 August, a second brood, and all three fledglings were ringed on 16 August.

Blackbirds bred freely from 1907 to 1914. They bred in small numbers until 1951, when two pairs nested (Eggling).

1.7.14 Wood pigeon (*Columba palumbus*)

This is the first year that wood pigeons have been recorded breeding on the Isle of May and there were two pairs that successfully fledged two young each. A poor nest was discovered in the Low Light water tank elders on 7 July with an egg on the ground below. A second attempt was made and two eggs were found on 3 August. Another nest was found in the Top Trap on 3 August with two small chicks. All chicks were fledged and were seen throughout September. The adults were regularly seen leaving the island to feed on the mainland and were seen returning to their nests.

1.8 MIGRANT AND WADER COUNTS

1.8.1 Migrants

Records of migrants were noted throughout the season from March through to November. The information is taken from the daily log at Fluke Street and the Isle of May Bird Observatory. For a more detailed account of the season, see the Isle of May Bird Observatory Annual Report 2015.

A total of 168 species were recorded during the year (joint record number equalling the 2013 season), with three new birds added to the list: great white egret, red grouse and pallid harrier.

Major highlights:

1st Great white egret, pallid harrier, red grouse
3rd Red-footed falcon, red-throated pipit
4th Gadwall, red kite
5th Gadwall, red kite, Mediterranean gull, olive-backed pipit
6th Mediterranean gull, kingfisher, olive-backed pipit
7th Mediterranean gull, kingfisher
8th Honey buzzard
12th Barn owl
14th Hoopoe
15th Richard's pipit

Also, first confirmed record of 'Siberian' chiffchaff through DNA.

Record breaking

New record day counts of the following species:

- Pink-footed goose 2,541 west on 25 September
- Barnacle goose 1,534 west on 8 October
- Common scoter 137N 44S on 24 June
- Red-throated diver 27S on 28 September
- Cormorant 170 on 23 September
- Short-eared owl 24 on 18 December
- Reed warbler 15 on 24 August

1.8.2 Wader counts

Wader counts were co-ordinated from July to September and made up of two teams: one surveying Altarstanes north to the Low Light and the other, the south to the Low Light. They were carried out by SNH staff with help from members of the Isle of May Bird Observatory Trust.

The results of each count are shown in Table 3.1. The dates of the peak counts are shown below.

Species	Peak count	Date
Oystercatcher	51	19/8
Purple sandpiper	80	9/8
Turnstone	134	9/8
Dunlin	7	9/8
Common sandpiper	6	25/8
Redshank	8	17/9
Greenshank	1	9/8
Curlew	78	17/9
Whimbrel	7	9/8 & 19/8
Knot	6	25/8
Green sandpiper	1	19/8
Ringed plover	1	19/8 & 17/9
Lapwing	1	25/8

1.9 MAMMALS

1.9.1 Grey seal

The number of adult seals started to increase in September and the first seal pup was born on 15 September on North Ness; however, it was not seen afterwards and presumably washed away. This was three days earlier than the first pup last year. However, thereafter numbers increased, with 52 born on the island by 15 October and with 103 counted on 22 October. As expected, the bulk of seal pups were born in November, with over 2,300 pups born (a full population census was not conducted).

1.9.2 Cetaceans

Observations of cetaceans were made by SNH staff, CEH, Bird Observatory occupants and the crew of the May Princess and Osprey.

It has been an exciting year for cetaceans, with seven orcas seen on 28 May, a pod including an adult bull, “Buster”, and a calf. These were first seen heading along the east side of the island towards the mainland and once at the North Ness, they eventually headed north.

On 22 August, a young humpback whale was seen breaching from the water north of the island. Another highlight was the sighting of a basking shark off the Low Light in late September.

There haven’t been many sightings of minke whale and harbour porpoise this year, with only one sighting in June of a minke whale. This could be due to the poor weather conditions making the fins of minke and harbour porpoise difficult to see from the island. During the calm days in August and September, plenty were seen, especially on 31 August when seven harbour porpoise were noted in the morning. See Table 3:2 for full details of the cetacean sightings.

Bottlenose dolphins were seen from the May Princess on several occasions, but these were close inshore.

Species	**Number of sightings throughout the month**						
	April	May	June	July	August	September	October
Harbour porpoise		3		1	6	1	
Minke whale		1	1	2	6		
Orca		1					
Humpback whale					1		
Basking shark						1	

1.9.3 Mice

It was a quiet year for the mice on the May; none were present in the buildings during spring and summer. Researchers from Nottingham University collected mice during April, July and October to study genetics and bacterial resistances within the Isle of May population. It seemed that the population increased during September, with more casual sightings being noted, and they started to come into the buildings as the nights got colder.

1.10 LEPIDOPTERA

1.10.1 Butterflies

Records of butterflies were made from informal observations by members of Fluke Street and the Isle of May Bird Observatory residents throughout the season.

Ten species were recorded throughout the season. The first butterfly noted was a small tortoiseshell on 9 March; this was most likely to have hibernated over winter in one of the buildings. Butterflies were seen throughout the season from March to October, with small tortoiseshell being noted throughout the year. The most numerous species was the red admiral, with up to 200 being seen in a day during September. See Table 3.3 for an overview of the season.

1.10.2 Moths

Moth trapping was attempted most nights when SNH staff were present on the island: the trap was run from 4 April until 8 October.

The MV light trap was set up in the garden outside the principal keeper's cottage. The trap was put into an outdoor shelter when the weather was adverse and for a certain time when pufflings were leaving their burrows as they are drawn towards the light. The trap was also moved a couple of times around the buildings as the breeding wrens were getting into the trap and feeding on the caught moths.

Trapping was conducted on 125 nights during 2015. This was less than previous years, mainly due to lack of power through some months and trapping becoming infrequent. See Table 3.5 for the number of days trapping occurred per month.

A total of 77 different species were recorded throughout 2015; this was less than the previous two years (96 in 2014 and 103 in 2013). The most numerous moth species on the island is likely to be silver Y; however, these are mainly day-flying moths and are not caught in the MV light trap frequently. The observers at the Low Light Bird Observatory recorded approximately 500 during one day. Marbled coronet was recorded on the highest number of nights, being noted on 69 nights throughout April to August.

2015 highlights include several moth species that were recorded for the first time on the island. These are the following: pale pinion, elephant hawkmoth, pepper moth, double lobed and lesser treble-bar.

Other scarce moths recorded this year include small phoenix, hummingbird hawkmoth, poplar hawkmoth, grey chi and pink-barred sallow. See Table 3.4 for an overview of the season.

Several micro moths were identified, the highlight being two thistle ermine in the trap on 9 July. This is the second time this species has been recorded on the island; the first was in 2013.

2 VISITOR MANAGEMENT

It proved to be another record year as 10,929 visitors were recorded on the island from 1 April to 30 September (eclipsing the previous record of 10,809 set in 2013).

Three boats were licensed to land visitors on the island (the second of three years for the current agreement): the *May Princess* from Anstruther, the *Osprey* RIB from Anstruther and the *Seabird* RIB from North Berwick. As expected, the *May Princess* carried the bulk of visitors, with 8,803 people (8,594 in 2014), the *Osprey* carried 1,219 (1,099 in 2014) and the *Seabird* 669 (803 in 2014). The other 238 visitors during the season arrived on private boats (including kayaks).

The weather dictates passenger runs and the island was closed on 22 planned dates whilst another 29 sailing days were lost to poor weather and bad sea states. Overall, the island was open for 132 days, with a daily average of 83 people. Interestingly, the weather was disappointing in the summer months and June and July saw a loss of seven sailing days to bad seas.

As normal, a number of public events were held on the island throughout the season, including Seabird Weekend (June), Family Fun Day (July), History Weekend (August), Open Doors Event (September) and Seal Weekend (September). This helped encourage and attract different audiences, especially families, to the island.

	May Princess	Osprey	Seabird	Others	Total	Open	Closed	Cancelled
April	782	132	32	36	982	19	8	3
May	1,454	186	60	95	1,795	20	4	7
June	2,181	248	206	19	2,654	24	4	2
July	2,048	295	178	33	2,554	26	0	5
Aug	1,772	273	134	30	2,209	26	0	5
Sept	566	85	59	25	735	17	6	7
Total	8,803	1,219	669	238	10,929	132	22	29

Table 1.1: Population estimates of Isle of May seabirds, 1980-2015. [Previous counts taken from Harris 1994, Wilson 2001, Moeller-Holtkamp 2002, Charras & Parkinson 2003, Bradburry & Alampo 2004 & 2005, Lamont & Alampo 2006-2008, Pickett & Alampo 2009]

Year	Fulmar (AOS)	Shag (AON)	Kittiwake (AON)	Guillemot		Razorbill	
				(Individual)	(Estimated pairs)	(Individual)	(Estimated pairs)
1980	143	1,041	No count	No count		No count	
1981	No count	1,163	No count	16,300		2,086	
1982	No count	1,425	No count	No count		No count	
1983	101	1,567	6,115	22,550		2,220	
1984	175	1,639	6,012	19,005		2,051	
1985	156	1,524	5,510	18,390		1,825	
1986	150	1,310	4,801	19,151		1,864	
1987	No count	1,916	6,765	17,546		1,887	
1988	No count	1,290	7,638	16,791		2,128	
1989	212	1,703	7,564	18,328		2,613	
1990	198	1,386	8,129	16,778	12,632	2,368	1,508
1991	250	1,487	6,535	16,834	11,440	1,633	1,425
1992	266	1,634	6,916	17,512	11,511	2,581	1,909
1993	266	715	7,009	17,919	12,418	3,022	2,052
1994	279	403	3,751	19,186	13,843	3,034	2,227
1995	296	503	7,603	25,754	15,326	4,248	3,108
1996	308	512	6,269	24,468	14,500	3,405	2,989
1997	382	502	6,518	26,711	17,340	3,478	2,719
1998	365	621	4,306	26,963	17,384	3,859	3,126
1999	312	259	4,196	21,694	16,933	3,786	3,429
2000	367	541	4,618	27,045	17,979	3,958	3,105
2001	369	734	3,639	28,103	18,442	4,114	3,346
2002	338	676	3,666	24,369*	20,185*	3,050*	2,844*
2003	248	968	3,335	26,722*	19,519*	3,105*	2,233*
2004	236	687	3,876	22,970*	20,332*	3,313*	2,677*
2005	276	281	3,790	22,667*	18,858*	4,109*	4,713*
2006	298	485	3,167	21,444*	15,578*	3,811*	2,975*
2007	281	399	3,424	16,770*	15,536*	3,635*	2,735*
2008	293	427	3,354	17,157*	15,036*	3,464*	2,591*
2009	358	465	2,316	16,888*	14,143*	3,008*	2,400*
2010	381	492	3,422	18,096	15,029	3,234	2,557
2011	306	540	2685	15691	14955	3012	2705
2012	290	648	2465	16991	14100	3305	3068
2013	218	322	1712	14764	13349	3155	2879
2014	325	338	2464	16602	14248	3796	2987
2015	**300**	**401**	**3433**	**21598**	**15945**	**4590**	**3204**

* Based on first all-island count (AIC1)

Table 1.2: All-island count of fulmar, shag, kittiwake, guillemot and razorbill, Isle of May, 2015

Section	Species

		Fulmar	Shag	Kittiwake	Guillemot		Razorbill	
		AOSs	AONs	AONs	Ind	Pairs	Ind	Pairs
A	**Rona (West)**	11	44	205	988	703	133	107
B	**Altarstanes to Peregrine's Nest**	37	21	393	2051	1504	844	510
C	**Greengates**	45	7	713	3914	3072	807	568
D	**South Plateau**	46	6	787	6922	5076	1134	712
E	**Cornerstone to Pilgrim's Haven**	16	5	425	4789	3489	766	597
F	**Pilgrim's Haven to Lady's Cave**	36	29	344	1557	1169	421	359
G	**The Maidens**	10	54	35	148	109	66	48
H	**South Ness to Lady's Bed**	0	9	43	15	11	35	25
I	**South Ness to Colm's Hole**	18	75	119	0	0	28	20
J	**Colm's Hole to Low Light**	15	68	121	303	203	119	87
K	**Low Light to Tarbet**	23	67	200	911	609	205	150
L	**Rona (North and East)**	4	16	0	0	0	0	0
M	**Lochside (South)**	40	0	0	0	0	0	0
N	**Lochside (North)**	8	0	48	0	0	32	20
	Totals	**309**	**401**	**3433**	**21598**	**15945**	**4590**	**3204**

Table 1.3: Population change 2014-2015 for cliff-nesting species.

	Fulmar (AOS)	Shag (AON)	Kittiwake (AON)	Guillemot		Razorbill	
				Ind	Pairs	Ind	Pairs
2014 total (AIC)	**325**	**338**	**2464**	**16602**	**14248**	**3796**	**2987**
2015 total (AIC)	**309**	**401**	**3433**	**21598**	**15945**	**4590**	**3204**
Change 2014-2015	**-16**	**63**	**969**	**4996**	**1697**	**794**	**216**
%age change 2014-2015	**-5**	**18**	**39**	**30**	**12**	**21**	**7**

Table 1.4: Conversion of individual guillemots and razorbills to pairs for the all-island count, Isle of May, 2015

Date	Time of C.stone count	Guillemot					Razorbill			
		Individuals at Cornerstone	k-value	Individual Main count	Pairs Main count		Individuals at Cornerstone	k-value	Individual Main count	Pairs Main count
03/06/2015	08:05	329	0.67	1214	812		111	0.73	334	244
03/06/2015	13:50	309	0.71	988	703		101	0.80	133	107
04/06/2015	08:20	293	0.75	1557	1169		95	0.85	421	359
04/06/2015	13:45	302	0.73	4789	3489		104	0.78	766	597
05/06/2015	08:15	300	0.73	6922	5076		129	0.63	1134	712
05/06/2015	13:50	297	0.74	0	0		128	0.63	32	20
07/06/2015		Average taken	0.73	15	11		Average taken	0.72	45	33
08/06/2015	08:05	279	0.79	3475	2740		122	0.66	610	405
08/06/2015	14:35	291	0.76	439	332		98	0.83	197	163
09/06/2015	08:05	300	0.73	2051	1504		134	0.60	844	510
10/06/2015		Average taken	0.73	148	109		Average taken	0.72	74	54
Totals				**21598**	**15945**				**4590**	**3204**

Table 1.5: Counts of guillemots in individual count sections during the all-island count, Isle of May, 2015.

	A		B		C		D		E		F		G		H		I		J		K		L		M		N	
	Ind	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**
3/6	988																		303		911							
4/6									4789		1557																	
5/6							6922																					
7/6															15													
8/6					3914																							
9/6			2051																									
10/6													148															
TOTAL	988	703	2051	1504	3914	3072	6922	5076	4789	3489	1557	1169	148	109	15	11	0	0	303	203	911	609	0	0	0	0	0	0

Table 1.6: Counts of razorbills in individual count sections during the all-island count, Isle of May, 2015.

	A		B		C		D		E		F		G		H		I		J		K		L		M		N	
	Ind	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**	**Ind**	**Prs**
3/6	133																10		119		205							
4/6									766		421																	
5/6							1134																				32	
7/6															35		10											
8/6					807																							
9/6			844																									
10/6													66				8											
TOTAL	**133**	**107**	**844**	**510**	**807**	**568**	**1134**	**712**	**766**	**597**	**421**	**359**	**66**	**48**	**35**	**25**	**28**	**20**	**119**	**87**	**205**	**150**	**0**	**0**	**0**	**0**	**32**	**20**

Table 1.7: Weather conditions during all-island count, Isle of May 2015

Date	Time		Cloud	Rain	Sea	Swell	Light	Vis	Wind speed	Wind direction
	Start	Finish								
03/06/15	08:05	11:35	1/8	1	4	3	1	1	3-4	W
03/06/15	11:40	14:00	4/8	1	4	3	1	1	3	W
04/06/15	08:20	10:50	3/8	1	1	1	1	1	2-3	SW
04/06/15	10:50	13:50	4/8	1	1	1	1	1	2-3	SW
05/06/15	08:15	11:50	8/8	1	2	2	1	2	3	SE
05/06/15	12:20	14:05	6/8	1	2	2	1	1	3-4	SW
08/06/15	08:05	10:40	7/8	1	1	1	3	1	1-2	S
08/06/15	14:35	15:35	6/8	1	1	1	3	1	2	S
09/06/15	08:05	11:55	8/8	1	1	1	1	1	1-2	SW

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/6						14:35-14:45	14:15-14:30	15:05-15:15	14:58-15:05	14:48-14:53	14:30-14:43	14:20-14:28	13:30-13:35	13:10-13:20	12:50-12:56	12:40-12:45	12:10-12:30	11:48-12:05	11:30-11:40	11:20-11:25
2/6	15:15-15:28	15:35-15:45	15:52-15:58	16:01-16:11	16:15-16:20															
3/6	08:50-09:05	08:28-08:40	08:10-08:18	09:35-09:40	09:20-09:30	11:00-11:10	11:12-11:23	11:34-11:42	11:45-11:52	11:53-11:55	12:34-12:45	12:45-12:50	13:08-13:15	14:24-14:29	12:58-13:05	14:35-14:42	15:08-15:23	14:48-15:02	15:38-15:45	15:50-15:55
6/6						08:33-08:49	08:20-08:30	09:50-10:02	10:05-10:15	10:16-10:20	10:30-10:42	10:45-10:52	10:55-11:00	11:25-11:35	11:05-11:15					
7/6	13:18-13:30	13:00-13:07	12:45-12:50	12:25-12:32	12:02-12:12											08:08-08:15	11:30-11:48	11:10-11:26	08:25-08:30	08:38-08:45
10/6	14:40-14:48	14:13-14:20	13:55-14:02	13:40-13:45	13:00-13:05	12:31-12:40	12:20-12:30	12:07-12:15	11:55-12:05	11:43-11:50	11:01-11:12	10:54-10:58	10:38-10:42	10:23-10:33	09:55-10:00	09:45-09:51	09:25-09:40	09:08-09:19	09:00-09:05	08:50-08:54
11/6	08:20-08:30	08:38-08:45	08:55-09:02	09:12-09:15	09:25-09:30										11:02-11:05	10:52-11:00	10:32-10:47	10:15-10:25	10:05-10:12	09:58-10:00
12/6						08:17-08:35	08:38-08:50	09:15-09:22	09:00-09:12	09:24-09:26	09:38-09:50	09:51-09:56	10:02-10:05	10:10-10:18						

Table 1.8: Times at which auk monitoring plots were counted, Isle of May, 2015.

Table 1.9.1: Counts of guillemots in monitoring plots, Isle of May, 2015.

Plot number	1/6	2/6	3/6	6/6	7/6	10/6	11/6	12/6	Mean	SD	CV	SE
1		375	382		339	343	401		**368**			
2		298	340		331	304	318		**318.2**			
3		159	147		158	137	153		**150.8**			
4		93	108		87	85	94		**93.4**			
5		277	286		256	242	242		**260.6**			
6		392	404	399		368		417	**396**			
7		302	279	321		273		297	**294.4**			
8	213		225	220		214		242	**222.8**			
9	191		185	200		179		214	**193.8**			
10	112		107	96		99		106	**104**			
11	148		143	178		148		150	**153.4**			
12	213		213	223		211		221	**216.2**			
13	116		109	99		100		107	**106.2**			
14	207		239	246		245		238	**235**			
15	158		161	158		155	156		**157.6**			
16	149		148		163	142	158		**152**			
17	292		305		339	308	349		**318.6**			
18	187		195		201	184	208		**195**			
19	173		166		159	167	177		**168.4**			
20	137		144		154	136	145		**143.2**			
Total		**4192**	**4286**		**4327**	**4040**		**4393**				

Table 1.9.2: Counts of razorbills in monitoring plots, Isle of May, 2015.

Plot number	1/6	2/6	3/6	6/6	7/6	10/6	11/6	12/6	Mean	SD	CV	SE
1		20	19		24	24	20		**21.4**			
2		30	40		16	19	24		**25.8**			
3		0	0		0	0	0		**0**			
4		16	15		14	10	12		**13.4**			
5		9	9		10	8	6		**8.4**			
6		48	32	32		24		44	**36**			
7		65	63	70		55		74	**65.4**			
8	5		13	11		6		14	**9.8**			
9	18		24	33		23		23	**24.2**			
10	3		2	2		1		3	**2.2**			
11	56		64	110		67		93	**78**			
12	4		6	6		7		3	**5.2**			
13	24		19	19		24		32	**23.6**			
14	60		130	130		121		120	**112.2**			
15	0		0	0		0	0		**0**			
16	0		0		0	0	0		**0**			
17	61		60		90	96	94		**80.2**			
18	58		71		79	90	88		**77.2**			
19	0		0		0	0	0		**0**			
20	0		0		0	0	0		**0**			
Total		**477**	**567**		**646**	**575**		**650**				

Table 2: Number of "commic" tern nests and clutch sizes, Isle of May, 2015

Area		Number of Nests		Nest Contents			
		Arctic tern	Common tern	1	2	3	4
Beacon Colony		154	13	24	118	25	
Kirkhaven Colony	Visitor Centre	91		12	69	10	
	Visitor Centre Roof	25		3	17	5	
	Visitor Centre Bank	15		1	13	1	
	Mouse House Field	79		14	46	19	0
	Visitor Centre to Jetty	49		8	36	5	
	Jetty Triangle	10		4	6		
	Logan's Road South	47		3	39	4	1
	Chapel Bank	14		5	9		
Total		**484**	**13**				

Table 3.1: Wader counts, Isle of May, 2015

Species	Date					
	26/07/2015	8/08/2015	9/08/2015	19/08/2015	25/08/2015	17/09/2014
Oystercatcher	44	31	19	51	29	19
Lapwing					1	
Ringed plover				1		1
Knot		2		3	6	
Purple sandpiper	34	52	80	47	64	35
Turnstone	71	122	134	104	88	46
Dunlin		2	7	5	6	1
Green sandpiper				1		
Common sandpiper			1	4	6	1
Redshank	9	4	6	3	7	8
Greenshank			1			
Curlew	46	3	60	41	60	78
Whimbrel		5	7	7	5	2

Table 3.2: Cetacean sightings, Isle of May, 2015

Species	Date	Number	Direction	Time	Location
Harbour porpoise	09/05/15	1			6 miles west of Pilgrim's
Harbour porpoise	26/05/15	1			Off east side heading south
Orca	28/05/15	7	North		Heading up the east side of the island to Rona and then headed north
Minke whale	30/05/15	1	South	12:30	Forth - south of island
Harbour porpoise	30/05/15	1			Off May Princess
Minke whale	03/06/15	1			
Minke whale	08/07/15	1	Lingering	10:15-10:20	East of island, half way to horizon
Minke whale	13/07/15	1		13:00	East of island, half way to horizon
Harbour porpoise	13/07/15	1	North	20:30	North end of island, half way out
Harbour porpoise	01/08/15	2	South	07:55-08:00	Off south end
Minke whale	01/08/15	1		08:05-08:45	Off south end, 1km out
Minke whale	02/08/15	1	North	07:50	SE side of island heading north
Harbour porpoise	02/08/15	1		15:00	Off Pilgrim's
Minke whale	05/08/15	1		10:45	North-east of island
Minke whale	09/08/15	3	Lingering	18:00-21:00	Feeding around south end - one showing extremely well
Harbour porpoise	09/08/15	5		18:00	Feeding around south end
Harbour porpoise	10/08/15	2		08:30	Feeding north of island towards crail
Minke whale	12/08/15	1		19:00	Feeding off south end of island heading west
Minke whale	13/08/15	1	North	15:30	Photographed close to west face cliffs by visitor
Humpback whale	22/08/15	1	North	07:00-07:15	Breaching off north end then moved north
Harbour porpoise	25/08/15	1	North	08:05	South end of island
Harbour porpoise	31/08/15	2	East	10:35	Adult and calf travelled down the east of the island
Harbour porpoise	31/08/15	5		11:40-12:00	Total of 5 (3 and 2 calves) off north end of island
Basking shark	28/09/15	1	North	Morning	Moving north past Low Light
Harbour porpoise	28/09/15	2	North	08:30	North end of island, half way out

Species	First date	Last date	March		April		May		June		July		August		September		October	
			Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max
Large white	19/8												7	4				
Small white	28/5						1	1	3	3			3	2	1	2		
Green-veined white	5/6								2	1	1	1	5	7	1	3		
White species	23/5						1	1					2	2				
Red admiral	16/5						2	2	6	2	19	20+	16	20	22	200		
Painted lady	6/6								2	1			17	50	10	5		
Small tortoiseshell	9/3		5	2	21	15	22	15+	12	5	22	50+	19	12	17	40		
Peacock	8/4				8	3	6	2	2	1	3	1	14	8	7	6		
Ringlet	5/7										4	1						
Meadow brown	9/8	16/8											3	1				
Comma	7/8												2	1				
Small copper	29/8	29/8											1	1				

Table 3.3: Butterfly table: first and last dates, the number of days and peak count per month, Isle of May, 2015

Macro moths: first and last dates, the number of days and peak count per month, Isle of May, 2015

Species	First	Last	April		May		June		July		August		September		October	
			Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max
Angle shades	7/6	7/10					1	1	4	2			1	2	2	4
Antler moth	18/7	9/9							5	6	7	3	2	1		
Beautiful golden Y	18/6	3/8					4	1	6	5	2	1				
Bright-line brown-eye	22/5	25/8			3	3	14	20	16	31	8	3				
Burnished brass	12/7	17/8							7	3	3	1				
Cabbage moth	26/5	12/7			1	1	3	3	2	2						
Campion	23/5	13/7			3	1	8	4	7	5						
Chamomile shark	7/4	10/5	1	1	1	1										
Cinnabar	22/4	10/7	4	2	13	8	11	4	1	1						
Clouded drab	20/4	20/4	1	1												
Clouded-bordered brindle	10/6	21/7					5	3	2	1						
Common carpet	17/8	29/8									2	1				
Common marbled carpet	9/9	23/9											2	1		
Common pug	8/6	14/6					3	2								
Common quaker	9/4	9/4	1	1												
Common rustic	12/7	2/9							11	22	22	64	1	1		
Common swift	8/6	25/6					6	10								
Common wainscot	13/7	17/8							5	2	3	2				
Currant pug	8/6	17/8					1	1			1	1				
Dark arches	9/6	8/10					3	3	19	149	22	223	4	11	4	2
Double lobed	8/8	8/8									1	1				
Dusky brocade	18/6	18/7					3	5	6	5						

Species	First	Last	April		May		June		July		August		September		October	
			Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max
Ear spp.	15/8	17/8									2	1				
Elephant hawkmoth	30/6	30/6					1	1								
Flame	23/6	18/7					4	1	1	1						
Flame shoulder	7/6	18/7					9	2	5	4						
Flounced rustic	8/8	8/8									1	1				
Foxglove pug	9/7	9/7							1	1						
Garden carpet	10/6	18/9					1	1			4	1	2	2		
Garden dart	5/8	17/9									21	11	4	5		
Garden tiger	10/7	20/8							9	14	16	11				
Ghost moth	7/6	17/8					3	1	7	1						
Grey chi	17/8	17/8									1	1				
Heart and dart	7/6	23/7					11	6	4	1						
Hebrew character	6/4	13/7	15	11	20	60	13	19	1	2						
Hummingbird hawkmoth	3/7	18/7							2	1						
Large yellow underwing	24/7	8/10							5	3	16	33	8	8	5	5
Lesser broad-bordered yellow underwing	8/8	25/8									8	7				
Lesser treble-bar	17/8	17/8									1	1				
Lesser yellow underwing	3/8	30/8									11	18				
Lime-speck pug	7/7	29/7							5	3						
Lunar underwing	17/9	2/10											4	7	1	2
Lychnis	16/8	16/8									1	1				
Marbled beauty	8/8	8/8									1	1				
Marbled coronet	25/4	15/8	3	3	22	23	20	74	18	15	6	4				

Species	First	Last	April		May		June		July		August		September		October	
			Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max
Middle-barred minor	25/6	25/6					1	1								
Mother of pearl	18/8	18/8									1	1				
Mottled rustic	7/6	17/8					10	8	13	9	4	3				
Netted pug	7/6	18/7					3	1	4	7						
Northern spinach	6/7	6/7							1	1						
Pale pinion	16/4	7/5	1	1	1	1										
Pepper moth	18/7	18/7							1	1						
Pink-barred sallow	18/9	18/9											1	1		
Polar hawkmoth	11/7	11/7							1	1						
Riband wave	8/8	16/8									2	2				
Rosy rustic	24/8	18/9									1	1	2	1		
Rustic	7/6	17/9					2	5			6	9	1	1		
Scalloped oak	8/8	16/8									2	2				
Shoulder-striped wainscot	4/7	4/7							1	1						
Silver-ground carpet	4/7	10/7							5	1						
Silver Y	11/5	22/10			1	1					2	3	30	500	14	20
Six-striped rustic	28/7	21/8							3	5	8	1				
Six-spot burnet	14/7	14/7					1	1								
Small magpie	10/6	17/8					2	1	3	1	2	1				
Small phoenix	17/8	17/8									1	1				
Small square-spot	26/5	18/9			2	2	7	4	12	10	3	2	4	2		
Smoky wainscot	25/6	5/8					1	1	2	3	2	1				

Species	First	Last	April		May		June		July		August		September		October	
			Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days	Max
Snout	13/7	13/7							1	1						
Spectacle	22/5	25/7			5	4	8	4	6	3						
Square-spot dart	17/8	31/8									7	4				
Square-spot rustic	25/5	25/8			2	1	2	6	6	2	5	1				
Thistle ermine	9/7	9/7							1	2						
Twin-spot carpet	8/8	21/8									4	1				
Twin-spotted quaker	11/4	11/4	1	1												
White ermine	10/6	12/7					4	1	1	1						
Willow beauty	17/8	24/8									2	2				
Woodworm pug	7/7	17/8							5	4	2	2				
Yellow shell	4/7	8/7							5	1						

Table 3.5 The number of days moth trapping occurred per month, Isle of May, 2015

Month	Number of trapping days
April	26
May	25
June	21
July	20
August	22
September	7
October	6
Total	**127**

APPENDIX 1

Isle of May research reports for 2015 season

Breeding season foraging ecology of seabirds

M Newell, M Harris, C Gunn, M Bogdanova, S Wanless & F Daunt
CEH Edinburgh, Bush Estate, Penicuik, Midlothian, EH26 0QB

In 2015, we intended to deploy GPS loggers on four species in order to better understand their foraging ranges. However, due to time restrictions, we were only able to deploy loggers on European shags as part of the work conducted under permits MON/RP/168 – Environmental and intrinsic drivers of population change – an energetics approach, and MON/RP/170 – Foraging behaviour of shags. These loggers were attached to the feathers of the backs of the birds and although they were much larger than the over-winter devices, the birds were targeted to be re-caught after a couple of days and the device removed. The retrieval rate was 100%. GPS devices were deployed on 34 shags. The data collected will be analysed over the forthcoming winter.

Auk vigilance behaviour

M Christie, S Wanless, R van der Wal

Predation is one of the main evolutionary pressures placed on animals and as a result, many animals have evolved a variety of behavioural and/or morphological adaptions in an effort to reduce their risk of predation. In this study, the vigilance behaviour of Atlantic puffin and common guillemot was measured to investigate whether this behaviour was affected by the blind area in the visual fields of the respective species. Vigilance behaviour was also compared between the two species.

Using the research hides, behaviour of both species was recorded using a video camera. In total, 96 videos were analysed, 48 for each species. Vigilance was measured in terms of head movement rate, the size of each head movement and the position to which the head moved. The results are currently being analysed.

Environmental and intrinsic drivers of population change – an energetics approach

O. Hicks, F. Daunt, S. Burthe, J. Green

We aim to understand the energetic costs responsible for environmental and intrinsic drivers of population change which will allow us to much more effectively quantify the mechanisms responsible for reproductive skew in the population. By doing so, we can predict how populations will respond to anthropogenic changes to their environment.

In particular, we consider the role that endoparasites play in driving seabird population dynamics. The recently established endoscope method of quantifying gut parasite load in the European shag (*Phalacrocorax aristotelis*) showed significant variation in parasite loads between individuals.

By attaching accelerometers to adult shags we are able to calculate energy expenditure and how this varies with parasite load. Building on previous work which found that parasites can affect reproductive success, we aim to use energetics to understand the mechanism behind this.

Breeding pairs were targeted to ensure male and female numbers are equal. Individuals for which parasite data and accelerometry data exist from previous years were targeted.

The loggers fitted (D3GT, and AXY-Depth) measured acceleration in three axes, depth and temperature and were attached to the central back feathers.

A total of 34 adult shags were endoscoped and fitted with acceleration data loggers. 20 birds were fitted with D3GT loggers and 14 were fitted with AXY-Depth loggers.

The accelerometer data has been downloaded and behaviours assigned and is currently being analysed with the parasite data to understand how different parasite loads affect energy expenditure during the breeding season. Data from 2014 and 2011 has been added to the dataset to help understand how the effects of parasitism are driven by varying environmental factors.

Long-term studies of breeding seabirds on the Isle of May

M Newell, M Harris, S Burthe, C Gunn, S Wanless & F Daunt
CEH Edinburgh, Bush Estate, Penicuik, Midlothian, EH26 0QB

The 2015 breeding season on the Isle of May NNR proved to be another good year following the general success of 2014. Breeding in 2015 commenced early for most species, especially European shags and black-legged kittiwakes.

- Of the six study species, Northern fulmar, European shags and black-legged kittiwakes had one of their most successful seasons on record. Common guillemot and Atlantic puffin had an above average breeding season while razorbill returned to normal after four poor years. Return rates were above the long-term average in all five study species. Sandeels (*Ammodytes sp.*) remained the main food of young razorbill, Atlantic puffins, shags and kittiwakes. The diet of common guillemots was dominated by clupeids. Northern fulmar breeding success (0.52 chicks per incubating pair) was well above average.

- European shags had an above average breeding season (1.91 chicks per pair). Return rate was above average at 87.9%. Diet was dominated by sandeel, which occurred in 94% of samples.

- Black-legged kittiwakes had an excellent season with productivity (1.07 chicks per completed nest) being well above average. Adult return rate (84%) was also well above the long-term average. The proportion of sandeel in the diet (80% by sample) was also typical.

- Guillemots had an average breeding season (0.78 chicks leaving per pair). Return rate of adults (93.1%) was above average. Adults fed their chicks almost entirely on medium-sized sprats (91% by number).

- Razorbill breeding success (0.60 chicks leaving per pair) was normal and adult return rate (86.2%) was typical. Chick diet contained more sandeel (59% of loads) than clupeids (40%).

- Atlantic puffins had an average season with 0.75 chicks fledging per pair laying. The return rate for adults (89.8%) was above average. Chicks were fed mainly sandeels (87% by number).

2) Post-fledging survival of seabirds

- In association with ringers resident at the Low Light, large numbers of young seabirds were ringed. The actual totals will appear in the annual report of the Isle of May Bird Observatory.

- Attention focussed on shag and guillemot and systematic searches were made to find and read the ring numbers of adult birds. This was made easier by many birds having been colour-ringed in previous years.

- Attempts were made to age and ring all shag chicks for future estimates of survival rates and age-specific breeding performance.

- As in previous years, guillemot chicks were weighed and measured to assess hatching date and condition, and then colour-ringed. A total of 266 chicks were sampled, a reasonable total after much lower totals in recent years.

We are grateful to David Steel and Bex Outram of Scottish Natural Heritage for logistical and occasional fieldwork support on the Isle of May. Sheila and Debbie Russell, Polly Phillpot, Holly Pickett, Nima Majlessi, Rich Howells, Eileen Butterfield, James Crymble and Maria Bogdanova all helped with fieldwork. We are grateful to Alex Gardner and the crew of the May Princess and Roy Giles with RIB Osprey for providing transport to and from the Isle of May throughout the season.

Foraging behaviour of shags

M Ito[1], M Newell[2], C Gunn[2],S Wanless[2] & F Daunt[2]
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The objective of this project was to examine the fine scale foraging behaviour of shags, by attaching specially designed loggers to the birds. We aimed to deploy two types of loggers, providing a wealth of novel behavioural data: a) acceleration/geomagnetic loggers: these loggers record 3D movements during prey search and capture; b) GPS loggers.

We achieved 34 successful deployments of GPS loggers simultaneously with accelerometers. The detailed analyses of these data will take place over the winter. The aim of the work is to fine-tune our method of estimating the amount of food captured from wing beat frequency by accounting for the effect of wind, which also affects wing beat frequency. These are the same set of deployments as used in project MON/RP/168 - Environmental and intrinsic drivers of population change – an energetics approach.

Over-wintering foraging ecology of seabirds

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CEH Edinburgh, Bush Estate, Penicuik, Midlothian, EH26 0QB

This project aims to obtain fine scale data on movements and foraging behaviour of seabirds in winter, by attaching specially designed loggers to European shags, Atlantic puffins, black-legged kittiwakes, razorbills and common guillemots. The loggers record daily location and foraging effort. Detailed data on location-specific foraging effort of seabirds will enable patterns of distribution and behaviour in relation to season and breeding status to be analysed.

The work on shags is a continuation of work commenced in 2002. A total of 49 geolocator loggers were retrieved from shags with a further 52 deployed which we plan to retrieve in 2016.

In 2015, 31 re-deployments of geolocator loggers were made on guillemots with a further four loggers retrieved.

In 2015, 11 geolocator loggers were retrived from razorbills but there were no further deployments. In 2015, 40 loggers were deployed on puffins with 35 retrieved from previous deployments. Of these, six were retrieved from dead puffins which had been predated by great black-backed gulls in an area of over one hundred predated puffins. These deployments will be targeted for retrieval in 2016.

A single logger was retrieved from a kittiwake in 2014 which had been deployed in 2008 with a further 15 retrieved from 2014 deployments. A further 30 new deployments were made.

Analysis of retrieved data will be undertaken but previous Geolocator work has led to several peer-reviewed papers including:

Bogdanova MI, Daunt F, Newell M, Phillips RA, Harris MP, Wanless S (2011) Seasonal interactions in the black-legged kittiwake, Rissa tridactyla: links between breeding performance and winter distribution. P Roy Soc B-Biol Sci 278:2412-2418

Harris MP, Daunt F, Newell M, Phillips RA, Wanless S (2010) Wintering areas of adult Atlantic puffins Fratercula Arctica from a North Sea colony as revealed by geolocation technology. Mar Biol 157:827-836

Non-linear responses of seabird top predators to coastal marine environmental change: implications for ecosystem resilience

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The objective of this project is to examine in detail the diet and demography of the European shag *Phalacrocorax aristotelis* (*hereafter shag*) breeding on the Isle of May, using a data set spanning three decades. During 2015, I aimed to contribute to the collection of data relating to shag diet and demography as part of the Isle of May Long-Term Study (IMLOTS).

A total of 52 shag regurgitations were collected on an ad hoc basis during nest visits and chick ringing, which form part of the long-standing monitoring methods conducted as part of IMLOTS. Initial results suggest that contrary to some recent years (in which diet has been more diverse) shag diet in 2015 comprised almost entirely of adult (1+) lesser sandeel *Ammodytes marinus*. We also collected ~40 shag pellets, mostly from a juvenile roost in the area of Tarbet, although these samples are yet to be analysed. This year, as part of this project, the location of samples was also recorded to explore the spatial variability in diet around the island. Detailed analyses and interpretation of these data will take place over the coming winter. The overall aim of this project is to explore the interaction between shags and their environment, in particular understanding the shape of these relationships, so we can make more informed assessments of the value of top predators as indicators of change in the coastal marine environment.

A multi-colony assessment of stress in black-legged kittiwakes (2015)

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Kittiwake populations are in severe decline across the northern hemisphere. This study aims to look at individual data on stress measures (corticosterone in feathers and telomere shortening rates) across a series of kittiwake colonies in conjunction with colleagues at the University of Alaska. Stress levels can be measured from feather and blood samples and used to investigate whether colonies exhibiting pronounced declines in numbers or breeding success are those that exhibit evidence of stress linked to diet or food availability, for example.

We successfully obtained adequate sample sizes of both blood and feather samples from both adults and chicks. In total, we blood sampled 12 adults and obtained feathers from 12 adults. Not all samples could be split for both telomere and stress analysis and were only used for telomere analysis. All samples have been sent away for analysis by colleagues in Alaska and will form part of a global collaborative study investigating stress and environmental conditions. We envisage that this collaborative analysis will lead to some very timely and interesting papers on the impacts of environmental stressors such as climate warming on this species.

Quantifying the impact of parasites on seabirds

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The role parasites play in driving seabird population dynamics has been largely ignored, despite the fact that seabirds are hosts to a wide variety of endo- and ectoparasites that reach high densities in most colonies and can act as disease vectors. The ultimate aim of this project is to evaluate how parasites impact their seabird hosts, particularly focussing on the European shag (*Phalacrocorax aristotelis*).

Nematode infections in shags

This research builds on previous work from 2010-2014 which significantly advanced our understanding of the role parasites play in this host. Endoscopy was developed as a novel and extremely useful way of measuring natural parasite loads in shags and also evaluating drug efficacy. We found that there was significant variation in parasite loads between individual birds and, importantly, that parasites are having significant impacts on shags. We have found that shag chicks experimentally treated with ivermectin show different responses to treatment in terms of behaviour and growth depending on their position in the brood hierarchy (shags hatch asynchronously) with the youngest chick in a brood responding the most to altered parasite load (now published in Ecology and Evolution: **Granroth-Wilding, H.M.V.**, Burthe, S.J., Lewis, S., Reed, T.E., Herborn, K.A., Newell, M.A., Takahashi, E.A., Daunt, F. & Cunningham, E.J.A. (2014) Parasitism in early life: environmental conditions shape within-brood variation in responses to infection. *Ecology and Evolution, doi: 10.1002/ece3.1192*). There are also interesting effects of parasites on adults - parents of shag chicks treated to remove parasites were found to spend less time foraging during the winter (a period when shag mortality is high) and to subsequently come back and breed earlier on the colony (journal manuscript currently in the final stages of writing).

One of the aims now is to establish, by monitoring over a number of years of variable environmental conditions, whether parasites tend to be more prevalent in some years (which may be indicative of environmental differences between years, e.g. diet, etc.). We also want to know whether individual shags' worm burdens vary between years or whether individuals can be consistently classed as having low or high burdens, and to establish whether individuals with higher burdens have reduced breeding success or increased probability of mortality. In order to do this, we are planning to measure parasite burdens in a number of individual shags each year, particularly targeting birds that have previously been assessed. We have now successfully built up five years of data from 2011-2015, where we have measured burdens across naturally parasitized shags and obtained repeated measures from individuals. We sampled a total of 68 adults successfully in 2015, 47 of which had been sampled in previous years.

Bacterial gut communities and parasites

In conjunction with this long-term work on parasite loads and implications for the host, we aimed in 2013 and 2014 to build on this work and to try and investigate how parasite burdens may be linked to gut microbiomes (bacterial communities within the gut). Recent literature suggests that the microbiome of individuals can be linked to differences in diet, and also potentially to variation in parasite loads. In 2013 and 2014, we successfully measured parasite loads and obtained swab samples of gut bacteria from the endoscope and from faecal samples to investigate this, with 30 adult shags sampled in 2015. Samples have been successfully processed and sequenced by colleagues at CEH Wallingford and we are awaiting the results from the samples.

In conclusion, 2015 was a highly successful field season, in which we achieved all of our aims. Sampling of adults to investigate microbiomes went smoothly and it is hoped that this will lead to interesting results and build on results obtained in previous years. We built on our successful development of endoscopy as a method for quantifying endoparasites in live wild seabirds and obtained vital data for exploring variation in natural parasite burdens. This will prove crucially important for achieving our ultimate aim of quantifying the impact of parasites on seabird hosts and we hope to develop this work further in 2016.

Endoscopy to assess nematode burdens of European Shags

S Burthe, R Butterfield, M Newell, C Gunn, R Howells

The intrinsic and extrinsic factors that relate to individual-level nematode burden variation of shags are poorly understood. As part of a long-term study, we assessed the number of nematode parasites infecting individual shags using medical endoscopy. Using this information, we will be able to examine how parasite burdens vary temporally (within and between years). Adults and nestlings were both sampled to assess intra- and inter-family variation in parasite burdens.

A total of 68 adults and 87 nestlings were endoscoped. The information on burdens is now being used for analysis comparing burdens among years and how they relate to life history traits. The data from adults endoscoped in this project is the same as from permit MON/RP/174 – Quantifying the impact of parasites on seabirds.