

Seabird Monitoring & Research Project Isles of Scilly 2006-2011

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Report Summary

The last six years have shown relatively mixed fortunes for the seabirds monitored in this study; these are summarised by species below. In many cases productivity figures are low and apparently insufficient to maintain the population. This is supported by the general downward trend for the islands' seabird assemblage as a whole since the early 1980s. Productivity and settlement rates are particularly low for Common terns and kittiwakes. If current trends continue it is possible that both may be lost as regular breeding species in Scilly. The main driving force behind these declines appears to be food supply although predation particularly by rats and poor weather are also important factors.

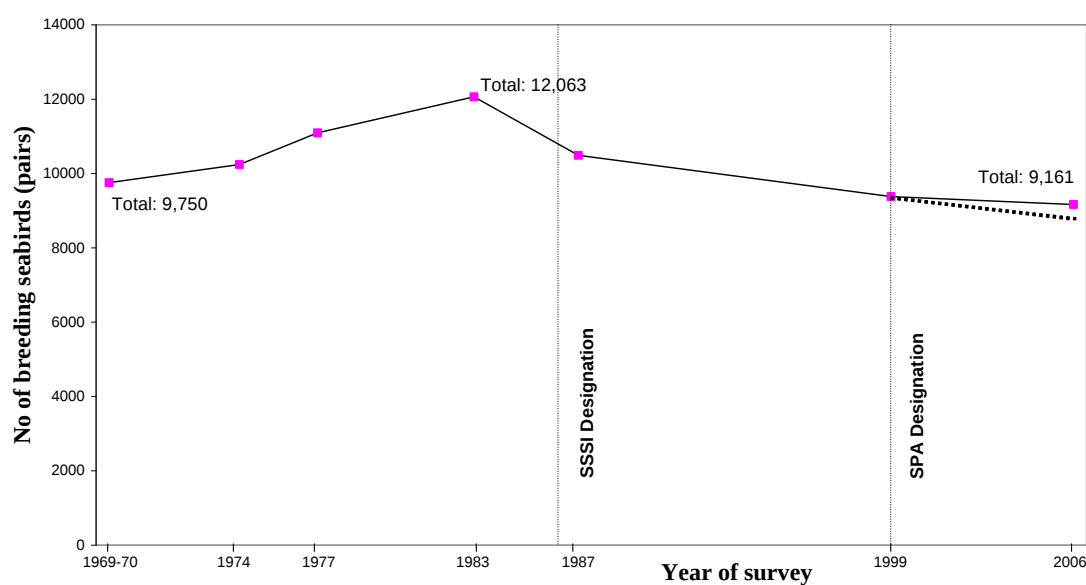
- **Kittiwake** Six sub-colonies (2006 -2008) reduced to just two by 2011 (Samson, St. Helen's, Gugh & Gimble Porth abandoned). Complete breeding failure 2006-2008; low productivity in 2009 and 2011 and 0.71 ch/pr in 2010. 72% reduction in numbers in the last 6 years from 266 breeding pairs in 2006 to just 74 in 2011
- **Herring gull** Three main sub-colonies studied (approx. 20% of population). Variable productivity at Samson; failed in 2007, poor 2008; average 0.63 ch/pr 2009-11. Sub-colony at Gimble Porth, Tresco declining and failing with no chicks fledged 2009-11. Extremely high productivity recorded for birds nesting on roof-tops in Hugh Town St. Mary's; average 1.77 ch/pr ($n = 6-8$)
- **Fulmar** Two biggest sub-colonies at Menawethan & Daymark studied (approx. 30% of population). Productivity variable but noticeably lower in recent years, although within the range of previous study estimates. Gradual reduction in numbers at the two sub-colonies 19% 2006-11
- **Common tern** Whole population studied. Complete failure 2006, 2007, 2010 & 2011. Limited numbers of chicks fledged 2008 & 09 average 0.33 ch/pr - too low to maintain population. Reduction in distribution of breeding attempts across islands with all attempts in recent years focused on low-lying Green Island
- **Manx shearwater** Sub-colonies studied on inhabited islands (up to 20% population), no clear evidence of breeding success recorded at sites with rat presence. Small new sub-colony discovered at Peninnis, St Mary's in 2010 & 2011. Large increase in Apparently Occupied Burrows recorded on St. Helen's from 9 AOBs 2006 to 39 in 2011 – rat clearance at this site since 1997/98 with some incursions
- **Storm petrel** Apparently Occupied Sites recorded at study beach on Annet 2010 & 2011; population estimate 34-49 breeding pairs present

Continued monitoring of productivity of the above species and sites will help to build up a detailed picture of year to year fluctuations in settlement and breeding success. This in turn will help to inform an effective conservation programme for the islands. Further study of food availability and foraging behaviour and range will also help inform marine management in the area such as the Isles of Scilly Marine Conservation Zone and a proposed fishery by-law to prevent any future sand-eel fishery in the area. The rat eradication work, as part of the Isles of Scilly Seabird Recovery Project, will undoubtedly continue to have a positive affect on the productivity of burrow nesting Manx shearwater in particular. And continued awareness work regarding seabird disturbance issues is recommended. Although predation by crows and ravens has had a negative impact on kittiwake productivity there is no clear evidence that any form of control will prevent the decline in this species and it is not recommended.

Introduction

The Isles of Scilly support an internationally important seabird assemblage in terms of both numbers and diversity. The results of the 2006 seabird survey¹ confirmed it as the most significant seabird colony in southwest England, supporting over 9000 pairs of 14 species of breeding seabird. However, this most recent count evidenced a continuing and worrying decline in the overall number of birds supported (25% decrease in the size of the assemblage since 1983 when it was designated a Site of Special Scientific Interest), see figure 1².

Figure 1. Species assemblage total 1969-2006



The key strategic goal of Isles of Scilly Seabird Conservation Strategy is to maintain and enhance this seabird assemblage by, among other things, ensuring the productivity of priority species is at least sustained at 2001 levels (the year of Special Protection Area designation and the baseline for priority species). In order to achieve this goal a key objective is to ensure effective monitoring of population, distribution and productivity of seabirds in Scilly³.

This report presents the results of productivity and population monitoring studies carried in the Isles of Scilly between 2006 and 2011. The main objective was to obtain productivity data for a number of key species at key sites, establishing and adding to baseline data for seabird breeding success and building up a comprehensive picture of seabird productivity on the islands to help to focus future conservation and survey work. Standard methods for estimating productivity were used⁴, with further details given in Appendix 1. Access to closed sites was granted by the Isles of Scilly Wildlife Trust who manage the land and an orange flag was displayed at all times to signal this permission.

¹ Heaney *et al.* 2007

² Lesser black-backed gull nests that were empty but fully formed are included in the counts as per the methods. A number of these in 2006 were subsequently abandoned without laying. The dotted line represents the trend in numbers if empty nests are not counted.

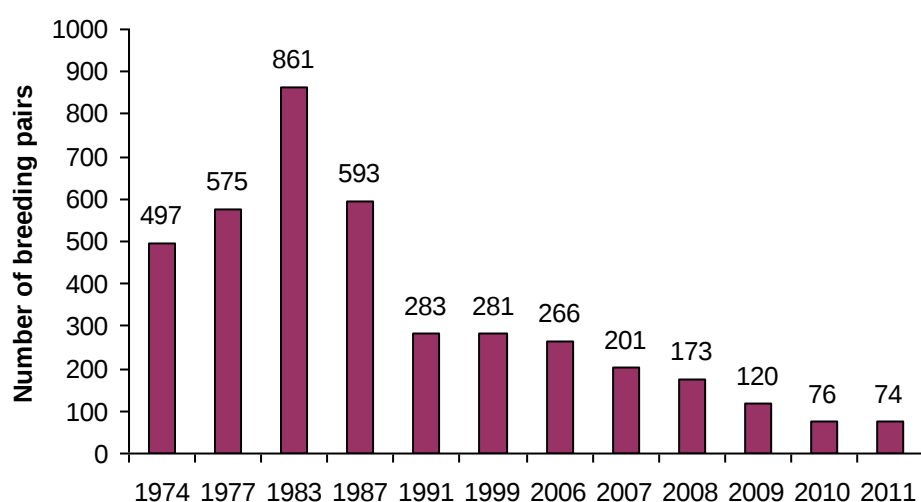
³ Lock *et al.* 2009

⁴ Walsh *et al.* 1995 and Gilbert, Gibbons & Evans 1998

Results - Black-legged kittiwake *Rissa tridactyla*

Kittiwakes have had mixed fortunes in Scilly. In the 1800s they were reported breeding on Men-a-vaur and Gorregan, but declined and appear to have been absent from Scilly between 1900 and 1938. Recolonisation and rapid increase then resulted in a count of 1,400 breeding pairs in 1969-70⁵. The kittiwake population in Scilly has been in decline again since the mid-1980s (see Figure 2), with a 70% drop in numbers between 1999 and 2011. This is in line with the steep declines recorded for this species across the UK in the past 2-3 decades⁶

Figure 2. Change in numbers of breeding pairs of kittiwake 1974-2011



The total Scillonian kittiwake population is divided between a number of smaller sub-colonies, with a number of sites used prior to the study period no longer attended (e.g. Men-a-vaur, Gorregan & Annet). During the study period, all the most recent sub-colony locations in Scilly, apart from that on St. Martin's and the new settlement on St. Agnes, have declined and been abandoned (see Table 1).

Table 1. Change in numbers of breeding pairs of kittiwake 1999-2011.

SUB-COLONY SITE	Attitude	1999	2006	2007	2008	2009	2010	2011
Gugh	NE	155	131	69	50	41	26	0
Gimble Porth, Tresco	NE	54	37	39	30	29	0	0
St. Helen's ⁷	SE	7	36	31	35	18	2	0
Samson North Hill	W	28	25	26	21	9	0	0
Samson South Hill	SSW	10	22	15	10	0	0	0
St. Martin's, Daymark	NE	27	15	21	27	22	47	69
Turk's Head, St. Agnes	NE					1	1	5
Total Breeding Pairs		281	266	201	173	120	76	74
Total Chicks Fledged		-	0	0	0	1	54	9

From 2006 the productivity of the entire kittiwake population has been recorded and the numbers of chicks fledged each year is also included in Table 1. Between 2006-2008 kittiwakes suffered complete breeding failure across Scilly and in 2009 just one chick fledged

⁵ Chown & Lock 2002

⁶ Mitchell et al. 2004

⁷ Data collected in conjunction with Will Wagstaff

on St. Agnes. In 2010 52 chicks were fledged on St. Martin's and a further 2 on St. Agnes, however the Gugh sub-colony which had been the largest in recent years, failed. In 2011, no birds attempted to breed at Gugh; the majority of birds settled at the Daymark, but failed to raise any chicks there. The birds at the Turk's Head in contrast did very well, fledging 9 chicks from just 5 nests.

In the sub-colonies that have been regularly monitored over the period of this study, most nesting attempts appeared to fail soon after hatching, with few large chicks seen, or late in the incubation period, with intact eggs abandoned. The average clutch sizes (where recorded) in 2008 and 2009 were higher than in 2006 and 2007, and included several clutches of 3 eggs. Clutch size data is not available for 2010 or 2011 because the majority of birds nested at the Daymark where the nests are not readily accessible and the nests on Gugh in 2010 were lost before the end of incubation when counts are made. The date that the first chicks were seen was as much as two weeks later in 2007 (3rd July) and 2008 (3rd July) than in 2006 (21st June).

Table 2. Average Clutch size (n = number of nests).

	1990s	2006	2007	2008	2009
Gugh		1.71 (103)	1.46 (56)	1.83 (36)	1.82 (38)
Gimble Porth, Tresco				1.77 (17)	1.75 (24)
Samson N		1.62 (21)	1.62 (21)	1.83 (18)	1.78 (9)
Samson S		1.65 (17)	1.2 (5)	1.5 (4)	0
Scilly	1.6-1.9				

Previous productivity records for Scilly range from 0.12 to 0.99+ between 1992 and 1998⁸ with wide variation in productivity between years and between sites (e.g. in 1993 Gugh 0.12 ch/ pr ($n = 125$); Samson 0.23 ($n = 57$); Gimble Porth 0.87 ($n = 8$)). Across the UK and Ireland, average productivity of kittiwakes for the period 1986-2008 was 0.65 fledged chicks per pair ($se \pm 0.03$) $n = 30-61$ colonies⁹. However, kittiwake breeding success has declined across much of the UK in recent years, and data collected across the southwest shows a very patchy success rate, with low productivity and failure at many sites whilst others have done well, for example at Exmouth 0.9 ch/pr in 2009¹⁰.

⁸ Robinson 2003

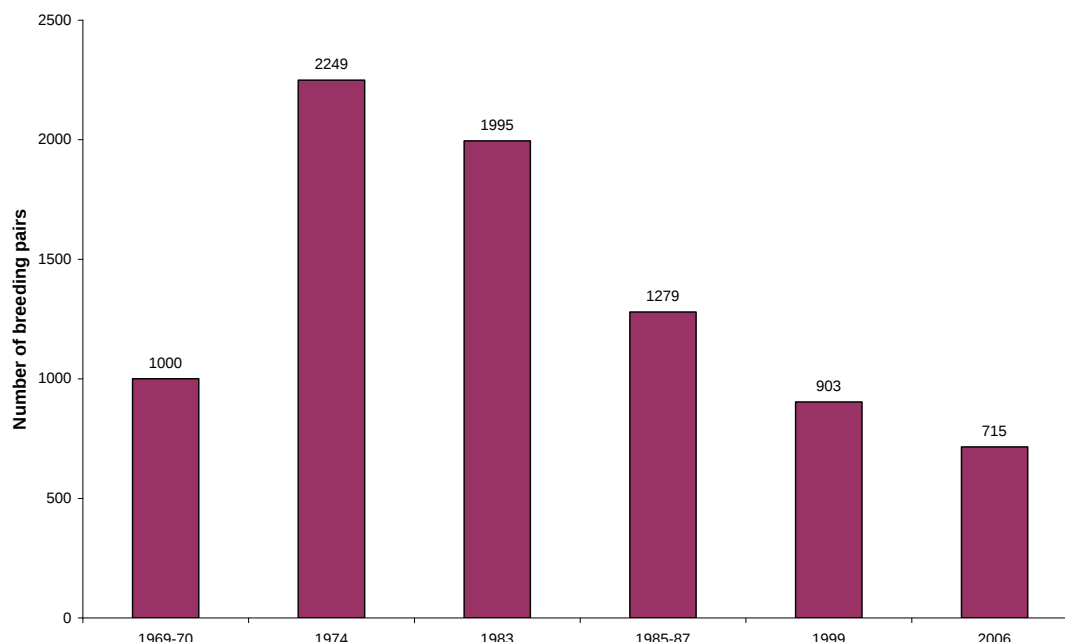
⁹ R. Mavor JNCC *pers comm*

¹⁰ H. Booker, RSPB *unpubl. data*

Results - Herring gull *Larus argentatus*

The population of herring gulls in Scilly has, in keeping with national trends, shown a sustained decline since the mid 1970s, with a 21% reduction in numbers between 1999 and 2006 to just 715 apparently occupied nests.¹¹

Figure 2. Change in numbers of breeding pairs of herring gull 1969-2011



Herring gull productivity has been recorded at three sites across the islands from 2007 to 2011 and varies widely between them (see Table 3).

Table 3. Herring gull productivity (chicks per pair); *n* = number of nests

SITE	2007	2008	2009	2010	2011
Samson	0 (<i>n</i> =52)	0.30 (<i>n</i> =84)	0.66 (<i>n</i> =73)	0.68 (<i>n</i> =63)	0.54 (<i>n</i> =71)
Gimble Porth, Tresco	<i>no data</i> ¹²	0.48 (<i>n</i> =50)	0 (<i>n</i> =41)	0 (<i>n</i> =17)	0 (<i>n</i> =9)
Hugh Town	<i>no data</i> ¹³	1.29 (<i>n</i> =7)	1.67 (<i>n</i> =6)	1.86 (<i>n</i> =7)	2.25 (<i>n</i> =8)

The boulder beaches on Samson's South and East shores support as much as 10% of the Scillonian herring gull population. The birds here failed completely in 2007 and had a poor year in 2008. However, in the last three years breeding success has been reasonable; approaching the levels recorded on Gugh in the 1990s and in the region needed to maintain a relatively stable population (see Figure 4).

The Gimble Porth sub-colony has declined rapidly and failed repeatedly in the time of the study. From 74 nests in 1999 and 54 in 2006, the number of herring gulls attempting to breed on the beach here declined to just 9 pairs in 2011. In addition, laying has become erratic and unsynchronised with most nest being lost or abandoned before hatching in recent years. The average clutch size recorded at this sub-colony has also declined each

¹¹ Heaney *et al.* 2007

¹² Few fledged chicks seen, minimum 4 chicks Gimble Porth, 3 Hugh Town (*pers. obs.*)

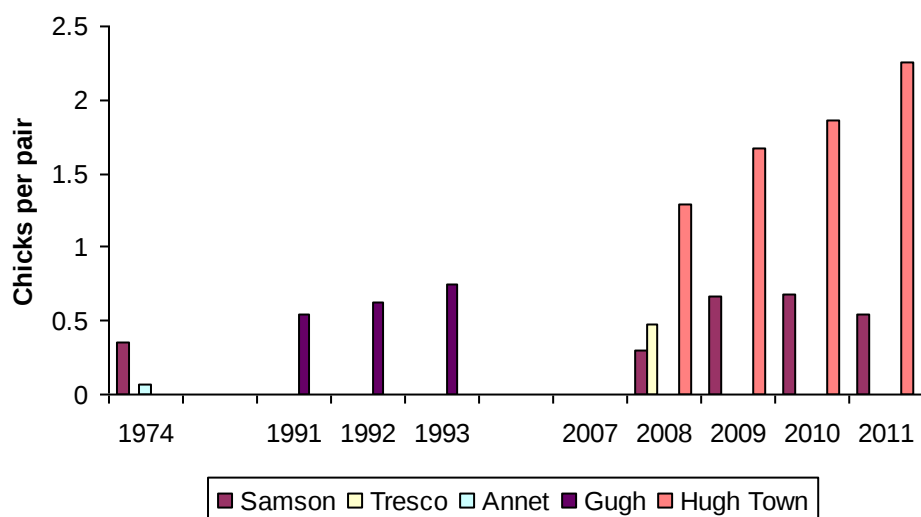
year; with the 9 well-built and therefore 'countable' nests recorded in 2011, subsequently not being laid in at all (see Table 4).

Table 4. Average Clutch size (n = number of nests)

	1990s	2006	2007	2008	2009	2010	2011
Samson		2.55 (n = 116)	2.23 (n = 52)	2.04 (n = 84)	2.56 (n = 73)	2.35 (n = 26) ¹³	2.31 (n = 71)
Gimble Porth, Tresco				2.20 (n = 50)	1.16 (n = 41)	0.94 (n = 17)	0 (n = 9)
Scilly	2.70 ¹⁴						

In strong contrast the birds nesting in Hugh Town, St. Mary's have shown consistently high breeding success. This roof-top environment has only been colonised relatively recently with the first nest recorded in town in 1995¹⁵, increasing to just 3 nests in 2006.¹⁶ However, the birds have achieved a high and apparently increasing productivity in this environment, with fledging estimates here exceeding all previous records for herring gulls in Scilly (see Figure 4).

Figure 4. Productivity data for Herring Gulls in Scilly¹⁷.



¹³ The total clutch size of all the Samson study site nests in 2010 could not be determined as a number had started to hatch at the time of surveying.

¹⁴ Robinson 2003

¹⁵ ISBR 1996

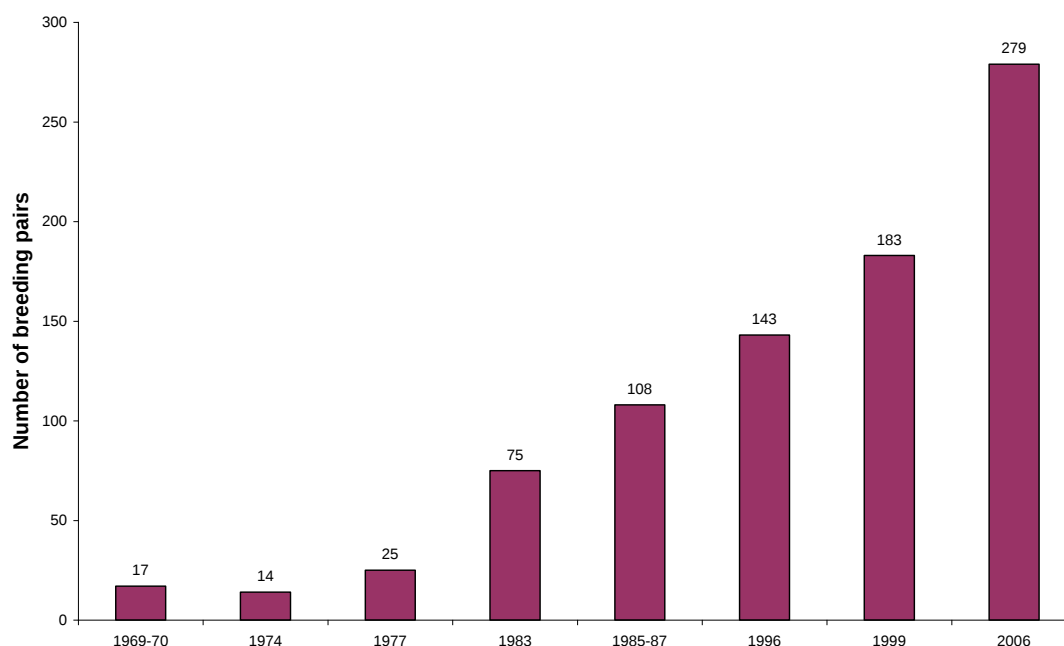
¹⁶ Heaney *et al.* 2007

¹⁷ 1974 data from Allen 1974; 1991-3 data from Robinson 1993

Results - Northern fulmar *Fulmarus glacialis*

Fulmars first bred in Scilly in 1944 (possibly 1938).¹⁸ Since then, their population in Scilly has increased rapidly, with a 52% rise in numbers between 1999 and 2006, to 279 breeding pairs. However, while the spectacular growth in distribution and abundance of fulmars in Scilly has mostly been in line with national trends, the rate of national increase has recently slowed or ceased in many areas. Numbers in Cornwall as a whole increased by just 2% and in Devon fell by 42% between 1985-87 and 2000.¹⁹ There is also now a strong indication that numbers in Scilly are declining with a 19% reduction in birds attempting to breed at the two main sub-colonies 2006-2011 (see Table 5).

Figure 5. Change in numbers of breeding pairs of fulmar 1969-2011



Between 2006 and 2011 productivity was recorded at the two largest sub-colonies in the islands which between them represent roughly a third of the total breeding population of fulmars in Scilly. The estimates vary quite widely between the years, with 2009 being a relatively good year, but 2011 relatively poor (see Table 5). The estimates recorded are comparable with the data collected on Annet in the early 1990s and also recent results from Lundy (see Figure 6).

Table 5. Fulmar productivity (chicks per pair); n = number of nests

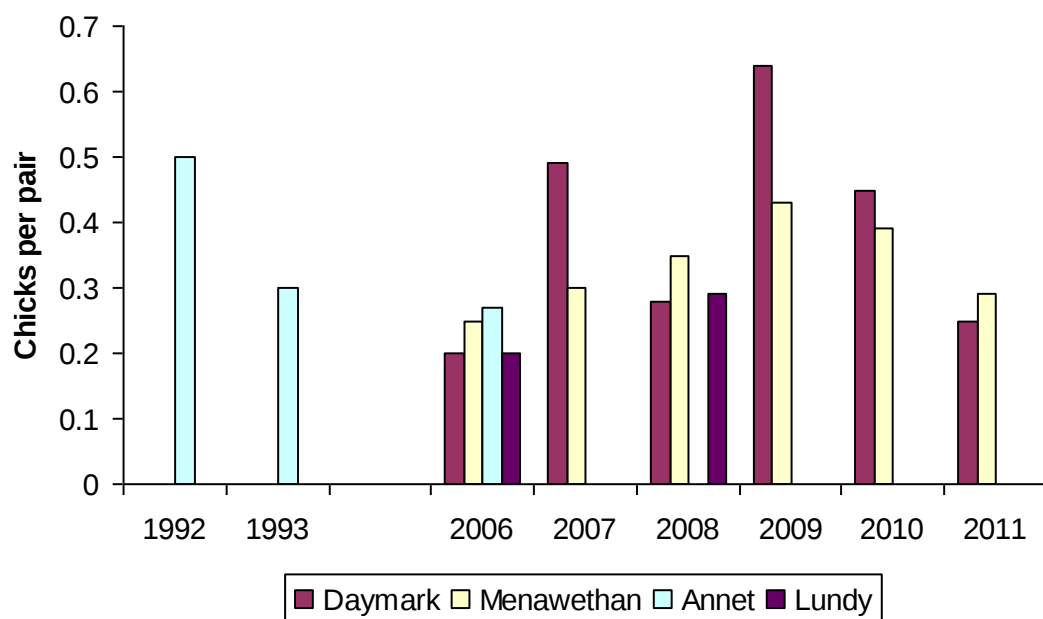
	Menawethan	Daymark
2006	0.25 (n = 44)	0.20 (n = 46)
2007	0.30 (n = 41)	0.49 (n = 45)
2008	0.35 (n = 37)	0.28 (n = 46)
2009	0.43 (n = 33)	0.64 (n = 36)
2010²⁰	0.39 (n = 30)	0.45 (n = 51)
2011¹⁹	0.29 (n = 24)	0.25 (n = 49)

¹⁸ Penhallurick 1969

¹⁹ Mitchell *et al.* 2004

²⁰ Observations by Liz Mackley & Will Wagstaff 2010 and Richard Bufton 2011 suggests that these were both relatively poor years for fulmar breeding success across the islands.

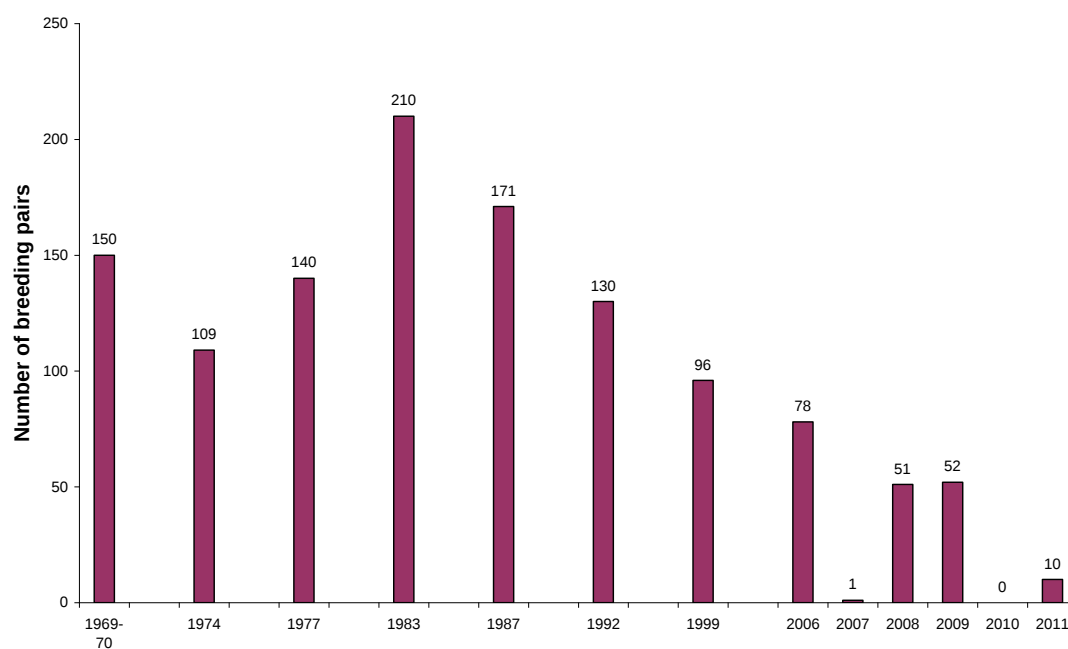
Figure 6. Productivity data for Fulmars in Scilly²¹



Results – Common Tern *Sterna hirundo*

The number of common terns in Scilly has been declining steadily since the 1980s. During the time of this study the numbers of birds attempting to breed in Scilly has become erratic, declining from 78 pairs to just ten in 2011 (see figure 7). In addition the distribution of the birds has contracted dramatically with the 96 breeding pairs in 2000 spread across 12 different sites (including 4 inhabited island sites); 78 pairs in 2006 spread across 6 sites and just one site favoured in the last 3 years.

Figure 7. Numbers of common terns in Scilly (breeding pairs)



²¹ 1992-3 data from Robinson 1993; 2006 data from Betts 2006

This must in a large part be due to their poor productivity. Having failed to fledge any young at all in 2006 and 2007, the 51 pairs that settled in 2008 managed a combined average of 0.26 chicks per pair and in 2009 0.36 ch/pr. Unfortunately, this figure is still lower than productivity estimates recorded in 2003 and 2004 and is lower than the suggested 0.66 chicks per pair needed to maintain a sustainable population.²² In 2010 settlement was erratic with a number of birds appearing to be settled on Green Island, only to abandon the site without laying. In 2011 the terns were late in arriving on the islands and fickle in their settlement. Eventually a number appeared to settle on Green Island very late in June, unfortunately before a full nest count could be undertaken the nests were destroyed by a storm tide. A subsequent search revealed broken egg shell representing a minimum of 10 clutches.

Table 6. Common tern productivity (chicks per pair)²³

Year	Productivity	Notes
2003	0.43 (<i>n</i> = 86)	
2004	0.59 (<i>n</i> = 76)	Majority of nests on North Hill, Samson
2006	0 (<i>n</i> = 78)	Young inundated by storm tide, Green Island
2007	0 (<i>n</i> = 1)	Only one breeding attempt recorded, Annet
2008	0.26 (<i>n</i> = 51)	Green Is. 41 nests; Peasehopper 10 nests
2009	0.39 (<i>n</i> = 52)	Green Is. 51 nests; Annet 1 nest
2010	0 (<i>n</i> = 0)	Birds settling on Green Is. but site abandoned before laying
2011	0 (<i>n</i> = 10+)	Late settlement, then Green Is. site inundated by storm tide

Results - Manx Shearwater *Puffinus puffinus*

Scilly supports regionally important numbers of breeding Manx shearwater (171 pairs in 2006)²⁴ and is one of only two breeding sites for this species in England. Although the majority of the population breed on uninhabited Annet and Round Island, a number of birds also breed in more accessible sites that support rats (see Table 7).

Table 7. Numbers of AOBs recorded at selected sites (dashes represent no survey)

	Gugh	Wingletang, St. Agnes	Shipman Head, Bryher	St. Helen's	Peninnis
2000	22	5	12	5	0
2006	9	8	13	9	0
2007	8	5	-	-	-
2010²⁵	6	3	-	-	4
2011	13	10	-	39	7

Following reports of night-calling birds in May and June at Peninnis, the Garrison and Giant's Castle on St. Mary's and a record of a dog digging up an adult bird at Giant's Castle in 2007²⁶,

²² Lascelles 2004

²³ 2003-4 data from Lascelles 2004; 2007 data from Barrie Nuttall *pers. comm.* Data 2006-11 collected in conjunction with Will Wagstaff

²⁴ Heaney et al. 2007; representing a 15% decline since the first comprehensive playback count in 2000

²⁵ Paul St. Pierre, AOBs recorded during habitat assessment survey, likely to be an underestimate as recorded mid-June

a comprehensive search (as in the 2000 and 2006 surveys) was repeated in these areas. This revealed a small colony of four shearwaters breeding at Peninnis in 2010, and in 2011 seven pairs were recorded at the same site. In 2010 suitable shearwater breeding habitat was surveyed on Great and Little Ganinick and at Little Innisvoulis in the Eastern Isles (cleared of rats 2006/7 with some subsequent incursions). As in 2000 and 2006 no Apparently Occupied Burrows (AOBs) were recorded.

In general the presence of rats at the sites in Table 7, mean that the majority of these breeding attempts are unlikely to have been successful in raising young. In both 2007 and 2011 AOBs at Gugh, St. Agnes and Peninnis were checked later in the season and showed no clear signs of activity or fledging success.

In 2011, St. Helen's which supported 9 breeding pairs in 2006, was re-surveyed and a total of 39 AOBs were recorded. St. Helen's was first cleared of rats in 1997/98 and although it has suffered incursions in 1999/2000, 2002/03, 2033/04 and 2008/09 these were quickly dealt with and the island has had a number of rat free years⁶.

Breeding success for Manx shearwater on Skomer and Bardsey over the years from 1986-2004, averaged 0.56 (± 0.04) and 0.81 (± 0.01) respectively.²⁷ In addition, a productivity estimate of 0.62-0.76 ch/pr (n = 64) was recorded for Manx shearwater on Lundy in 2007.²⁸

Results - Storm Petrel

In 2006 1398 pairs²⁹ of storm petrel were recorded breeding in Scilly, exclusively at islands free of rats. Following the discovery and subsequent clearance of rats on the previously rat free island of Annet in 2004/05, a new data set monitoring the number of apparently occupied storm petrel nest sites at a section of boulder beach there was initiated (see Table 8). The correction factor applied to account for active nest sites not detected, because either both parents were absent or a bird present failed to respond (see Appendix 1), produces a population estimate of between 34 and 49 birds for this one beach.

Table 8. Number of AOSs recorded at Annet study beach

Year	Number AOSs	Notes
2000	49 ($\pm$)	17 responses x 2.86
2006	37	13 responses x 2.86
2010	40	14 responses x 2.86
2011	34	12 responses x 2.86

²⁶ Dog recorded as digging up and killing adult bird at Shipman Head sub-colony in 2008 possibly twice

²⁷ Mavor *et al.* 2006

²⁸ H. Booker *pers. comm.*

²⁹ Heaney *et al* 2007, representing a 5% decline in numbers since the first comprehensive playback survey in 2000

Discussion

As an evolutionary adaptation to the unpredictable marine environment, seabirds are strongly 'k' selected compared with many other birds. They tend toward high longevity, delayed reproduction and a relatively large number of reproductively active years in which to raise young. As a result they generally have small clutch sizes and may take the option to forgo breeding altogether in years when the likelihood of successfully raising young is low. Due to this life history strategy, seabird populations are to some extent able to buffer the effect of a few years of poor breeding success, with individual birds living long enough to hopefully make up the productivity shortfall in subsequent better years. However, if productivity levels continue to be depressed over successive years whole cohorts of young will fail to be raised, creating a gap. Unfortunately, the longevity and delayed maturity of the seabirds will initially mask this problem, and it may not become apparent until the older breeding birds start to senesce and are not replaced by new recruitment of young birds to the breeding population.

The complete and partial breeding failures recorded at the kittiwake, common tern and herring gull sub-colonies over the course of this study are of real concern and undoubtedly contributing to the serious declines in their breeding numbers in Scilly. As a result the future of common terns and kittiwakes as regular breeding birds in Scilly appears threatened. Kittiwakes in particular have been absent from Scilly in the past and their numbers are in sharp decline right across Southern England. Kittiwakes are at the Southern edge of their range here in Scilly and it is possible this may be a 'sink population' reliant on recruitment from other colonies. Observations of prospecting juveniles and colour-ringed adults in recent years support this theory. Low productivity across the region will result in a reduced recruitment of adults from elsewhere to maintain the Scilly population. This may be what occurred in the Channel Islands where kittiwakes have recently been lost as a breeding species and which was also on the edge of the species range.

The factors contributing to the breeding successes and failures recorded in this study are likely to be complex and in many cases interrelated. Although we can only speculate as to the exact reasons for low productivity a number of factors, only some of which will be in our control, are likely to be coming into play, and are discussed below.

Mammalian predators

Scilly supports just one indigenous species of mammal, the Scilly shrew (*Crocidura suaveolens*), which is not known as a predator of seabirds, their eggs or young. The same cannot be said of several species of introduced predators; brown rats, which are widespread on the inhabited islands; cats and dogs; and hedgehogs which are currently confined to St. Mary's.

Introduced mammalian predators, and brown rats in particular, are known to be the overriding factor constraining the suitability of offshore islands for seabirds throughout the world,³⁰ and there is no doubt that the presence of rats in Scilly is having a major detrimental impact on seabird populations. With this in mind, an intensive rat control programme has been carried out in Scilly since 1993,³¹ and a majority of uninhabited islands are now considered 'rat-free'. However, mainly due to the proximity of islands, there are

³⁰ Brown & Grice 2005

³¹ Mawer 2007

new incursions each year, e.g. Menawethan in 2006, and these confirm the need to monitor and actively maintain this status.

In particular Manx shearwater breeding on Gugh, St. Agnes, Bryher and St. Mary's (up to 20% of the total population) are likely to be suffering a significant adverse influence on productivity from the presence of rats. During the breeding season shearwaters regularly leave their eggs and young unattended for protracted periods down the burrows where they are highly vulnerable to mammalian predators, leading to reduced productivity and population decline.³² No clear evidence of chicks fledging from any of the sites with rat presence was recorded during this study, however the discovery of healthy fledglings disorientated by the lights of St. Mary's in both 2007 and 2008, suggest that some sub-colonies in Scilly experience success. Chronic long-term decline through depression of productivity, probably occurred at historical sub-colonies at North end of Tresco, St. Martin's and Menawethan.³³

The Isles of Scilly Seabird Recovery Project is a joint initiative to review current and consider future rat control work on the islands. A recent feasibility study suggests it should be possible to eradicate rats from St. Agnes and Gugh which would make a great difference to the birds attempting to breed there. A possible example of the predicted positive effects of rat removal can be seen on St. Helen's. Rats were first cleared from the island in 1997/8 and although there have been incursions (1999/2000, 2002/03, 2003/04 & 2008/09) the number of shearwater recorded breeding there has increased from 5prs in 2000 to 9prs in 2006 and 39prs in 2011.

The presence of feral cats on Gugh was confirmed in 2007 by the discovery of fresh cat kills of adult lesser black-backed gulls on at least two of the study visits (headless corpses with the breast meat chewed). However, no direct evidence of the continued presence of feral cats was confirmed on Gugh in 2008 or 2009. In addition there have been worrying reports of dogs digging up and killing adult Manx shearwaters in 2007 (Giant's Castle) and 2008 (Shipman Head).

Avian predators

A number of avian predators occur naturally on the Isles of Scilly including raptors, herons, large gulls, corvids and some waders that may opportunistically take eggs. Numbers of most of these species are low and they are unlikely to take seabirds in numbers sufficient to affect seabird population size. Scilly, does, however, support both lesser and great black-backed gulls in large numbers, such that they are regarded as of conservation importance in their own right, and are amongst the interest features of several of the Scillonian SSSIs, the SPA and the Ramsar site.

The majority of kittiwake nesting sites in Scilly have herring gull nests on the boulders directly below (including the only successful sites in the last 3 years), which may be expected to pose a large predation risk. There are reports of interactions with large gulls³⁴ and a number of nests on Samson appeared to suffer egg predation in 2007 and 2008. However it is unclear whether this occurred before or after the nest was deserted; with previous studies suggesting that nest predation by gulls in Scilly was not a significant causal factor in population decline.³⁵ This conclusion was supported by further study in 2010³⁶ which found

³² E.g. Rum, Canna and Calf of Man (Brooke 1990, Thompson *et al.* 1997, 1998, Upton *et al.* 2000, Swann 2000)

³³ Allen 1974, Robinson 1993

³⁴ Great black-backed gull observed menacing nesting kittiwakes from an abandoned nest W.Wagstaff *pers comm* 2009

³⁵ Allen 1974, Robinson 2003, Heaney *et al.* 2007

no evidence that large gulls were taking the eggs or chicks of kittiwakes on Gugh or St. Agnes. The study did however record a pair of carrion crows predating the kittiwake eggs on Gugh in 2010. In 2011 the majority of kittiwakes bred at the Daymark and unfortunately here a pair of ravens were seen predating the nests and the sub-colony failed. Raven predation was not recorded at this site in the 2010 study.

Food Availability

Although predation by Corvids has clearly had a significant impact on kittiwake productivity in this study it is not necessarily the main factor driving the population decline. Low settlement rates, reduced clutch sizes and later laying found across this study all suggest the underlying problem may be food supply.³⁷ Similarly, high rates of cannibalism and interspecific predation within the larger gull species recorded in 2010 indicates issues with the availability of forage fish.³⁸ Changes in food supply can mean that adult birds are unable to find sufficient food to meet both their own requirements and the requirements of their offspring, and food availability can affect nest survival rates, with food-stressed parents spending longer foraging away from the colony, so exposing their nests to adverse weather and predators for longer.³⁹ The fact that the kittiwake sub-colony failures recorded in Scilly in recent years occurred mainly during the early chick rearing rather than the incubation stage also indicates that there were reductions in food availability.⁴⁰

Fluctuations in food supply may relate to wider regional and global factors such as changes in the management of fisheries discards and waste and the possible effects of climate change on the availability of suitable prey species. In particular, fluctuations in sea temperature may affect the behaviour and distribution of seabird prey species,⁴¹ and this can be particularly problematic for birds such as kittiwakes and terns that feed on or near the surface, have short foraging ranges, inflexible time budgets or restricted diets.⁴²

Recent work at the Plymouth Marine Lab⁴³ has found a significant effect of density and distance of oceanic fronts on Kittiwake productivity. In the study oceanic fronts are used as a proxy for food availability and pelagic biodiversity. Using satellite images, charts, similar to atmospheric weather synoptic charts, can be produced for the marine environment to show where cold and warm waters meet. The mixing of the different temperatures at these fronts causes up-welling, bringing up nutrients, lots of plankton, copepods and therefore fish. The convergence water also keeps the zooplankton and its predators in one place. Some fronts form in permanent locations such as rocky outcrops where water from different levels mixes; others, caused by weather conditions, form out in the sea and are less predictable. Productivity data for kittiwakes across the south west region over the last ten years, including data from Scilly, has been analysed along with data on the density (strong, thick fronts mean more food) and distance (from the colonies) of the fronts in the region. The strong correlation found between both density and distance of the fronts and the individual kittiwake colony success further supports the theory that food supply is the main driver of productivity and population in the region.

³⁶ Votier 2011

³⁷ Mavor *et al.* 2006; correlation between clutch size and food availability; Bolton *et al.* 1993, Paillisson *et al.* 2007

³⁸ Votier 2009

³⁹ Bukacinska *et al.* 1996, 1998, Perrins & Smith 2000, Pons & Migot 1995

⁴⁰ Suryan *et al.* 2002

⁴¹ Planque & Taylor 1998, Arnott & Ruxton 2002

⁴² Daunt *et al.* 2002

⁴³ Miller P., Booker H. & Votier S. *Frequent locations of oceanic fronts as an indicator of seabird foraging habitat* 11th International Seabird Conference, Plymouth 2011

Weather Conditions

Wet and windy weather during the breeding season is likely to have a two-fold depressive effect on productivity. Firstly, it can result in reductions in productivity due to poor fishing conditions and secondly, bad weather will have direct effects on eggs and chicks. Long periods of almost continuous rain and numerous strong blows through the summer months in 2007 and to some extent 2008, almost certainly had a deleterious effect on breeding success; with wet weather coinciding with peak hatching times for both kittiwake and herring gull. In addition, a number kittiwake sites have suffered nest losses during the study as the unstable and water-logged cliffs collapsed. Unsettled weather conditions in early spring and summer can also influence the density and location of fronts (see above). Rough weather combined with high tides has twice now (2006 & 2001) resulted in the inundation and total failure of the common tern breeding colony on the low-lying Green Island. It is also possible that burrow flooding in wetter years may have caused the failure of some Manx shearwater nesting attempts, as has been recorded at other sites.⁴⁴

Other Factors

Other factors can potentially affect productivity and population in seabirds including exploitation and persecution, incidental mortality (by-catch and bird-strike), disease, natural toxins and pollution. However, there is no evidence that any of these factors is having a significant affect during the breeding season in Scilly. Disturbance however may be important. The loss of gull and tern colonies from the inhabited off-islands in recent years may well be influenced by disturbance, and attacks by dogs on Manx shearwater have been recorded on both Bryher and St. Mary's. The abandonment by common terns of the Green Island site before laying in 2010 coincided with a protracted helicopter medical evacuation over the site, and kite surfing in the area also causes repeated 'dreads' of the breeding birds when they are spooked by the kite over-head.

⁴⁴ Brooke 1990

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References

- Allen R (1974) *Gulls and other seabirds in the Isles of Scilly, April to August 1974*. Nature Conservancy Council.
- Arnott SA & Ruxton GD (2002) *Sandeel recruitment in the North Sea: demographic, climatic and trophic effects*. Marine Ecology Progress Series 238: 199-210.
- Betts M (2006) *Seabird Warden Report 2006*. Unpubl. Isles of Scilly Wildlife Trust.
- Bolton M, Monaghan P & Houston DC (1993) *Proximate determination of clutch size in lesser black-backed gulls – The roles of food supply and body condition*. Canadian J. Zool. 71 (2): 273-279.
- Brown A & Grice P (2005) *Birds in England*. T & AD Poyser, London.
- Bukacinska M, Bukacinski D & Spaans AL (1998) *Experimental evidence for the relationship between food supply, parental effort and chick survival in the Lesser Black-backed Gull Larus fuscus*. Ibis 140: 422-30.
- Bukacinska M, Bukacinski D & Spaans AL (1996) *Attendance and diet in relation to breeding success in herring gulls (Larus argentatus)*. Auk 113: 300-9.
- Daunt F, Benvenuti S, Harris MP, Dall'Antonia L, Elston DA & Wanless S (2002) *Foraging strategies of the black-legged kittiwake Rissa tridactyla at a North Sea colony: evidence for a maximum foraging range*. Marine Ecology Progress Series 245: 239-247.
- Gilbert G, Gibbons GW & Evans J (1998) *Bird monitoring methods*. RSPB, Beds.
- Hamer KC, Thompson DR & Gray CM (1997) *Spatial variation in the feeding ecology, foraging ranges and breeding energetics of Northern Fulmars in the north-east Atlantic Ocean*. ICES J. Mar. Sci. 54: 645-53.
- Heaney V, Lock L, St Pierre P & Brown A (2008) *Important Bird Areas: Breeding seabirds on the Isles of Scilly*. British Birds 101: 418-438.
- Lascelles B (2004) *Terns playing hard to get*. Isles of Scilly Wildlife Trust Magazine, Number 6.
- Lock L, Brown A, Webber J, Mawer D and St Pierre P (2009) *Isles of Scilly Seabird Conservation Strategy 2009-2013*. RSPB/Isles of Scilly Wildlife Trust/Natural England.

- Mavor RA, Parsons M, Heubeck M & Schmitt S (2006) *Seabird numbers and breeding success in Britain and Ireland 2005*. JNCC< Peterborough.
- Mawer D (2007) *Seabird Warden 2006-2007 Project Report*. Unpubl. Isles of Scilly Wildlife Trust.
- Mitchell PI, Newton SF, Ratcliffe N & Dunn TE (2004) (Eds.) *Seabird populations of Britain and Ireland – results of the Seabird 2000 census (1998-2002)*. T & AD Poyser, London.
- Paillisson JM, Reeber S, Carpentier A, Marion L (2007) *Reproductive parameters in relation to food supply in the whiskered tern (Chlidonias hybrida)*. J of Ornithol. 148 (1): 69-77.
- Perrins CM & Smith SB (2000) *The breeding Larus gulls on Skomer Island National Nature Reserve, Pembrokeshire*. Atlantic Seabirds 2: 195-210.
- Planque B & Taylor AH (1998) *Long-term changes in zooplankton and the climate of the North Atlantic*. ICES J. Mar. Sci. 55: 644-54.
- Pons JM & Migot P (1995) *Life-history strategy of the Herring Gull, changes in survival and fecundity in a population subjected to various feeding conditions*. J. Anim. Ecol. 64: 592-9.
- Ratcliffe N, Pickerell G & Brindley E (2000) *Population trends of Little and sandwich Terns Sterna albifrons and S. sandvicensis in Britain and Ireland from 1969 to 1998*. Atlantic Seabirds 2: 211-26.
- Reeves SA & Furness RW (2002) *Net loss – seabirds again? Implications of fisheries management for seabirds scavenging discards in the northern North Sea*. Unpubl. Rep. Royal Society for the Protection of Birds, Sandy.
- Regehr HM & Montevecchi WA (1997) *Interactive effects of food shortage and predation on breeding failure of black-legged kittiwakes: indirect effects of fisheries activities and implications for indicator species*. Marine Ecology Progress Series 155: 249-260.
- Robinson P (2003) *Birds of the Isles of Scilly*. AC Black, UK.
- Robinson P J (1993) *The status of breeding seabirds in the Isles of Scilly*. In Isles of Scilly Bird Report 1992. Cornwall Bird-Watching & Preservation Society.
- Upton A J, Pickerell G and Heubeck M (2000) *Seabird numbers and breeding success in Britain and Ireland 1999*. JNCC, Peterborough.
- Votier SC (2011) *Investigating declines in black-legged kittiwakes Rissa tridactyla and implications for future management in the Isles of Scilly*. Univ Plymouth.
- Votier SC, Bearhop S, Ratcliffe N, Phillips RA & Furness RW (2004) *Predation by great skuas at a large Shetland seabird colony*. Journal of Applied Ecology 41 (6): 1117-1128.
- Walsh PM, Halley DJ, Harris MP, del Nevo A, Sim IMW & Tasker MC (1995) *Seabird monitoring handbook for Britain and Ireland*. JNCC/ RSPB/ ITE/ Seabird Group, Peterborough.

Appendix 1 Further notes methods

Kittiwake

Monitoring of kittiwake productivity is aided by their nesting in distinct localised colonies and by their construction of obvious nests. According to standard methods,⁴⁵ individual nests are recorded on detailed maps, with the aid of digital photographs. Where possible, initial nest contents are recorded in June, by direct observation using a mirror on a stick. Where possible individual nest histories are followed at two weekly intervals. Where this is not possible a minimum of two counts are made, one at the beginning of the breeding season and one at the end. Productivity is estimated as the number of chicks surviving to fledging age (usually estimated 15th - 20th July) divided by the number of completed nests recorded.



Figure 8. Kittiwakes nesting on Gugh 2009

Herring Gull

The major practical difficulty in productivity monitoring of gulls is the mobility of the chicks, making them hard to count. A standard method to control for this is to select naturally isolated small patches of breeding habitat. Direct observational methods can then be employed, recording the fortune of mapped nests from a remote vantage point. A large proportion of herring gulls in Scilly nest in relatively discrete sub-colonies at the back of boulder beaches backed by low cliffs. This type of habitat is found along the east and south

⁴⁵ Walsh *et al.* 1995; Gilbert, Gibbons & Evans 1998; Heaney *et al.* 2007

east coasts of Samson and at Gimble Porth Bay on Tresco. With the aid of annotated digital photographs, individual nests are recorded, noting the initial nest contents in early June. These nests are then observed at 2 weekly intervals to assess activity and final counts of chicks surviving to fledging age made in mid July both using direct counts along the beaches and also those made from a vantage point to spot any chicks that may have been hiding.

Fulmar

The number of apparently occupied sites (AOSs - one or two fulmars occupying a site capable of holding an egg) are recorded from a boat in late May/ early June for the entirety of the sub-colonies on Menawethan in the Eastern Isles and on the Daymark headland on St. Martin's. The count is repeated and an average recorded in order to reduce errors caused by day to day variations in numbers of AOSs and as far as possible distinguish breeding sites from other AOSs. This method also minimises disturbance as incubating fulmars if flushed can easily dislodge their egg causing failure of the breeding attempt. The sites are then surveyed again in mid August and the number of young birds present counted. In accordance with the methodology it is assumed that all large young (including downy young of adult size) fledge and productivity is estimated from dividing the number of young by the average count of AOSs.

Manx Shearwater

The number of apparently occupied burrows (AOBs) is recorded in late May using standard tape-playback methods.⁴⁶ The same recording of both male and female Manx shearwater, calls from Skokholm, is used as in previous surveys in Scilly.⁴⁷ A correction factor of 1.08 is used to estimate the number of AOBs from the number of responses. Apparently occupied burrows (those eliciting a response) are then carefully mapped for future reference using digital photographs rather than physical marks, as many are close to well-used footpaths where flags may draw unnecessary attention. Subsequent checks for signs of breeding success include;

- Checks for external signs of activity around the burrows - no cobwebs or vegetation across the entrance, no fresh rat droppings in the vicinity, streaks of guano, a 'petrel smell' and white belly feathers in the entrance.
- Checks for activity in late September after any chicks will have fledged - any down near the entrance or further in amongst the nest lining.
- An evening check for 'star-gazing' youngsters is made towards the end of the season - timed to coincide with a new moon and estimated peak fledging at other nearby colonies.⁴⁸

Storm Petrel

As with the Manx shearwater diurnal tape playback is used to record the number of Apparently Occupied Sites (AOSs) at the peak incubation (estimated early July for Scilly). For all surveys a response rate of 0.35 (LCI 0.252, UCI 0.448), recorded on Annet in 2000, is used to estimate the number of AOSs from the number of responses.

⁴⁶ Walsh *et al.* 1995, Gilbert, Gibbons & Evans 1998

⁴⁷ Heaney *et al.* 2007, Heaney *et al.* 2002

⁴⁸ Lundy, H. Booker *pers. comm.* & Skomer, E. Brown *pers. comm.*

Appendix 2. Full Results 2000

ISLAND	FUL	MX	SP	COR	SH	LB	HG	GB	KIT	COT	GUI	RAZ	PUF	TOTAL	SSSi Grouping
Annet	21	123	938		209	517	42	137		1		4	47	2039	Annet SSSi
St Agnes & Burnt Is						2	25			3				30	Big pool and Browarth Point (St. Agnes) SSSi
Castle Down, Treco										13				13	Castle Down (Tresco) SSSi
Gimble Porth, Treco						29	74		54					157	Castle Down (Tresco) SSSi
St Martin's	32					58	18	3	27					138	Chapel Down (St. Martin's) SSSi
Great Ganinick					23	2	2	21						48	Eastern Isles SSSi
Little Ganinick					25		6	32						63	Eastern Isles SSSi
Little Ganilly								20						20	Eastern Isles SSSi
Great Ganilly	4					9	13	32						58	Eastern Isles SSSi
Nornour						1	3	6						10	Eastern Isles SSSi
Great/Little Arthur	3					1	8	34						46	Eastern Isles SSSi
Ragged Island				12	39		9	18				1		79	Eastern Isles SSSi
Menawethan	27				37	6	5	63				1		139	Eastern Isles SSSi
Little Innisvovls					28			10						38	Eastern Isles SSSi
Great Innisvovls	7			2	69		3	50						131	Eastern Isles SSSi
Hanjague	2											1		3	Eastern Isles SSSi
Gugh, Bow & Cow	2	22				1123	159	3	155					1464	Gugh SSSi
Gweal					105	4	15	62						186	Norrard Rocks SSSi
Mincarlo	15		17	25	82	2	6	23			1	70	53	294	Norrard Rocks SSSi
Illiswigig			3		25		8	12				7		55	Norrard Rocks SSSi
Maiden Bower						5	1	1						7	Norrard Rocks SSSi
Castle Bryher	13		17		22		1	2				4		59	Norrard Rocks SSSi
Scilly Rock			14		39	2	10	1			39	22	25	152	Norrard Rocks SSSi
Green Is (Tresco)										1				1	Pentle Bay, Merrick and Round Is.
Round Island	32	34	183		2	1	8	5						265	Pentle Bay, Merrick and Round Is.
Carn Near, Tresco							22							22	Pentle Bay, Merrick and Round Is.
Appletree Banks, Tresco										39				39	Pentle Bay, Merrick and Round Is.
Bryher										1				1	Rushy Bay and Heathy Hill (Bryher) SSSi
Samson	2				7	1062	184	5	38	11				1309	Samson (with Green, White, Puffin and Stony Islands) SSSi
Green Island (Samson)										7				7	Samson (with Green, White, Puffin and Stony Islands) SSSi

ISLAND	FUL	MX	SP	COR	SH	LB	HG	GB	KIT	COT	GUI	RAZ	PUF	TOTAL	SSSi Grouping
White Island (Samson)				1	32	27	15	39						114	Samson (with Green, White, Puffin and Stony Islands) SSSi
Puffin Island					4	108	31	2						145	Samson (with Green, White, Puffin and Stony Islands) SSSi
Shipman Head		12			4	50	23	13						102	Shipman Head and Shipman Down (Bryher) SSSi
Men-a-vaur	16		20		24						117	101	25	303	St Helen's (Norwethel& Men-a-vaur)
Norwethel						13	10	18						41	St Helen's (Norwethel& Men-a-vaur)
Peashopper Is								1		1				2	St Helen's (Norwethel& Men-a-vaur)
Crow's Is							3	3						6	St Helen's (Norwethel& Men-a-vaur)
Half-tide Rock								1						1	St Helen's (Norwethel& Men-a-vaur)
Foremans Island							5	1						6	St Helen's (Norwethel& Men-a-vaur)
St Helens		5				530	64	6	7				11	623	St Helen's (Norwethel& Men-a-vaur)
Teann & Pednbrose						24	62	16		1				103	St Helen's (Norwethel& Men-a-vaur)
Rosevean			37		30	2		1				4		74	Western Rocks SSSi
Rosevear			57		117		2	95				11	3	285	Western Rocks SSSi
Gorregan	2		49		74	1					39	64	1	230	Western Rocks SSSi
Great Crebawethan					5	1								6	Western Rocks SSSi
Melledgan			140	16	105			28				6	2	297	Western Rocks SSSi
White Island (St Martins)	5					28	34	2						69	White Island (off St. Martin's) SSSi
Wingletang, St Agnes		5												5	Wingletang Down (St. Agnes) SSSi
Hedge Rock								2						2	None
Great Cheese Rock										5				5	None
Plumb Is							6							6	None
Guther's Island					1		18	29						48	None
Pernagie Island								11						11	None
St Marys & Tolls Is							2							2	None
Merrick (Bryher)										13				13	None
Merchants Point, Tresco							6							6	None
TOTAL	183	201	1475	56	1108	3608	903	808	281	96	196	296	167	9378	

Appendix 2. Full Results 2006

ISLAND	FUL	MX	SP	COR	SH	LB	HG	GB	KIT	COT	SAT	GUI	RAZ	PUF	TOTAL	2000
Annet	37	89	788		177	281	24	187		1			4	50	1638	2039
St Agnes, Kallimay point							8								8	
St Agnes, Browarth							1								1	
Tresco, Gimble Porth						4	54		37						95	237
St Martin's, Daymark	46					4	12	3	15						80	138
Great Ganinick					23		4	22							49	48
Little Ganinick					39			19							58	63
Little Ganilly					1		6	20							27	20
Great Ganilly	2				5	1	6	31							45	58
Nornour							5	9							14	10
Great/Little Arthur	6					2	5	40							53	46
Ragged Island				10	48	3	1	19					7		88	79
Menawethan	44				79	5	1	51					2		182	139
Little Innisvouls					38			14							52	38
Great Innisvouls	23				96	3	6	40					1		169	131
Hanjague	2				1								2		5	3
Gugh	2	9				875	69	4	131						1090	1464
Gweal					116		9	50							175	186
Mincarlo	29		20	18	102	5	4	28					66	38	310	294
Illiswilgig			9		23			19					8		59	55
Maiden Bower							1								1	7
Castle Bryher	8		6		26	1	2	7					3		53	59
Scilly Rock			23		45		2	2				29	52	36	189	152
Seal Rock							1								1	0
Round Island	28	43	251		7	1	3	9							342	265
Tresco, Appletree Banks							25								25	
Merrick Island, Tresco										1					1	
Green Is (Tresco)										4					4	1
St Martins, Pernagie Point							1								1	

ISLAND	FUL	MX	SP	COR	SH	LB	HG	GB	KIT	COT	SAT	GUI	RAZ	PUF	TOTAL	2000
Samson	5				11	1094	142	8	47	3					1310	1309
Green Island (Samson)										56	1				57	7
White Island (Samson)				9	19	1	11	60							100	114
Puffin Island					5	128	36	5							174	145
Hangmans Island						2	4								6	0
Bryher, Shipman Head Down	1	13					4								18	1
Shipman Head	12				4	6	7	6							35	102
Men-a-vaur	20		20		31	1	1					95	90	6	264	303
Norwethel						36	32	15							83	41
Peashopper Is							1	1		13					15	2
Crow's Is							1	3							4	6
Foremans Island							1	4							5	6
St Helens	1	9			7	685	80	5	36					13	836	623
Teaen						5	49								54	103
Pednbrose								18							18	0
Old Man, Teaen							2								2	0
Rosevean			46		38								11	4	99	74
Rosevear			129		137		5	109					7	14	401	285
Gorregan	6		37		73		4	1				31	80		232	230
Great Crebawethan					3										3	6
Melledgan			69	13	141	1	2	47					9	13	295	297
White Island (St Martins)	6					187	32	6							231	69
St Agnes, wingletang		8					4								12	35
St Agnes, Long point							2	1							3	
Burnt Island															0	0
Bryher, Gweal Hill							8								8	
Tresco, Appletree Point							4								4	
Half-tide Rock															0	1
Plumb Is, St Martins						2	11								13	6
St Marys, Hugh Town							3								3	2

ISLAND	FUL	MX	SP	COR	SH	LB	HG	GB	KIT	COT	SAT	GUI	RAZ	PUF	TOTAL	2000
Broad Ledge															0	0
Guther's Island					1	2	13	25							41	48
Pernagie Island								11							11	11
Murr rock															0	0
Kittern Rock, Gugh	1														1	0
Merrick Island, Bryher							2	1							3	0
Hedge Rock								1							1	2
Great Cheese Rock															0	5
Plumb Is, Tresco							4								4	13
TOTAL	279	171	1398	50	1296	3335	715	901	266	78	1	155	342	174	9161	
Seabird 2000	183	201	1475	56	1108	3608	903	808	281	96	0	196	296	167		9378