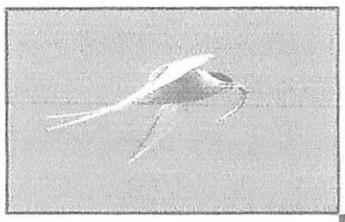
ROSEATE TERN

SPECIES RECOVERY PROGRAMME

Isles of Scilly

2003 REPORT



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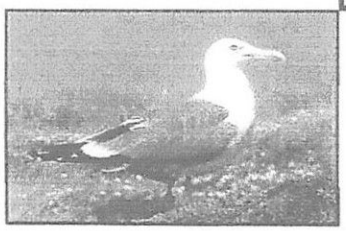

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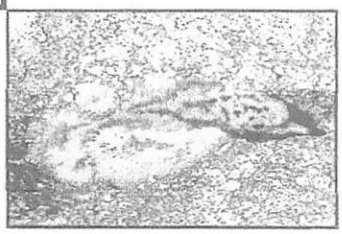


This Report was compiled in September 2003 by:

The Seasonal Tern Warden of the Isles of Scilly Wildlife Trust

Ben Lascelles
Carn Thomas
Hugh Town
St. Mary's
Isles of Scilly
TR21 OPT

E-mail: ioswt@btconnect.com

Index

1. Abstract

The Roseate Tern (*Sterna dougallii*) is the only breeding species in Britain to qualify as a Red Data species on all four criteria: rarity, localised distribution, declining numbers and international importance. It is also recognised as being near threatened with extinction globally. Thus this species is of high conservation value and is now the subject of concerted international conservation action (NCC and RSPB, 1990). After the Rio Earth Summit of 1992 a national Roseate Tern Action Plan was prepared as part of the UK Biodiversity Action Plan. This seeks to increase the UK population to 200 pairs and ensure a minimum of 5 UK colonies with at least 10 pairs in each by 2008 (UKBAP website, 2002). It aims to do this through the protection and enhancement of historical breeding sites; the Isles of Scilly qualifies as one of these historical sites.

The Roseate Tern was nesting in fair numbers around Scilly up to the early 1840's, but only a few pairs remained by 1854, and it was last seen about 1867 (Robinson, 1920). Fifty years later it returned, and it has bred regularly in small numbers (less than twenty) since then. However, numbers began to decline again in the 1990's when there were 6-8 pairs present most years (ISBR, 1990-94). These small numbers counted for some 10% of the British population. The Roseate Tern was at this time regarded as Scilly's most important breeding bird species. It last bred in Scilly in 1994, and the reasons for its abandonment are unclear, but it is thought that disturbance, avian and mammalian predation, and lack of suitable nest sites may all have played a part in its sad demise. Since 1994 the Roseate Tern has been a scarce summer visitor, averaging a handful of record each year (ISBNHR, 2001). Reversing the decline of the more widespread Common Tern (*Sterna hirundo*), and establishing a productive colony, is seen as an integral part of the Roseate Tern Species Recovery Programme (RTSRP) on the islands. Monitoring in 2003 focused on the productivity of Common Terns and factors that influence breeding success.

The Common Tern is a summer visitor to the UK, arriving from its East African wintering grounds in April and May each year. Birds tend to form breeding colonies during May, and incubate eggs for 22-25 days, with a further 25-30 days before chicks fledge (Hume, 1993). Breeding birds leave the UK at the end of August and beginning of September. Common Terns were slow to arrive in Scilly in 2003. The first count of over 50 birds did not occur until the 13th May and it was not until the 28th May that the first nests were discovered on Annet. Widespread breeding across the rest of the archipelago did not begin until the second week of June. This is over a week later than in previous years on Scilly, when colonies would normally be occupied by mid May (Robinson, 2000 and 2002), and approximately two weeks later than suggested by Hume (1993).

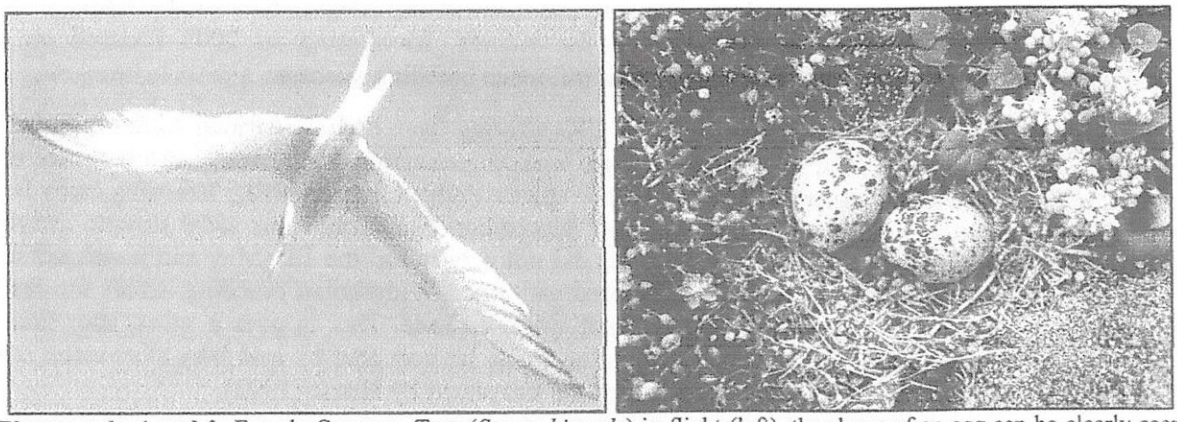
A minimum of 83 pairs of Common Terns were confirmed breeding at eight different sites around the islands in 2003. The majority of birds nested at three main colonies; with minimum numbers of 20 pairs on Annet; 20 pairs on Appletree Banks, Tresco; and 25 pairs on Green Island, Samson. In summary, of the total 239 eggs discovered during the season, 40% hatched, and 40% of hatched eggs survived to fledging. This yields a total of 36 chicks fledged from 83 pairs, a productivity ratio of 0.43 chicks per pair. These productivity figures for Scilly are roughly half those suggested by Hume (1993). Norman Radcliffe of the RSPB has suggested that a productivity ratio of at least 0.66 chicks per pair is required to maintain a stable population on Scilly.

In 2003 predation of eggs and chicks by gulls, and bad weather between the 16th and 20th July, were seen as the major reasons for reduced productivity. Around 30% of eggs laid were predated, and with over 85% of observed mobbings aimed at Herring (*Larus argentatus*), Lesser (*Larus fuscus*) and Greater Black-backed (*Larus marinus*) Gulls it can be assumed they are the main predators. The four days of bad weather in July are thought to have caused a 50% loss of chicks that were under a week old on Green Island, Samson and Annet. Human disturbance and food availability did not seem to be major causes for concern.

Two sightings of migrant Roseate Terns (*Sterna dougallii*) were recorded during the summer, though no breeding was suspected. One pair of Sandwich Tern (*Sterna sandvicensis*) failed to raise any young, the first confirmed breeding since 1998. A lone Arctic Tern (*Sterna paradisea*) summered in the Appletree Banks colony and was the first summer record since 1977, though it never paired.

2. Introduction

The Nature Conservancy Council (NCC) carried out seabird monitoring in 1974 and 1987 focusing primarily on determining population sizes for various seabirds, including tern species, around Scilly (ISBR, 1974, and 1987). These studies detected local increases and declines in the tern population but provided little information on causes. By 1990 English Nature (formerly NCC) had come to appreciate the extent to which previous surveys had produced inadequate data on tern productivity and the causes of breeding failure. As a result systematic survey work began in 1992 on both Common and Roseate Terns (Robinson, 2000). This identified the pressures of predation by rats, and possibly cats, on terns around Scilly. Trial clearance of rats began on Samson in the winter of 1992/93 using a 0.05% dressing of warfarine on chopped grain bait (ISBR, 1992). This proved successful and rat poisoning has been extended to a number of other offshore sites, and continues up to the present day (Mawer, pers. comm.). The 1992 survey work also highlighted the problem of the exposed nature of offshore rocky sites to wind and high tides. The following year work commenced on the application of sand to some offshore rocks preferred by breeding terns with encouraging results. Although there were immediate increases in both number of laying pairs and numbers hatched, such concentrations of young terns on exposed sites brought increased predation from gulls (ISBR, 1992). The work also attempted to reduce predation from gulls with the provision of nest boxes at two sites. Two pairs of Roseate Tern used these boxes, with one pair raising two young (ISBR, 1992).



Photographs 1 and 2: Female Common Tern (*Sterna hirundo*) in flight (left), the shape of an egg can be clearly seen on the birds belly. Two-egg clutch (right).

In the year 2000 the Isles of Scilly Environmental Trust (now the Isles of Scilly Wildlife Trust), English Nature (EN), and the Royal Society for the Protection of Birds (RSPB) established a Roseate Tern Species Recovery Programme (RTSRP) for the Isles of Scilly. In the years 2000 to 2002 English Nature contracted the Channel Seabirds Group (CSG) to run the programme based on North Hill, Samson. North Hill has historically had small numbers of breeding terns (including Roseate) and was thought to offer the best location for a productive tern colony (Robinson, 2002). The CSG attempted to encourage the formation of a Common Tern colony on Samson via the aid of nest boxes, a solar powered CD lure device, and dummy terns during the breeding season. This was reasonably successful in encouraging Common Terns to the site; with 10 pairs in 2000, 25-36 pairs in 2001, and 15 pairs in 2002 (Robinson, 2000-2002). During this time there was little monitoring of sites other than Samson. Limited monitoring of other historical tern breeding sites was carried out by the Isles of Scilly Bird Group (ISBG) in 2002, and it became clear that a more in-depth study was required. In 2003 English Nature funded the ISWT to employ a Seasonal Tern Warden for Scilly to monitor tern distribution, productivity and causes of decline for the whole archipelago. This report highlights the findings of the first years study.

2.1 Roseate Tern Decline in the Isles of Scilly

The number of breeding pairs of Common Tern in Scilly has undergone a near 50% decline in the last 30 years (ISBR 1970-1999; ISBNHR 2000-2002). Reversing this decline by increasing productivity is seen as the first major step in the RTSRP. The main factors suggested for Roseate and Common Tern decline on Scilly have been; predation from Brown Rat - *Rattus norvegicus* (ISBR, 1992), Domestic Cat - *Felis domesticus* (ISBR, 1992), Carrion Crow - *Corvus corone* (Robinson, 2000), gulls - *Larus sp.* (ISBR, 1992), and Oystercatcher - *Haematopus ostralegus* (ISBR, 1995; and Wescott pers. comm.); disturbance from human development (ISBR, 1992); poor quality nesting habitat (Higginson, pers. comm.); and bad weather and high tides (ISBR, 1994 and 1998). However, there is little hard data evidence to support these influencing factors, and it was felt in 2003 that a baseline investigation covering all aspects should be carried out to try and rule out at least some causal factors:

2.2 Aims and Objectives for 2003

In 2003 the aim was to closely monitor the Common Tern population in Scilly and attempt to:

- Accurately determine breeding localities and productivity of tern species around Scilly
- Compare breeding success at different colony sites around Scilly
- Determine the identities and distribution of potential predators to terns
- Ascertain if food availability is a causal factor for decline in breeding tern numbers
- Monitor the effect of human disturbance upon breeding terns
- Identify ways that tern productivity might be increased in the future

Photographs 3 and 4: Annet (left), and the tern colony on the southern end of Annet (right).

2.3 Study Sites for 2003

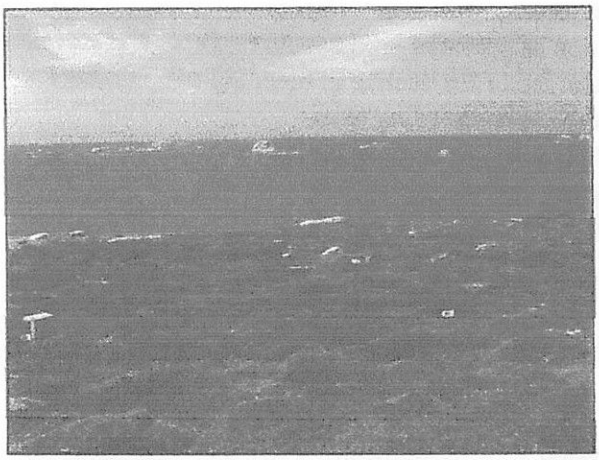
Five main Common Tern colonies, holding at least five breeding pairs, became established in Scilly in 2003. These were: the southern end of Annet; North Hill, Samson; Green Island, Samson; Foreman's Island, Tresco and Appletree Banks, Tresco. The Annet, North Hill and Appletree Banks colonies allowed regular access and were chosen for particularly detailed study. The presence or absence of suggested factors for tern decline were noted at each colony and a detailed comparison was made for the 2003 breeding season. These three sites were the focus for the predator, and food carrying, observation work.

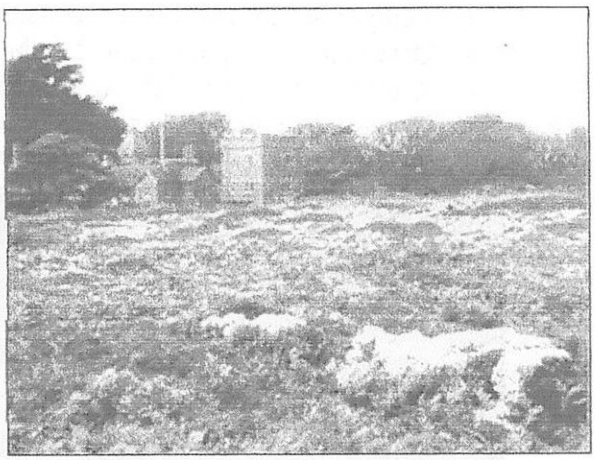
South End, Annet

Annet lies at the eastern edge of the Western Rocks and is the premier seabird breeding site in Scilly. It is a designated seabird sanctuary and is closed to the public during the summer months. The Annet site can be described as a sandy dune habitat, and is situated behind the boulder beach on the southern end of the island. It consists of a sandy area interspersed with Sea Mayweed (*Tripleurospermum maritimum*) and, Tree Mallow (*Lavatera arborea*), and bordered by extensive areas of Bracken (*Pteridium aquilinum*). There are no rats/cats present, the colony site is above the high tide level, and the vegetation provides some suitable cover for young terns. However, there are several large colonies of Lesser Black-backed Gull, as well as over 150 pairs of Greater Black-backed Gull nesting on the island. The southern end of Annet was the most successful breeding site for Common Terns in 2002 (Robinson, 2002).

North Hill, Samson

Samson is situated to the south of Bryher and is uninhabited. The island has restricted, but regular, access (with the North Hill tern colony area being roped off) throughout the summer. Rats were once present on the island but appear to have been successfully eliminated in recent times (Mawer, pers com; Robinson, 2002). Four species of gull nest on the island, Lesser Black-backed Gull, Greater Black-backed Gull, Herring Gull, and Kittiwake (*Rissa tridactyla*). Common, Roseate, and Sandwich Terns have historically used both the North Hill and Green Island sites on a regular basis (e.g. ISBR, 1986, 1992 and 1994), with the North Hill site often favoured for a second breeding attempt following initial failures (Robinson, 2000). The North Hill site can be described as waved heathland with short heather and areas of exposed granite. In 2003 it was observed that the terns favoured nesting between heather patches or on top of boulders, not within the heather itself. There have been 15 tern nest boxes situated on North Hill since 1992 (Robinson, 2000) and the site was the subject of attempted colony formation work by the Channel Seabirds Group between the years 2000 and 2002.





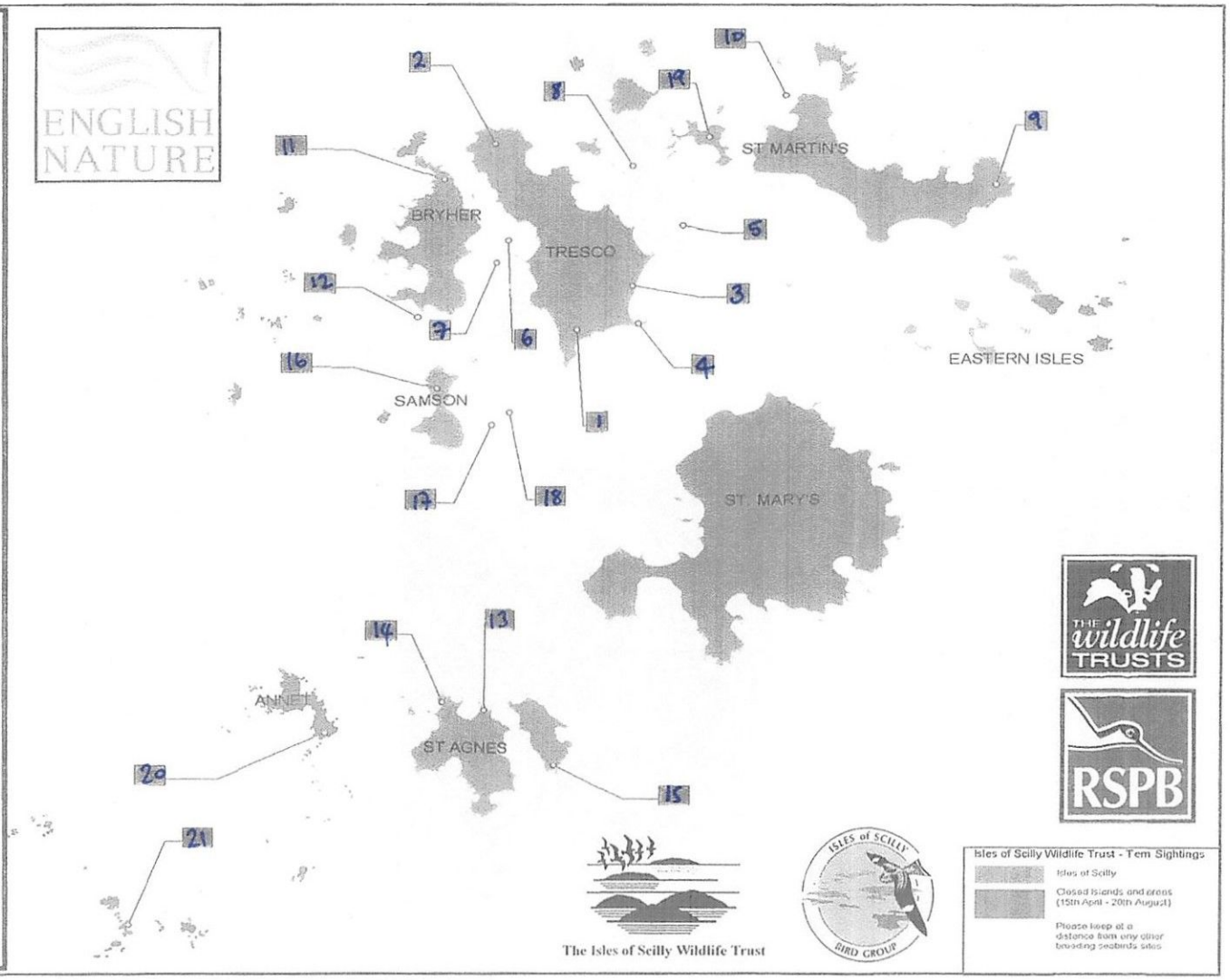
Photographs 5 and 6: North Hill, Samson (left); and Appletree Banks, Tresco with the Abbey in the background (right).

Appletree Banks, Tresco

Tresco is the second largest island on Scilly; it is inhabited and has no access restrictions. Rats, cats and dogs all live on the island. The Appletree Banks site is situated on the southern shores of Tresco and was the last known breeding location for the Roseate Tern in Scilly (ISBR, 1994). The colony site can be described as grassy dunes, with extensive areas of Bracken around the edge, as well as smaller patches of Heather (*Calluna vulgaris*), Gorse (*Ulex europaeus*), Bramble (*Rubus fruticosus*) and Marram Grass (*Ammophila arundinacea*). There are some sandy areas that the terns seem to favour for nest attempts (Author, pers. obs.). Large numbers of gulls use the nearby Abbey Pool to bathe, but no breeding colony is situated in the vicinity. The Appletree Banks colony held a colony of over 50 breeding pairs of Common Tern prior to 1985 (ISBR, 1985), but there has been irregular breeding by smaller numbers since then (ISBR 1986-2002). Regular human disturbance occurs at the site, as it is situated close to the Tresco heliport and a footpath passes close by.

Map of Historical Breeding Sites for the Common Tern on the Isles of Scilly

No.	Site Name
	Tresco
1	Appletree Banks
2	Castle Down
3	Pentle Bay
4	Skirt Island
5	Cheese Rock
6	Half Tide Rock
7	Merrick
8	Foreman's Island
	St. Martins
9	Chapel Down
10	Plumb Island
	Bryher
11	Shipman Head Down
12	Colvel Rocks
	St. Agnes/Gugh
13	Kalimay point
14	Browarth
15	Nr. Hoe Point Gugh
	Samson
16	North Hill
17	Green Island
18	Stony Island
19	**Tean**
20	**Annet**
	Western Isles
21	Rosevear



3. Methods

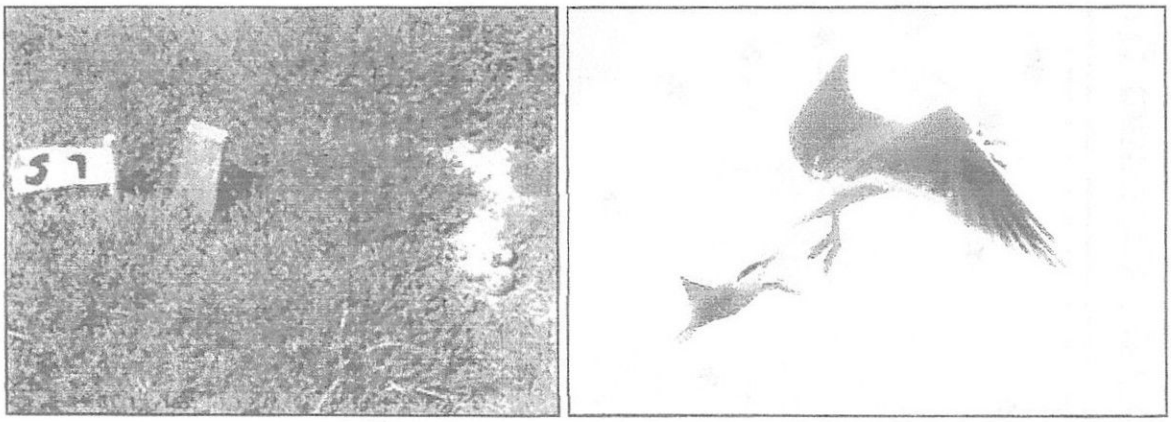
The methods used are based around those suggested by Ratcliffe and del Nevo (1995), and Gilbert et al. (1998) in the Roseate Tern Species Recovery Programme, as well as those laid out in the Seasonal Tern Warden job description (Annex A?). To allow consistent data collection colony sites were visited every week and the numbers of adults, nests, eggs and chicks noted. During these visits predator presence, food carrying and human disturbance were also monitored.

3.1 Determining Distribution and Productivity

A list of 21 historical tern-breeding sites was provided by Will Wagstaff at the beginning of the 2003 season. Regular reports and sightings from these locations were made during the summer by the author, members of the Isles of Scilly Bird Group, members of the public and the Boatman's Association. This collaborative monitoring enabled the number of birds at each locality to be noted at least once a week. As soon as it became apparent that a colony had become established the author visited the site to ascertain the exact number of pairs and nests present. As a result every tern nest discovered on Scilly during 2003 was followed to completion.

To determine exactly how many nest attempts occurred at each site, and to allow individual nest outcomes to be followed, nests found on Samson, Tresco and Annet were marked with numbered, 20-centimetre, bamboo poles, and a GPS location logged.

Flush counts, to determine how many birds were present at each colony, took place during each visit. Counts were made whenever a large number of terns were in the air, and when potential predators were noted in the area.



Photographs 7 and 8: Marked nest on North Hill, Samson (left); and a Common Tern (*Sterna hirundo*) mobs a Lesser Black-backed Gull (*Larus fuscus*) on Annet.

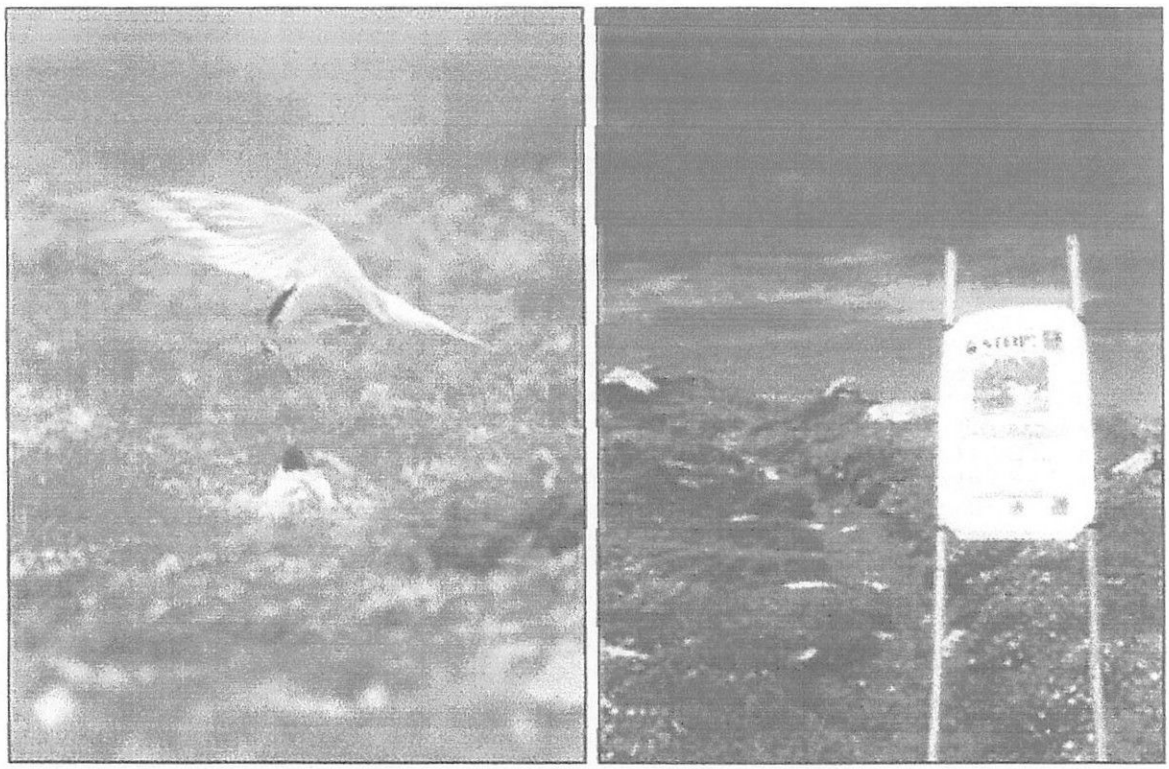
3.2 Predators

Predation by a number of different species has been suggested as a major cause for the decline in the number of breeding terns in Scilly (e.g. Robinson 2000, ISBR 1994). To identify which predators pose the biggest threats to breeding terns two half-hour observations were made every week at the three study sites. During these observations the number of times a Common Tern mobbed a potential predator over the colony site, and the identity of the species mobbed were noted. With this data it was possible to compare the number of mobbings made per pair per hour (pp/ph) at each colony site.

3.3 Food Availability

Food shortages have been identified as the major cause of reduced productivity for Arctic Terns (*Sterna paradisaea*) nesting in Shetland during the 1980's (Fisheries Research Services, 1993). The availability of food to tern species in Scilly has never been studied, and could potentially be a cause for the recent decline in breeding numbers. To determine this, food carrying observations were made during two half-hour periods every week (at the same time as the predator observations) at the three colony sites. During food carrying observations the species, size and final destination of food items were noted. Food size was assigned to one of four categories; ½ *x* length of the bill, 1 *x* length of the bill, 1½ *x* length of the bill, or 2 *x* length of the bill. With these data, catch rates can be determined for the three study sites on a number of fish per pair per hour (pp/ph) basis.

To further test food availability, a total of 15 chicks were weighed to ascertain if they were underweight for their age (wing measurements from carpal joint to longest primary were also taken to help determine chick ages), and a total of 15 eggs were measured to determine if they were small compared to other tern colonies around the UK.



Photographs 9 and 10: Food pass at nest changeover on Appletree Banks, Tresco (left); and the roped off tern colony on North Hill, Samson (right).

3.4 Effect of Human Disturbance

Disturbance here is defined as a situation where human activity has significant detrimental impacts on breeding performance, site fidelity or adult survival as stated in Ratcliffe and Del Nevo (1995). It has been suggested that disturbance of terns on Scilly has had a detrimental impact on their breeding success in the past (ISBR, 1970). During colony visits the number of people passing the colony and the number of birds that reacted to their presence was noted. Disturbance from the regular helicopter arrival and departures on Tresco was also noted.

It had been suggested that disturbance by the author might also have an adverse effect upon tern breeding success. Therefore colony visits were kept to an absolute minimum, and the time spent in colonies on each visit was recorded.

4. Results

	TRESCO				SAMSON		ANNET	BRYHER	
	ATB	SI	FI	CD	NH	GI	SE	CR	TOTALS
Max flush Count	36	80	14	4	20	46	60	6	266
Estimated min. pairs	20	2	7	1	7	25	20	1	83
Total nests found	24	2	7	1	8	28	36	1	107
3-egg nests	17	1	-	0	6	14	8	1	47
% 3-egg nests	71%	50%	-	0%	75%	50%	22%	100%	44%
2-egg nests	4	1	-	1	2	8	14	0	30
% 2-egg nests	17%	50%	-	100%	25%	29%	39%	0%	28%
1-egg nests	3	0	-	0	0	6	14	0	23
% 1-egg nests	13%	0%	-	0%	0%	21%	39%	0%	21%
Total no. eggs	62	5	c.15	2	22	64+	66	3	239+
Total Predated eggs	8	2	-	0	5	16	31	3	65
% Eggs Predated	13%	40%	-	0%	23%	25%	47%	100%	27%
Total Abandoned eggs	9	0	-	0	2	-	10	0	21
% Eggs Abandoned	15%	0%	-	0%	9%	-	15%	0%	9%
Total Unknown Eggs	5	0	-	0	0	-	5	0	10
% Unknown Eggs	8%	0%	-	0%	0%	-	8%	0%	4%
Eggs Hatched	40	3	-	2	15	20	20	0	100
% Eggs Hatched	65%	60%	-	100%	68%	31%	30%	0%	42%
Chicks Fledged	c.10	0	4+	2	5	c.10	c.5	0	36+
% Eggs Fledged	16%	0%	27%	100%	23%	16%	8%	0%	15%
% Hatched Eggs Fledged	25%	0%	-	100%	33%	50%	25%	-	36%
Productivity	0.5	0	0.57	2	0.71	0.4	0.25	0	0.43

Figure 1: Summarising breeding numbers, egg laying, predation, abandonment and fledging success for all known Common Tern (*Sterna hirundo*) clutches at breeding sites in the Isles of Scilly in 2003.

* Colony names are summarised as follows: **Tresco**; ATB = Appletree Banks, SI = Skirt Island, FI = Foreman's Island, CD = Castle Down; **Samson**; NH = North Hill, GI = Green Island; **Annet**; SE = South End; **Bryher**; CR = Colvel Rocks

** Data is incomplete for both Foreman's Island, due to its late discovery during the breeding season, and for Green Island, due to the inaccessibility of the site.

*** All figures given represent minimum numbers of birds, nests, eggs and chicks discovered unless otherwise stated.

**** The large maximum flush counts on Skirt Island, Tresco, and Annet were taken early in the season when breeding birds arrived on mass, and these numbers did not remain at the sites for the rest of the summer.

***** Productivity is defined as the number of chicks raised per pair (as suggested by Ratcliffe and Del Nevo, 1995).

4.1 Archipelago Overview

Common Terns arrived late in Scilly in 2003. No counts greater than 20 birds were made until the 13th May when 60-80 birds were noted on the East Craggy Ellis (Pender, pers. comm.). These moved to Skirt Island, Tresco the next day, before dispersing to inspect potential colonies around the islands. This is in contrast to previous years where colonies were already established by 26th April 2000 (Robinson, 2000) and 18th May 2002 (Robinson, 2002). The reasons for this late arrival are unknown. The vast majority of breeding Common Terns had departed by early September 2003.

Confirmed breeding took place at eight colony sites on or around four main islands during 2003. The colonies ranged in size from a single pair on Castle Down, Tresco to approximately 25 pairs on Green Island, Samson. An absolute minimum of 83 pairs of Common Tern bred around the Scillonian Archipelago in 2003. The majority of clutches contained three eggs at all colonies, with the exception of Annet, where two eggs predominated. Predation rates of chicks and eggs varied markedly between occupied sites (e.g. Colvel Rocks, Bryher experienced a 100% egg predation rate; whereas Castle Down experienced a 0% egg predation rate). Main causes of predation were thought to be the larger species of gulls. Bad weather, consisting of heavy rain and strong winds, between the 16th and 20th of July undoubtedly caused the loss of around 50% of chicks that were less than a week old, and reduced overall fledging success considerably. Even so productivity of Common Terns in Scilly in 2003 was 0.43 chicks per pair. In summary, of the total 239 eggs discovered during the season, at least 30% were predated, 40% hatched, and 15% reached fledging stage, a total of 36 chicks fledged from 83 pairs.

4.2 South End, Annet

The Annet colony was occupied from the 28th May to the 22nd July 2003. Flush counts varied widely during the summer, with reports of 60 birds at the end of May, followed by a low of 10 in early June, before building up to over 30 in July. But it is thought that a minimum of 20 pairs accounted for the 66 eggs laid. 16 nests with 26 eggs were discovered at the site on the 28th May, but by the 11th June only four nests and seven eggs were left. There was no predated egg shell present suggesting predation from large gull species. The majority of these predated nests were situated on the boulder bank south of the colony. All pairs whose eggs were predated had re-laid within the main colony area by the 18th June, when the first eggs were hatching. By the 23rd June there were at least eight chicks and 35 eggs. Anywhere between 10 and 20 chicks were thought to be present on the 9th July with more eggs hatching. But bad weather between the 16th and 20th July, and limited boat availability, meant access to the island was not possible for a period of two weeks after this. When it was possible to visit on the 22nd July the colony was windswept and deserted, and any abandoned chicks/eggs had been consumed presumably by the gulls. It seems likely that only four pairs of early breeders avoided the bad weather and egg predation and fledged no more than five chicks between them. This shows a very poor productivity ratio of just 0.25 chicks per pair. This is a reduction on last year when 50-60 pairs are thought to have used the site and enjoyed a high productivity ratio (Robinson, 2002).

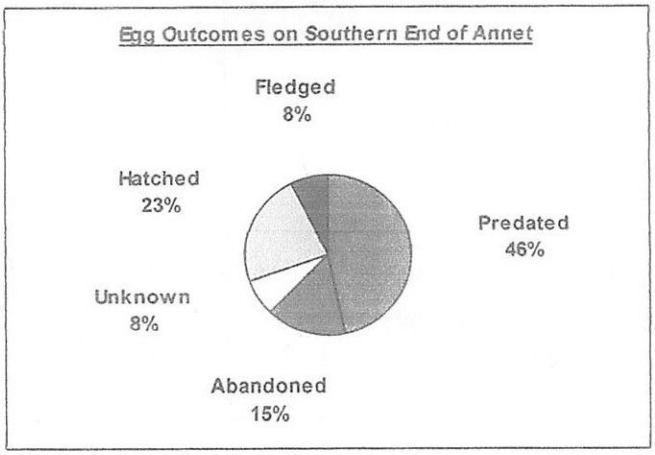


Figure 2: Showing the outcomes of all 66 Common Tern eggs discovered at South End of Annet colony during 2003.

This site experienced 36 nest attempts in total and after the predation of nests around the colony edge 40% of clutches contained two eggs and just 20% contained three. This is in contrast to Appletree Banks, Tresco where 70% of clutches contained three eggs. A total of 66 eggs were laid at this site and 47% of these were predated. Predation of eggs reduced markedly once the colony was well established, following the completion of courtship, and the commencement of mass incubation.

The highest number of mobbing observations on Annet involved Lesser and Greater Black-backed Gulls (60% and 26% respectively), suggesting that they are seen as the main predators at the site. Predation of eggs reduced markedly once the Common Tern colony was fully established, but a numbers of gulls (especially young non-breeding birds) continued to try to enter the colony throughout incubation and egg hatching. Predation of chicks undoubtedly occurred on a large scale, though the whereabouts and number of chicks became increasingly difficult to determine as the chicks became more mobile and the colony site more overgrown.

Food items were brought at an average rate of 1.23 items pp/ph over the breeding season. A minimum rate of 0.1 items pp/ph and a maximum of 2.15 items pp/ph were noted during individual visits. Few birds were noted actually fishing around the island itself during the summer of 2003. Birds fishing off Samson and Tresco would often be seen travelling to Annet with fish. This is a long way to travel with food and the chances of food items being stolen by gulls on the journey must be higher here than on any other site.

4.3 North Hill, Samson

Only seven pairs of Common Tern used the North Hill site this year, following the removal of the dummy terns and CD lure provided by the Channel Seabirds Group between 2000 and 2002. This is less than the previous three years where 10 pairs were present in 2000, 25-36 pairs in 2001, and 15 pairs in 2002 (Robinson, 2000-2002).

In 2003 the first birds were seen using the site on the 12th June, when four birds were present and three nests located. By the 20th June this had increased to 13 birds and six nests. The first chicks hatched around the 24th June, and all nests had chicks by the first week of July. At least seven large chicks were found hiding in artificial nest boxes on the 24th July, and a single pair was still defending the site (presumably with young) on the 15th August. The site was empty by the end of August.

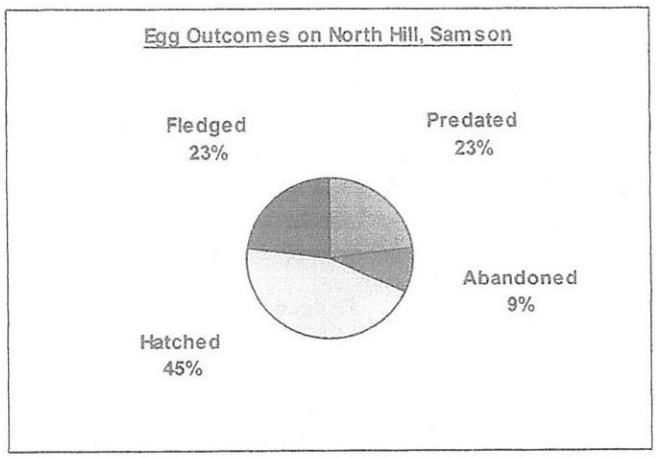


Figure 3: Showing the outcomes of all 22 Common Tern eggs discovered at North Hill, Samson colony during 2003.

At least eight nest attempts were made at the site in 2003, and 75% of these contained 3-egg clutches. A total of 22 eggs were laid, of which 15 hatched and at least five fledged, yielding a productivity ratio of 0.71 chicks per pair. One of the reasons for this higher productivity ratio compared to other sites may have been the presence of the 15 artificial nest boxes, as on several occasions chicks were found hiding in them, and successfully avoiding predators. However, two nests, containing five eggs, were thought to have been predated here at the beginning of June. The predators were presumed to be gulls, due to the close proximity of the Lesser Black-backed Gull colony, and the lack of predated egg shell. A single pair of Lesser Black-backed Gulls nested within five metres of the edge of the tern colony. The incubating gulls were subjected to relentless harassment by the terns during the breeding season, with several counts of over 200 mobbing observations made in five minute periods. This nest undoubtedly caused the Common Terns considerable stress, and resulted in birds spending reduced time away from the colony fishing.

Food items were noted being carried to the colony at an average rate of 0.7 fish per pair per hour over the course of the breeding season. This rate is much less frequent than at the other two study sites where averages of 1.1 fish pp/ph, and 1.2 fish pp/ph were noted on Appletree Banks, Tresco and Annet respectively.

No cases of people entering the North Hill colony were noted in 2003, as opposed to five in 2002 (Robinson, 2002). The baler twine fencing around the North Hill colony remained intact throughout the breeding season after initial maintenance. Three informative signs were designed and positioned along the path leading around the colony, and seemed to have the desired effect of deterring people from the area. An army helicopter twice circled North Hill on the 14th June and caused the entire colony to take to the air on each occasion.

4.4 Appletree Banks, Tresco

A minimum of 30 pairs bred at four locations on and around Tresco this year. The largest colony on Appletree Banks was occupied from the 5th June to the 5th August, and contained a minimum of 20 pairs. Historically this site has contained larger numbers of breeding terns, for example around 60 pairs of Common Tern were present at the site in 1974 (ISBR, 1974) and 50 pairs in 1990 (ISBR, 1990).

On the 2nd June 2003 Bryan Thomas discovered six Common Terns defending the site, and two nests. By the 11th June approximately 20 birds were present and eight nests had been found. Numbers of nests and territory holding birds increased rapidly over the next 10 days. A visit on the 24th June found the first eggs hatching, over 35 birds present at the site, and at least 20 active nests. Between 10 and 15 young chicks were observed in the colony at the beginning of July, and the majority of these are thought to have fledged. However, once these had departed at the beginning of August the colony quickly broke down, and later nesting pairs were unsuccessful in fledging any young.

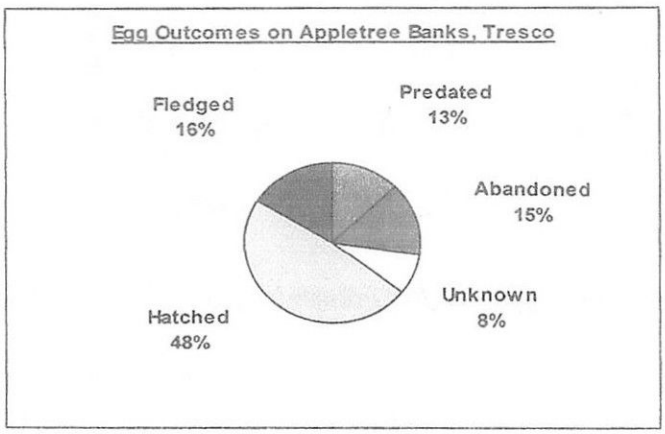


Figure 4: Showing the outcome of all 62 Common Tern eggs discovered at Appletree Banks, Tresco colony in 2003.

At least 24 nest attempts, containing 62 eggs, were made during the 2003 breeding season. 70% of nests here contained three eggs and no predation was observed until after the majority of eggs had hatched in July. At least 65% of eggs laid are thought to have hatched of which 25% fledged (a minimum of 10 young), meaning a productivity ratio of 0.5 chicks per pair. Predation appears to be much less of a problem here than at the other two study sites due to the lack of gull colonies in the area. However, Brown Rats (*Ratus novegicus)* are present on the island as are a number of Carrion Crow (*Corvus corone*), Jackdaw (*Corvus monedula*), and Grey Heron (*Ardea cinerea*) that could all be potential tern egg/chick predators. Carrion Crows have been implicated as a main predator of tern chicks and eggs on Scilly in the past (e.g. Robinson, 2002), but with just two mobbing observations made on this species on Tresco in 2003 there is, as yet, no evidence to suggest they are a major threat to tern productivity.

Human disturbance has also been suggested as a major reason for failed breeding on Tresco in the past. In 1985 Tresco sites were noted to be subject to much human disturbance (IOSBR, 1985), and in 1992 three pairs of nesting Roseate Tern suffered human disturbance and raised only two chicks between them (ISBR, 1992). In 2003 people were noted around the Appletree Banks colony 25 times during observation watches and a further 20 times outside of observations. On each occasion up to 10 Common Terns would mob the people until they had passed a safe distance, before returning safely to nests. Generally birds seemed undeterred by the regular helicopter activity and continued incubation.

Food availability does not seem to be a problem at Appletree Banks, as the colony site is situated close to the favoured fishing grounds of the Tresco and Samson flats. Food items were brought at an average rate of 1.1 food item pp/ph. Several individual pairs and nests were closely followed here during the breeding season and these pairs would bring in food items at an increased rate of once every ten minutes once eggs had hatched.

4.5 Other Breeding Sites

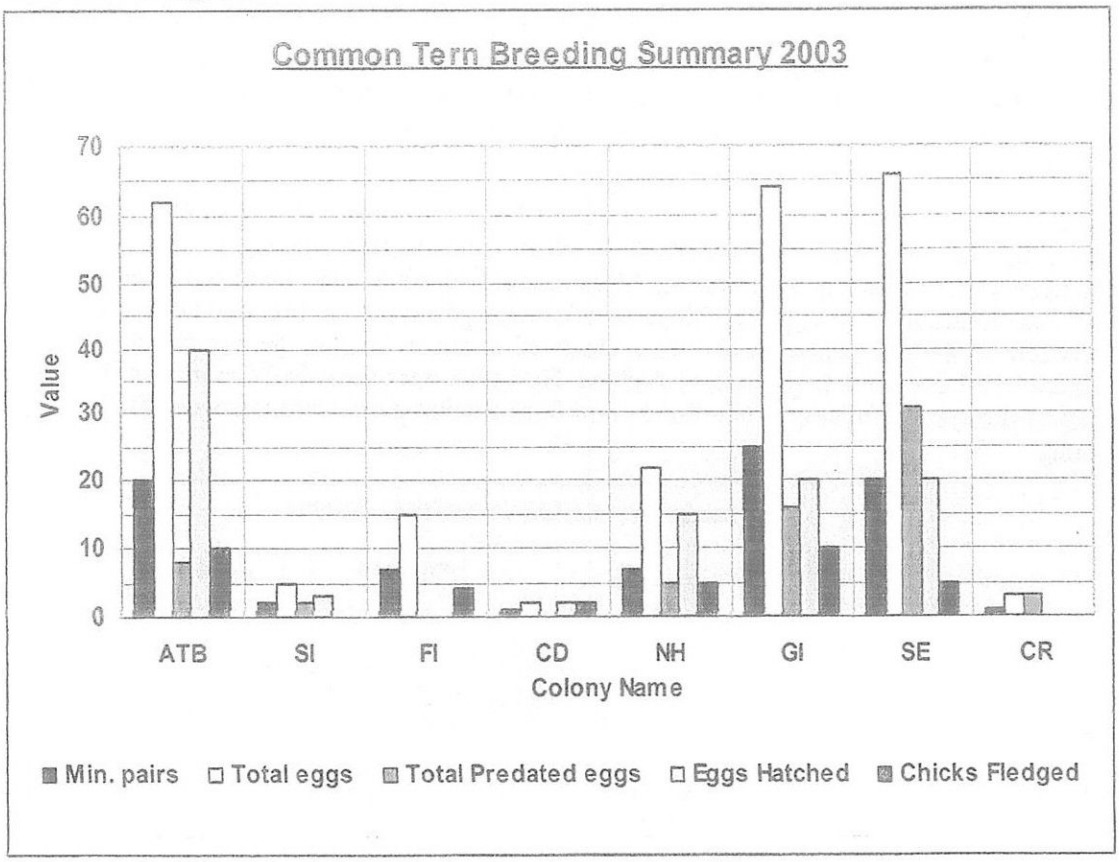


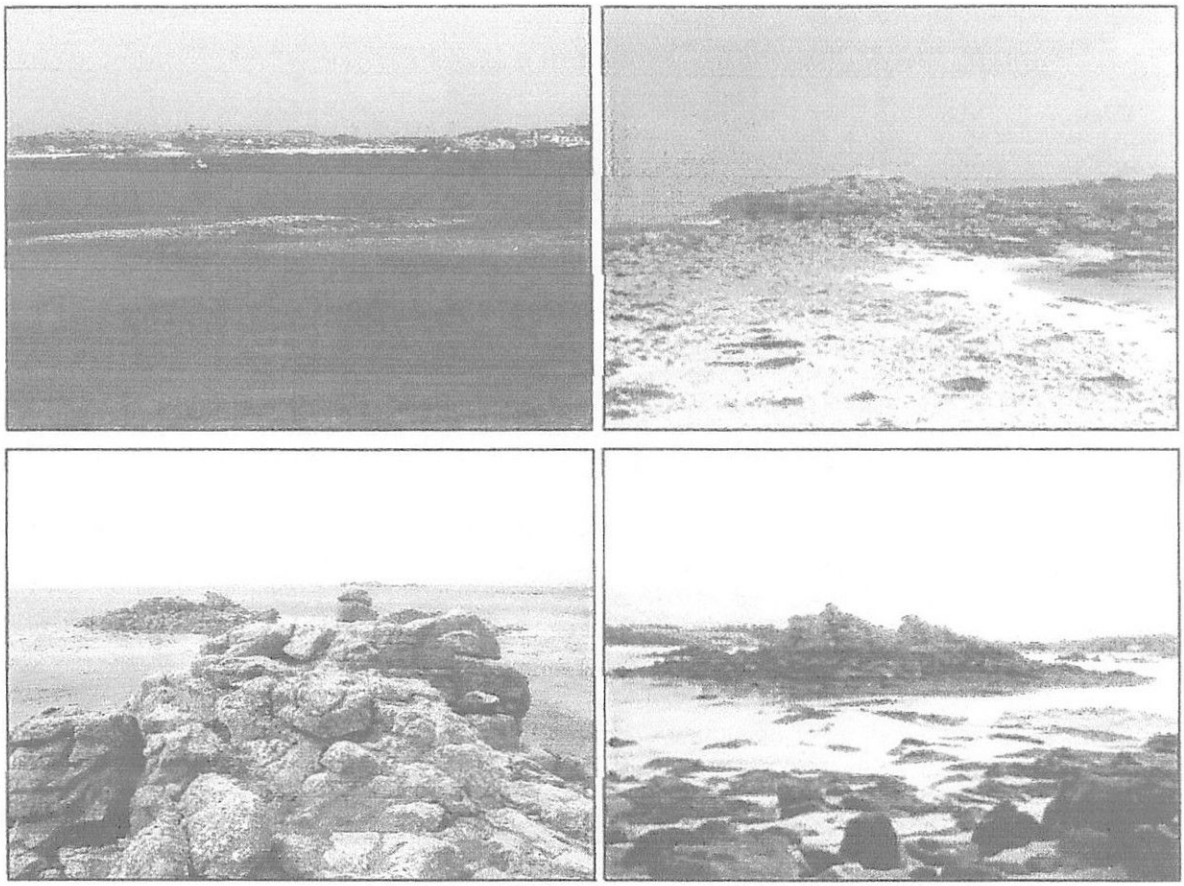
Figure 5: Showing summary of breeding success of the eight Common Tern colonies discovered in Scilly in 2003.
* Colony names are summarised as follows: **Tresco**; ATB = Appletree Banks, SI = Skirt Island, FI = Foreman's Island, CD = Castle Down; **Samson**; NH = North Hill, GI = Green Island; **Annet**; SE = South End; **Bryher**; CR = Colvel Rocks

Green Island, Samson- This site has historically been favoured by nesting terns in Scilly, but is especially prone to bad weather and inundation by high tides, due to its exposed and low-lying nature. Birds were present here from the 20th May, and up to five pairs were thought to be nesting. Access to the island on the 14th June produced a flush count of 46 birds and 26 nests were discovered. Nests at this site were not marked due to the terrain and limited access at low tides. Flush counts remained consistently above 30 birds during the breeding season, and around 25 nests appeared active. The first chick hatched here on the 20th June, and by the 28th at least 15 chicks were thought to be present. Some nests were lost to a high tide around the 18th June, and the bad weather between the 16th and 20th July also caused many chick fatalities. A minimum of 10 chicks fledged from this site in 2003, a far cry from the 190 chicks ringed here in 1924 (Penhallurrick, 1969).

Interestingly a large number of predated eggs and chick body parts were found in the colony throughout the summer. It seems highly improbable that gulls or crows were responsible, and with no rats thought to be present on Samson, it seems likely that Oystercatchers also nesting on the island (or adult terns) predated already dead chicks and abandoned eggs. Oystercatchers have been suggested as a Common Tern egg predator by the ISBR (1995) and by Wescott (pers. comm.).

Skirt Island, Tresco- On the 16th June two Common Tern nests, containing five eggs were discovered at this site. One clutch of three eggs hatched around the 5th July, but the chicks were predated within a week. One adult of the other pair was found dead on the nest on the 14th July, there were no signs of disease or predation, suggesting death by natural causes, i.e. old age. No chicks fledged from here in 2003. This site was used as a low tide roost site by upwards of 50 terns in mid May and late July, and was also favoured by the migrant Roseate Tern in late July.

Foreman's Island, Tresco- Initial visits here in May and June failed to note any Common Tern breeding presence. However breeding was confirmed late in the season, when a Roseate Tern was also found at the site on the 19th July. Access to the island on the 25th July found four chicks within a few days of fledging and a minimum of seven pairs using the site. This site is sheltered, and low lying in parts, but offers a good variety of cover and has no rat presence. Therefore it is quite possible that birds had already fledged from here before the colony was discovered.



Photographs 11-14: (From top left clockwise) Green Island, Samson; Skirt Island, Tresco, Covel Rocks, Bryher; and Foreman's Island, Tresco.

Castle Down, Tresco- Two eggs were found at the site on the 24th May, and the adults were very flighty following the author a considerable distance from the nest. Eggs hatched around the 10th July, and both chicks had fledged by the 7th August. This pair seems to have benefited from being away from gull colonies and significant human disturbance.

Bryher- Two birds were seen mobbing a Greater Black-backed Gull over Colvel Rocks on the 14th June. Bryan Thomas discovered a lone nest with three eggs here on the 20th June. By the 26th June their eggs had been predated, presumably by Carrion Crow as pieces of eggshell were discovered at the site. Up to four birds remained here during July but no new nest attempts were discovered.

4.6 Predators

85% of mobbing observations were aimed at the three large gull species, and of these 50% were on Lesser Black-backed Gulls (*Larus fuscus)*. This species was seen as the main predator on both Samson and Annet where large Lesser Black-backed Gull colonies are situated in close proximity to the Common Tern colonies. Herring Gulls (*Larus argentatus*) and Greater Black-backed Gulls (*Larus marinus*) make up a smaller, but still significant, proportion of the mobbing observations (17% and 25% respectively). Single figure mobbing observations of these two species were made on Samson, whereas on Tresco they made up the bulk of observations.

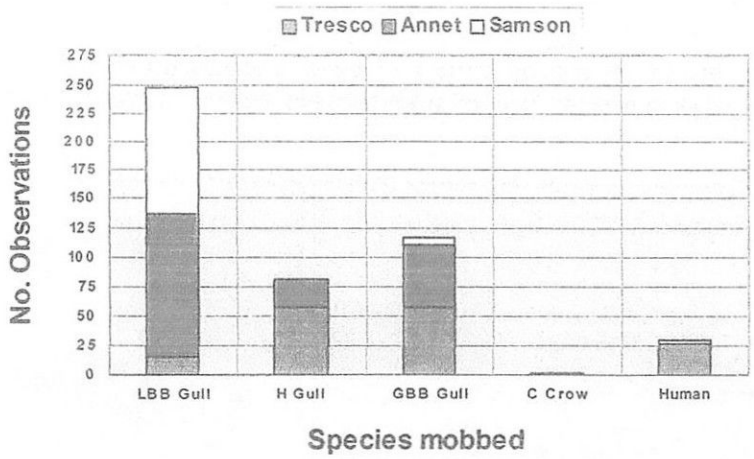


Figure 6: Number of mobbing observations for selected species at the three Common Tern (*Sterna hirundo*) study colonies in Scilly during 22 hours of predator observation watches in 2003.
* LBB Gull = Lesser Black-backed Gull (*Larus fuscus*), H Gull = Herring Gull (*Larus argentatus*), GBB Gull = Greater Black-backed Gull (*Larus marinus*), and C Crow = Carrion Crow (*Corvus corone*).
** Human relates to mobbing of any human related disturbance (e.g. people and/or helicopters) and is shown here for comparison.

Other species were also noted being mobbed during the 22 hours of observations, though none pose any actual threat to tern breeding success. The following species were noted being mobbed on at least one occasion; Red-legged Partridge (*Alectoris rufa*), Feral Pigeon (*Columbia livia*), Ringed Plover (*Charadrius hiaticula*), Oystercatcher (*Haematopus ostralegus*), Marsh Harrier (*Circus aeruginosus*) and Starling (*Sturnus vulgaris*). A single pair of Ringed Plover, and three pairs of Oystercatcher, nested amongst the Common Terns on Appletree Banks and Annet respectively. In all cases their nests were abandoned, following harassment from terns, and they re-laid a little distance away from the tern colonies.

	ATB, Tresco	SE, Annet	NH, Samson	Total
Total Mobbings	194	199	121	**514**
Total Observation Time (mins)	540	360	420	**1320**
No. Breeding Pairs	20	20	7	**47**
No. Mobbings per pair per hour	**1.08**	**1.66**	**2.47**	**0.50**

Figure 7: Showing total numbers of mobbing observations for the three study sites, and the resulting average number of mobbings made per pair per hour.

The three study sites show marked variations in the number of mobbings made per pair per hour. On average an Appletree Banks pair would mob twice every two hours, on Annet they would mob something three times every two hours, and on Samson a much higher rate of five times every two hours. Samson terns therefore spent twice as long mobbing potential predators than terns on Appletree Banks or Annet. This can be attributed to the single Lesser Black-backed Gull nest in very close proximity to the tern colony on Samson, which was subjected to relentless mobbing during the summer.

4.7 Food Availability

Food Size	Tresco	Annet	Samson	Total
1/2 x bill length (or 17.5 - 18 mm)	69	41	12	122
1 x bill length (or 35 - 36 mm)	49	47	10	106
1 1/2 x bill length (or 52.5 - 54 mm)	49	31	7	87
2 x bill length (or 70 - 72 mm)	23	28	5	56
Total No. Food Items	**190**	**147**	**34**	**371**
Total time of Observations (minutes)	540	360	420	1320
No. Breeding Pairs Present at Colony	20	20	7	47
Ave. No. Food Items to Colony per Hour	21.11	24.50	4.86	16.82
Ave. No. Food Items per Pair per Hour (pp/ph)	1.06	1.23	0.69	0.99

Figure 8: Showing size of food items observed being taken to the three study sites. Catch rates are defined as the average number of food items taken to the colony per pair per hour (pp/ph) for the breeding season as a whole. Bill length represents the size of food items in relation to the bill length of the Common Tern (*Sterna hirundo*). Average bill length is 35-36mm (Olsen and Larsson, 1995).

The average length of food items caught on Scilly in 2003 was 3.9 cm, with a minimum size of 1.5 cm and a maximum of 9cm. This is smaller than the 5.5-7.5 cm average food size stated by Hume (1993), but as the majority of food observations were made in the first two weeks after egg hatching when chicks require smaller food items little can be read into this. 90% of observed food items were sandeels (*Ammodytes sp.*), with Goby sprats (*Gobiidae sp.*) and shrimp (*Atyids sp.*) also identified on several occasions. 60% of observed food items were less than or equal to the length of the Common Tern bill. Tresco and Annet show similar averages of 1 and 1.25 food items to the colony pp/ph respectively for the breeding season as a whole. Samson showed a reduced catch rate of 0.7 food items to the colony pp/ph. The resultant average catch rate for the three study colonies over the whole breeding season was 1 fish to the colony pp/ph.

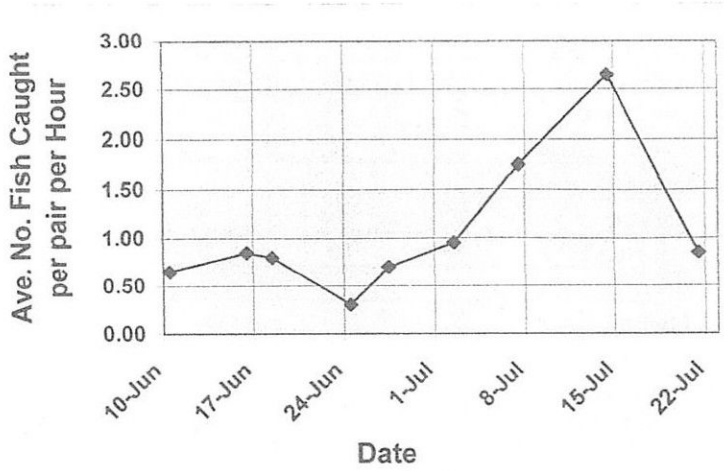


Figure 9: Variation in catch rates throughout the breeding season at the Appletree Banks, Tresco colony. Data shown is the average number of food items brought to the colony per pair per hour (pp/ph) on each visit to Appletree Banks.
* The Common Tern breeding season can be roughly split into three periods, courtship and egg laying (approx 10-20 June on Appletree Banks), mass incubation (approx 20 June-3 July) and chick presence (3-22 July).

Catch rates were not constant throughout the breeding season, and figure 6 shows that they varied widely from week to week at the Appletree Banks, Tresco colony. The North Hill, Samson and Annet colonies also show a similar pattern. During courtship and egg laying an average of 0.75 food items were brought to the colony pp/ph. The catch rate dropped to just 0.25 food items pp/ph during mass incubation, before rising rapidly to over 2.50 food items pp/ph once eggs had begun to hatch after the 24th June. The catch rate then fell away again at the end of the study period when chicks began to fledge.

4.8 Human Disturbance

Human presence around tern breeding sites in 2003 was minimal, but still at a level where terns may be disturbed from breeding. 40 people were noted around the Appletree Banks, Tresco colony during visits over the summer, with the actual total likely to be significantly greater. Helicopter activity also occurs regularly around the site, with at least two flights a day. However, Common Terns nesting here showed remarkable tolerance and overall productivity did not seem to suffer as a result of the high human presence.

Breeding in reasonable numbers (five plus pairs) was thought likely at Merrick, and Skirt Islands, Tresco early in the season, but several incidents of human disturbance may have deterred terns from nesting here. People were observed sitting on Skirt Island in late May (Wagstaff, pers. comm.), and in early June (pers. obs.) and probably discouraged greater numbers of terns from nesting here. Around 20 Common Terns had consistently been seen in the Merrick Island area during late May, but the area was soon deserted, after the island was apparently accessed by people moving the pub sign in early June (Wagstaff, pers. comm.).

The North Hill, Samson colony remained undisturbed during the summer. However, day trippers and fisherman were seen on a number of occasions accessing the offshore Green and Stony Islands sites at low tide. Terns nesting on Green Island were very flighty and defensively took to the air even when people were a considerable distance from the island. Tackling human disturbance around tern colonies is a tough task, as there are so many sites spread over all the islands, but hopefully the awareness-raising campaign of 2003 has gone some way towards addressing this problem.

Tern Warden Disturbance

Colony Name	No. Visits To Colony	No. Visits Colony Entered	Total Time In Colony (Minutes)	Average Time In Colony (Minutes)
TRESCO				
Appletree Banks	15	11	179	16
Skirt Island	14	8	55	7
Castle Down	6	5	27	5
Foreman's Island	3	1	30	30
SAMSON				
North Hill	9	7	51	7
Green Island	8	5	94	19
ANNET				
South End	8	7	118	17
BRYHER				
Colvel Rocks	4	2	10	5
TOTAL	**67**	**46**	**564**	**12**

Figure 10: Showing number of visits, times entered, and duration of visits to different Common Tern (*Sterna hirundo*) colonies on Scilly, summer 2003.

During survey work in 2003 the eight colonies were entered by the author a total of 46 times over 98 days on 67 visits. This produces an average time spent in a colony of just 12 minutes on each visit. Ratcliffe and Del Nevo (1995) suggested that a maximum of 40 minutes could be spent in a tern colony at any one time without having a detrimental affect on breeders. Obviously the 12-minute figure is far below this. These restricted visits made finding chicks more difficult later in the breeding season, but in most cases it was possible to observe the colony from a distance and determine where nests/eggs/chicks were present. No cases of desertion or abandonment of eggs or chicks were attributed to the author's presence in the colony.

4.9 Roseate Tern Presence in 2003

There were two sightings of Roseate Terns in Scillonian waters in the spring and summer of 2003. The first was of a lone bird sighted on a pelagic trip six miles south of the islands on May the 22nd (Flood and Fisher, pers. comm.). This indicates the latest arrival of Roseate Tern in Scillonian waters in the last 30 years. The second sighting related to one (possibly two) Roseate Tern, found around Foreman's Island on the 19th July. This bird stayed around the islands for a minimum of four days, and, encouragingly, took in the colonies at Skirt Island, Appletree Banks, and Green Island, as well as Foreman's, during its stay.

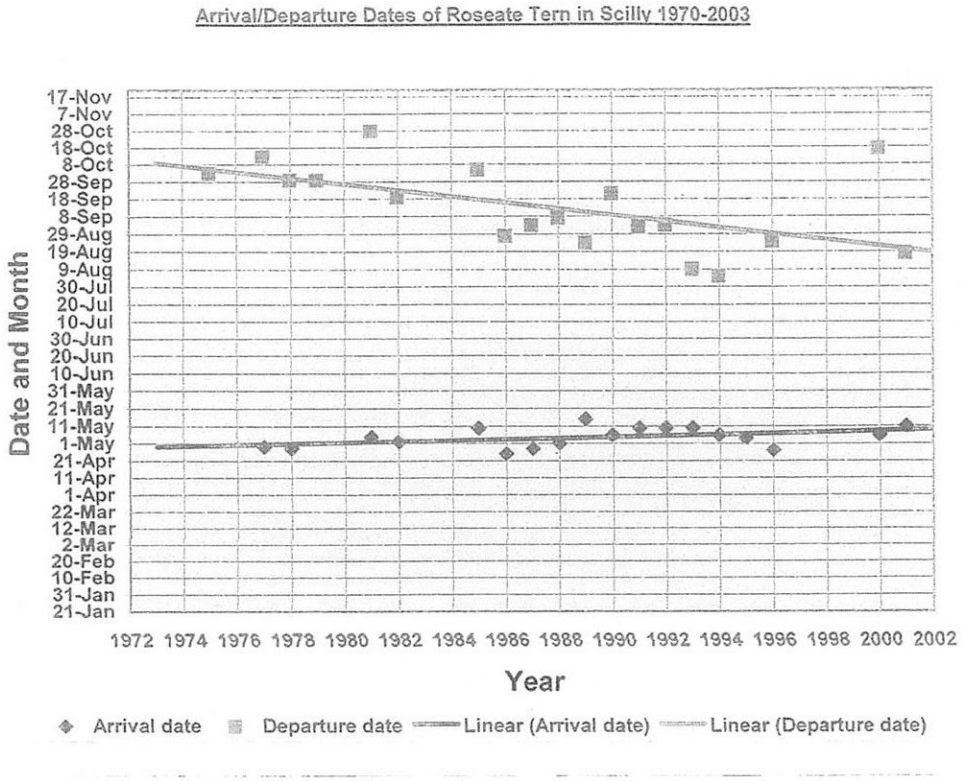


Figure 11: Showing yearly arrival and departure dates of the Roseate Tern (*Sterna dougallii*) in Scilly 1972-2002
* Data for arrival and departure dates may be incomplete post 1994 as there are few records each year.

From figure 11 it can be seen that in recent years Roseate Terns are arriving later and departing much earlier from Scillonian waters. Sightings since the last known breeding in 1994 have been irregular, but the pattern is clearly one of earlier departure pre 1994. In 1973 birds remained from late April to early October, whereas in 2001 Roseate Terns arrived during early May and departed well before the end of August. In 1973 Roseate Terns spent a maximum of 160 days in Scillonian waters, but by 2001 this had dropped to a maximum of just 100 days of the year.

Sandwich Tern-

Up to five pair regularly frequented the Green Island, Samson colony during the summer. One pair laid a single egg here on the 14th June, but unfortunately it was damaged by the parents and failed to hatch. This is the first confirmed breeding in Scilly since a lone pair tried to use the same site in 1998 (ISBR, 1998). Sandwich Terns were also seen on several occasions over both the Annet and Appletree Banks, Tresco colonies in July and August, but no breeding was suspected at these sites.

Arctic Tern-

A lone Arctic Tern remained at the Appletree Banks, Tresco colony throughout the summer, and unsuccessfully tried to court a Common Tern on numerous occasions. It was first sighted by Ashley Fisher on the 6th June, and remained here until the last week of August. This is the first long staying summer record since 1977 (ISBR, 1977). Migrant Arctic Terns were also noted at Skirt Island, Tresco; Green Island, Samson; and from pelagic trips during early August (Author, pers. obs.).

5. Discussion

In 1985 there were estimated to be at least 200 pairs of Common, five pairs of Sandwich, and five pairs of Roseate Tern breeding in Scilly (ISBR, 1985), but in 2003 this had fallen to a minimum of 83 pairs of Common, and a lone pair of Sandwich Tern (Author, pers. obs.). So it would seem that the Common Tern population has undergone a 50% decline in Scilly in the last 30 years (ISBR, 1969-1999, and ISBNHR 2000-2002), with a number of factors contributing to its disappearance.

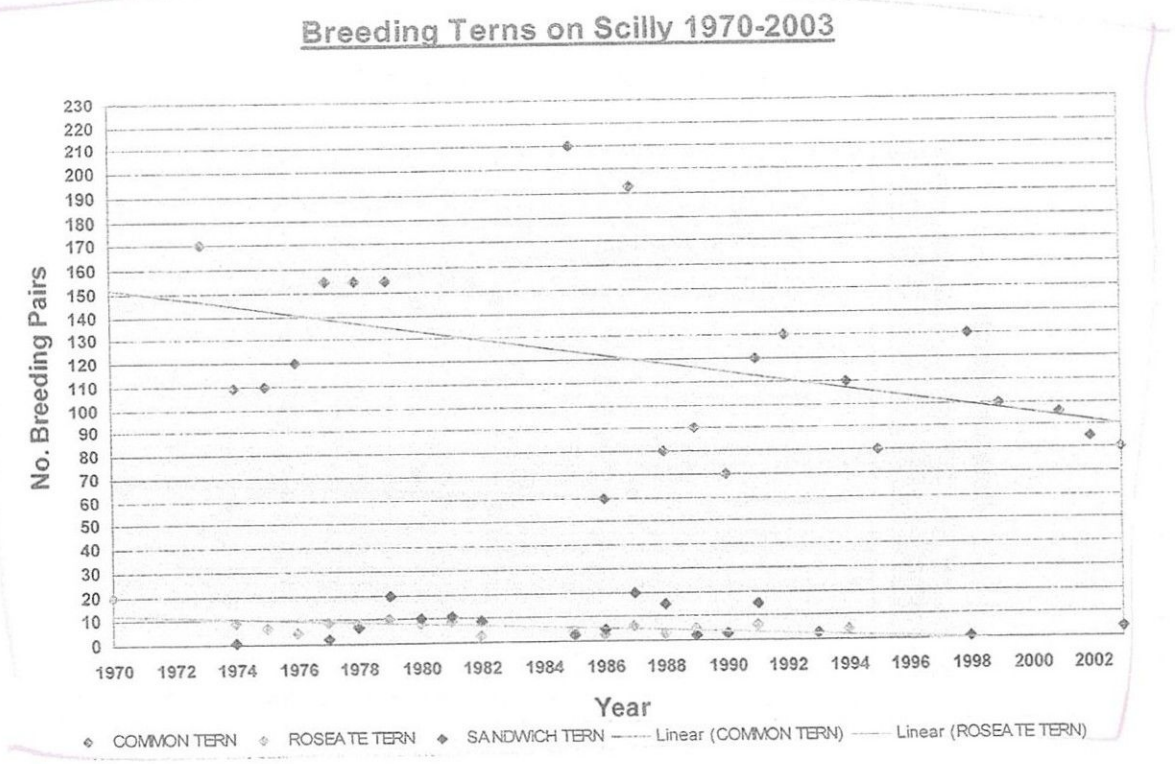


Figure 12: Numbers of breeding pairs of Common, Roseate, and Sandwich Terns around the Isles of Scilly 1969-2003. Also showing linear regression lines to view overall trends for Common and Roseate Tern decline.
* Figures taken from a variety of sources such as ISBR 1969-1999 and ISBNHR 2000-2002, personal observations and past Roseate Tern Species Recovery Reports 2000-2002.
** Data collection in the last 30 years has not been systematic, and has used many different methods of estimating numbers and productivity of terns; therefore it is possible that yearly counts may be incomplete or inaccurate.

The three year study by the Channel Seabirds Group to encourage Common Terns to North Hill Samson in 2000, 2001 and 2002, shows that small numbers of terns can be encouraged to breed in areas using CD lure devices. The smaller number of breeding terns present in 2003 suggests that perhaps this is not their favoured nest site. Old ISBR's show that the North Hill site is usually utilised by failed breeders from Green Island, Samson, that have moved for a second nest attempt (e.g. ISBR, 1982). Small rocky offshore sites such as Green Island are prone to inundation by high tides and exposure of nests to bad weather. In 1994 around 100 (ISBR, 1994) and in 1998 approximately 60 (ISBR, 1998) Common Tern nests were washed away from Green Island by spring tides. However, this and similar small island sites have also proved to offer safe havens for Common Tern when rat and cat predation has been a problem on main island sites (IOSBR, 1991). Ways of discouraging breeding terns from these sites should be looked at in the future.

Predation by a number of species has been suggested as major limiting factors to Common Tern productivity in the past. Brown Rat (and very probably domestic cats on St. Agnes) predation was noted as a major problem for nesting birds in the 1980's and early 1990's (e.g. ISBR, 1991; Robinson, 2002). Brown Rats appear to have been successfully eliminated from the majority of uninhabited islands in recent times, and it is essential for these sites to remain rat free in the future.

Carrion Crows were identified as the likely predators at the North Hill, Samson site in the years 2000-2002 (Robinson, 2002), but there was no evidence in 2003 to suggest that predation by this species significantly reduced breeding success. Oystercatchers have also been implicated as potential predators in the past (e.g. ISBR, 1995; Wescott, pers. comm.). Further monitoring of the distribution and feeding habits of both Carrion Crow and Oystercatcher in Scilly are required.

The early predation of eggs by gulls on Annet in 2003 meant that egg laying dates were spread throughout June at this site. A study by Sorakite and Budrys in 2000 showed that colonies where egg laying is synchronised over a short time period enjoy better overall fledging success. If terns are to achieve optimum productivity in Scilly then reducing predation rates of eggs and chicks is essential. The 15 nest boxes on North Hill, Samson were used by chicks for cover in 2003, and in 1994 two out of four pairs of Roseate Terns in Scilly used artificial nest sites (IOSBR, 1994). On Inchmickery in the Firth of Forth (EBP website), and on Anglesey (Avery, 1991) artificial tern shelters have been provided for a number of years and have successfully enhanced breeding success. These examples show that the use of tern shelters to increase productivity has been successfully proved on Scilly and elsewhere. Therefore the author recommends the positioning of new, larger, well maintained, stone shelters at the Annet; North Hill, Samson; and Appletree Banks, Tresco colonies.

Large gull species, and in particular Lesser Black-backed Gulls, were noted breeding in the vicinity of several Common Tern colonies in 2003. The presence of these birds caused significant disruption to Common Tern breeding, in particular on North Hill, Samson. If Common Terns are to achieve optimum productivity in Scilly then gulls need to be discouraged from tern breeding areas. An English Nature study by Owen, Kirby and Holmes in 2001 looked at the effectiveness of gull culling for nature conservation purposes, and showed that culling of adult gulls is seldom the most efficient means of management. Therefore the culling of adults is not recommended in Scilly, as this would offer only a short term solution. However, the repeated destruction of gull nests (preferably before egg-laying) within the immediate vicinity of the tern colonies on Annet and North Hill, Samson would certainly reduce gull presence in the areas, and is recommended for next year.

At present the amount of suitable habitat for breeding terns in Scilly appears small. On Annet the area measures just 0.02 hectares in size, and became more overgrown with Bracken as the summer progressed. On Appletree Banks, Tresco it was suggested that the terns nested in an area that had been accidentally burnt several years ago, though this could not be substantiated. Bracken on the North Hill, Samson site was cleared in 1992 (ISBR, 1992) and the ISWT cut/burned and cleared an area of 0.3 hectare (100m x 30m) area between 1999 and 2001 (Mawer, pers. comm.). However, in 2003 the vegetation here has grown up over the season limiting the amount of available nesting space for terns. Terns have not been recorded nesting in bracken covered areas on Scilly, and these three colonies are all in danger of becoming more overgrown with vegetation in future years.

Clearing vegetation around these three nesting areas would have the duel benefit of providing more breeding habitat for terns, and reduced cover for predatory gulls. There are several logistical problems associated with this suggestion. Firstly, Annet is very inaccessible and it would prove impossible to land heavy duty Bracken rolling machinery here. Controlled burning has been suggested as an alternative, but this is likely to break the dormancy, and is likely to be followed by increased Bracken vigour (Mawer, pers. com.). A further problem lies in the fact that most effective habitat management would need to be carried out during the summer when terns are nesting. What may be achievable is limited vegetation management of breeding sites in April, before tern colonies become established. This has been achieved on Ram Island, Massachusetts, USA, where vegetation is cut in early May then sprayed twice with the herbicide "Round Up" to prevent regrowth (Parken, 2000). Any habitat management work on Tresco will require permission from the Tresco Estate, and they should be contacted and involved in the project next year.

Food items were brought to Scilly tern colonies at an average rate of one fish per pair per hour over the course of the breeding season. Much higher catch rates were noted when chicks were present and food demand at its highest. Therefore plenty of food seems to be available to Common Terns in Scilly, as this figure compares favourably with a study by Sorakite and Budrys in 2000 who suggested a similar catch rate. However, studies on Sand eel stocks in Shetland have shown that food abundance can change rapidly between years (Fisheries Research Services, 1993), and background monitoring of food availability in Scilly is recommended by the author for future years. Egg size and chick weights also appear to be at a level that is comparable with the Sorakite and Budrys study. There is therefore no need to weigh and measure chicks and eggs in the future unless the rate at which food items are brought to colonies significantly reduces.

Human disturbance has also been suggested as a major factor in reduced productivity in recent years (e.g. ISBR, 1970). It seems that up until 1984 there was a large tern colony on Appletree Banks, Tresco (ISBR 1969-1984). After this date birds have still nested there, though in smaller numbers and less regularly (ISBR 1985-2002). It seems likely to me that the building of the Tresco heliport in 1985 must have had a detrimental effect on the tern colony, particularly in the first few years after its completion. However, observations in 2003 show that terns do continue to use the area and that the regular helicopter landings and departures do not overly disrupt breeding. Perhaps some breeding terns have become accustomed to the disturbance, while others have not. The colony here has been roped off in the past, but was stopped a few years ago as it was deemed to be encouraging people to view the area (Parks, pers comm.). In 2003 there were no access restrictions and the colony was as or more productive than both the Annet and Green Island, Samson sites, proving that Common Terns can breed successfully with minimal levels of human disturbance. Whether or not the more retiring Roseate Tern would be successful under such conditions is unclear. Certainly human presence around tern colonies should not be encouraged in the near future. The fencing and signs on North Hill, Samson should remain in place next year, and discussions with the Tresco Estate about roping off the colony on Appletree Banks again are required.

5.1 The future for Roseate Terns breeding in Scilly

It is now 10 years since the last confirmed breeding of Roseate Terns in Scilly, and with just two records made during the spring and summer of 2003 the future may look bleak. However, these sightings show that at least birds are still migrating through the area, and visiting established Common Tern colonies on Scilly. A long term study of terns breeding on Cape Cod, Massachusetts, USA showed that Common Terns had an average lifespan of about 10 years, with a smaller number living to 11 or 12 years, and a few exceptional individuals reaching 18 years of age. (Gibson-Hill, 1947). It is thought that Roseate Terns live for a similar length of time, and therefore birds with a memory of breeding in Scilly will now be reaching old age. If the Roseate Tern is to become a regular breeder on Scilly again then ways of encouraging first time breeders to the area may need to be identified. The provision of CD lure systems and dummy terns has proved only marginally successful on Scilly in the past (Robinson, 2002), and has also been relatively unsuccessful at tern colonies in the Irish Sea (Newton and Crowe, 2000). Other ways of attracting breeding terns are not obvious at the present time, and will need further research in the future. In the meantime what needs to be established before Roseate Terns can be encouraged to the area is the provision of optimum breeding habitat.

The Roseate Tern generally breeds on small rocky islands in the company of other terns for protection (Snow and Perring, 1998). The eggs, normally one or two in number, are placed in a hollow among rocks, or close to a stone outcrop (Gibson-Hill, 1947). The Roseate Tern prefers more cover than other terns and usually nests in rock crevices or sites overhung by vegetation (EBP website). The current Scilly tern colony sites offer little of the suitable habitat described. Nesting Common Terns are aggressive and push other nesting tern species to the edges of breeding colony where their nests are more prone to predation (Author, pers. obs.). The establishment of several large (over 50 pairs) Common Tern colonies, with suitable habitat for nesting Roseate Terns, would go a long way to reducing predation rates of tern chicks and eggs, and provide returning Roseate Terns with the chance of optimum breeding success.

6. Conclusions and Recommendations

Common Tern breeding distribution around the Isles of Scilly in 2003 is somewhat fragmented, with three colonies of around 20 pairs and a number of other sites containing lesser numbers of breeding birds. A minimum of 83 pairs bred in total and raised just 36 chicks to fledging, producing a productivity ratio of 0.43 chicks per pair. This figure is still significantly lower than the 0.66 suggested by Norman Radcliffe of the RSPB, and considerably less than the 0.76 to 1.35 ratio experienced at Irish Sea Common Tern colonies between 1997 and 1999, where Roseate Terns also breed in large numbers (Newton and Crowe, 2000). The reason for this low productivity ratio on Scilly is predation as, only 40% of eggs hatched, and just 35% of hatched eggs fledged. This is roughly half the 90% of eggs hatching rate, and the 69% of chicks that hatched survived to fledging rate suggested by Hume (1993). Increasing the overall productivity of Common Terns in Scilly is essential if large tern colonies are to be formed.

Predation rates of eggs and chicks were high in Scilly in 2003. Close to 30% of eggs laid are thought to have been predated, with the majority of these taken by large gulls. If terns are to achieve optimum productivity in Scilly then reducing predation rates of eggs and chicks is essential. Predation by other species such as Carrion Crows and Oystercatchers requires further study.

Food availability does not seem to be a limiting factor in Common Tern breeding success at the present time. An average food catch rate of 1 item to the colony per pair per hour, an average egg size of 47mm long by 35 mm wide, and an average chick growth rate of 10 grams per day on Scilly in 2003 all compare favourable with studies by Hume (1993) and Sorakite and Budrys (2000).

If Roseate Terns are to return to breed successfully in Scilly then, a strong, successful Common Tern colony is seen as an essential part of their recovery plan. Roseate Terns are subject to much inter site movement between years in the UK. For example, 70 pairs of Roseate Terns bred on Coquet Island in Northumberland in 2003, as opposed to less than ten in 2000 (Birdguides website) and it is possible the same may happen on Scilly in the future. What needs to be ensured is that when Roseate Terns do return to Scilly they are given the chance to have a successful breeding season and thus return again in the following years. Therefore the following recommendations are made for future work:

- An intensive study period of between 3 and 5 years is required before any truly meaningful patterns of Common Tern productivity and distribution can be identified and addressed.
- The creation of optimum Common and Roseate Tern nesting habitats via the aid of planting, nest box placement and sand application.
- The destruction of gull and oystercatcher eggs and nests within the vicinity of tern colonies.
- An in depth study into gull population trends around tern colonies.
- Further study on the impacts of other predators present around tern colonies.
- Expansion of colony areas by management and clearance of invading vegetation.
- Involving the Tresco Estate in the project.
- Look at ways of discouraging terns from nesting on low lying offshore islands, or ways of improving these sites.
- Base line monitoring of food availability.
- Continue awareness raising campaign and tern sightings board.
- Continue rat control and review practice next year.
- Identify and improve sites where colonies of 50 plus Common Terns can nest.
- Discourage human presence around tern colonies.

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8. Appendix

8.1 Summary of Abbreviations

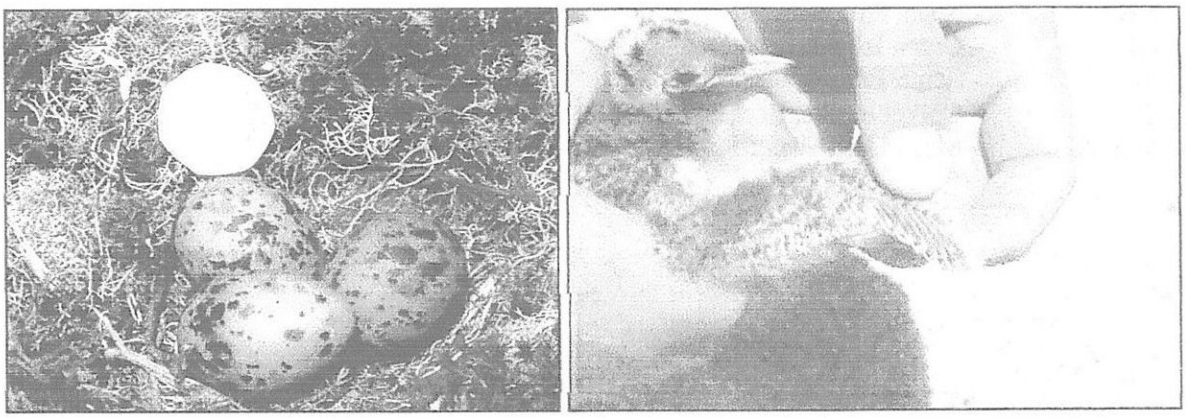
NCC	- Nature Conservancy Council (now EN)
RSPB	- Royal Society for Protection of Birds
EN	- English Nature (previously NCC)
UKBAP	- United Kingdom Biodiversity Action Plan
ISBR	- Isles of Scilly Bird Report
ISBNHR	- Isles of Scilly Bird and Natural History Review
RTSRP	- Roseate Tern Species Recovery Programme
ISWT	- Isles of Scilly Wildlife Trust (previously ISET)
ISET	- Isles of Scilly Environmental Trust (now ISWT)
CSG	- Channel Seabirds Group
CD	- Compact Disk
pp/ph	- Per pair per hour (applied to food catch and mobbing observations)
ATB	- Appletree Banks, Tresco
SI	- Skirt Island, Tresco
FI	- Foreman's Island, Tresco
CD	- Castle Down, Tresco
NH	- North Hill, Samson
GI	- Green Island, Samson
SE	- South End, Annet
CR	- Colvel Rocks, Bryher
MHWS	- Mean High Water Springs

8.2 Egg Biometrics

	Length (mm)	Breadth (mm)	Volume (ml)	Fresh mass (ml)	Egg Size (S=LW2)
Ave. Egg Biometrics	46.81	34.74	27.17	29.24	56497.50
Max. Egg Biometrics	50.5	37.1	32.44	34.91	69508.71
Min. Egg Biometrics	44.1	32.9	22.96	24.72	47734.28

Figure 13: Variations in egg biometrics for Common Terns (*Sterna hirundo*) on Tresco, Annet and Samson in 2003.
*Volume is determined using the equation: Volume = 0.00048*Length*(Breadth squared) as defined by Ratcliffe and del Nevo in the RSPB Roseate Tern Species Recovery Programme in 1995.
** Fresh mass is determined using the equation: Fresh Mass =0.0005166*Length*(Breadth squared) as defined by Ratcliffe and del Nevo in the RSPB Roseate Tern Species Recovery Programme in 1995.
*** Egg size is determined using the equation: Size (S) = Length* (Breadth squared) as defined by Sorokaite and Budrys in 2000.

Egg weight and clutch size are related to the amount of fish eaten by the female before egg laying, with larger, heavier eggs standing a greater chance of successful fledging (Hume, 1993). Figure 13 shows that egg size varied considerably on Scilly in 2003. Average egg size as given by Hume is 41mm long by 31mm wide; all Scilly eggs were larger than this. A total of 15 eggs were measured at three colony sites in the first week of July to determine an average egg mass of 29 ml. Insufficient measurements were made to enable a comparison of eggs sizes at the different sites.



Photographs 15 and 16: A three egg clutch of Common Tern eggs on Appletree Banks, Tresco (left) and a Common Tern chick about to be measured on Green island, Samson (right).

8.3 Chick Biometrics

Chick Age (Days)	0-4 days	5-7 days	8-10 days	10+ days
Ave. weight (g)	17 g	53 g	72 g	108 g
Max. weight (g)	22 g	66 g	95 g	-
Min. weight (g)	10 g	45 g	62 g	-

Figure 14: Variations in weight of Common Tern (*Sterna hirundo*) chicks of different ages on Tresco, Annet and Samson in 2003.

A total of 15 chicks were weighed at three colony sites ranging in age from one to 14 days. Hume in 1993 suggested an average chick weight of 11-17 grams at hatching, followed by an initial weight loss, before adding weight thereafter. On Scilly weighing revealed that chicks put on approximately 10 grams of weight a day for the first ten days after hatching. The wing measurement data revealed that wing length, from carpal joint to the tip of the longest primary, grew approximately 10mm each day.

8.4 Tables and Graphs

Figure 1: Summarising breeding numbers, egg laying, predation, abandonment and fledging success for all known Common Tern (*Sterna hirundo*) clutches at breeding sites in the Isles of Scilly in 2003.

Figure 2: Showing the outcome of all 62 Common Tern eggs discovered at the Appletree Banks, Tresco colony in 2003.

Figure 3: Showing the outcomes of all 22 Common Tern eggs discovered at North Hill, Samson colony during 2003.

Figure 4: Showing the outcomes of all 66 Common Tern eggs discovered at South End of Annet colony during 2003.

Figure 5: Showing summary of breeding success of the eight Common Tern colonies discovered in Scilly in 2003.

Figure 6: Number of mobbing observations for selected species at the three Common Tern (*Sterna hirundo*) study colonies in Scilly during 22 hours of predator observation watches in 2003.

Predated Common Tern chick parts on Green Island, Samson (left), and dead adult Common Tern found on Skirt Island, Tresco (right). Both photographs taken by Ben Lascelles

Figure 7: Showing total numbers of mobbing observations for the three study sites, and the resulting average number of mobbings made per pair per hour.

Figure 8: Showing size of food items observed being taken to the three study sites. Catch rates are defined as the average number of food items taken to the colony per pair per hour (pp/ph) for the breeding season as a whole.

Figure 9: Variation in catch rates throughout the breeding season at the Appletree Banks, Tresco colony. Data shown is the average number of food items brought to the colony per pair per hour (pp/ph) on each visit to Appletree Banks.

Figure 10: Showing yearly arrival and departure dates of the Roseate Tern (*Sterna dougallii*) in Scilly 1972-2002

Figure 11: Showing number of visits, times entered, and duration of visits to different Common Tern (*Sterna hirundo*) colonies on Scilly, summer 2003.

Figure 12: Numbers of breeding pairs of Common, Roseate, and Sandwich Terns around the Isles of Scilly 1969-2003. Also showing linear regression lines to view overall trends for Common and Roseate Tern decline.

Figure 13: Variations in egg biometrics for Common Terns (*Sterna hirundo*) on Tresco, Annet and Samson in 2003.

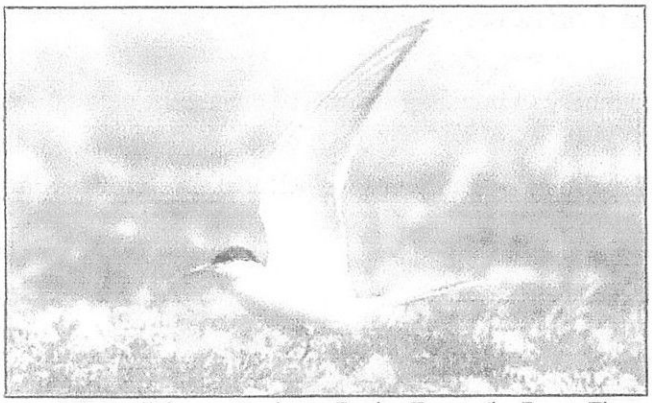
Figure 14: Variations in weight of Common Tern (*Sterna hirundo*) chicks of different ages on Tresco, Annet and Samson in 2003.

8.5 Photographs

Front Cover: Arctic Tern (*Sterna paradisea*), Sandwich Tern (*Sterna sandvechicus*), and courting pair of Common Tern (*Sterna hirundo*) all by Bryan Thomas. Lesser Black- backed Gull (*Larus fuscus*) and 10 day old Common Tern chick by Ben Lascelles.

Photographs 1 and 2: Female Common Tern (*Sterna hirundo*) in flight (Ben Lascelles), the shape of an egg can be clearly seen on the birds' belly. Two-egg clutch (Ben Lascelles)

Photographs 3 and 4: Annet (Ben Lascelles), and the tern colony on the southern end of Annet (Bryan Thomas).

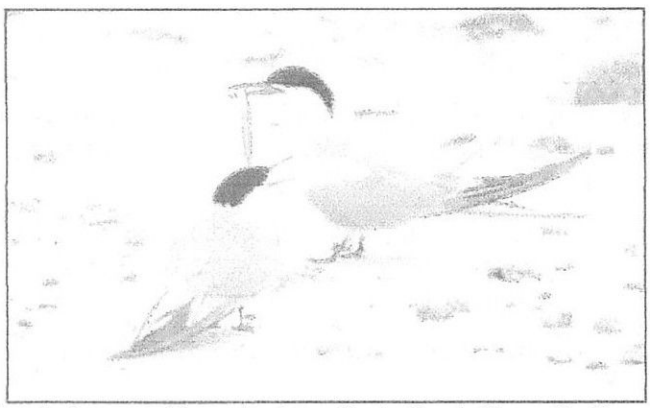


Common Tern alights on Appletree Banks, Tresco (by Bryan Thomas)

Photographs 5 and 6: North Hill, Samson (Ben Lascelles); and Appletree Banks, Tresco with the Abbey in the background (Ben Lascelles).

Photographs 7 and 8: Marked nest on North Hill, Samson (Ben Lascelles); and a Common tern (*Sterna hirundo*) mobs a Lesser Black-backed Gull (*Larus fuscus*) on Annet (Bryan Thomas).

Photographs 9 and 10: Food pass at nest changeover on Appletree Banks, Tresco (Bryan Thomas); and roped-off tern colony on North Hill, Samson (Ben Lascelles).



Food passing during courtship on Appletree Banks Beach, Tresco (by Bryan Thomas).

Photographs 11-14: Green Island, Samson; Skirt Island, Tresco; Colvel Rocks, Bryher; and Foreman's Island, Tresco (all Ben Lascelles).

Photographs 15 and 16: A three egg clutch of Common Tern eggs on Appletree Banks, Tresco (Ben Lascelles), and a Common Tern chick about to be measured on Green Island, Samson (Bryan Thomas).

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