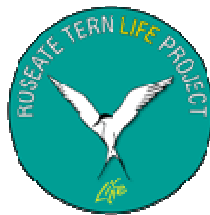


Annual Roseate Tern Newsletter 2016



Roseate tern adult and fledgling at Rockabill ©Brian Burke

Compiled by Chantal Macleod-Nolan
RSPB, Nature Recovery Unit
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Introduction

Welcome to the 10th edition of the Annual Roseate Tern Newsletter, which covers the 2016 breeding season. This newsletter follows the previous successful format developed by a number of RSPB's practitioners and scientists alike throughout late 1980-90s and comprises news and breeding numbers from roseate tern colonies across Europe and North America.

We found it fascinating to read about fates and issues facing roseate terns and colony managers 20-30 years ago. In many cases these issues were similar to the current challenges and it is important to keep learning and passing lessons for future generations of managers. This is also the main aim behind reviving the annual newsletter. Sites and wardens facing common issues (vegetation, predation, disturbance, etc.) can share their experiences along with what management practices have been trialled and which interventions were successful. We hope that this also marks a closer cross-Atlantic collaboration between practitioners working with the roseate tern.

A quick glance back to the most recent newsletter we could locate (No. 9, 1996), although not terribly scientific, provides a comparison of the breeding numbers in 1996 and 2016. There have been many changes since then however, it is clear that there has been an increase of both North American and European populations. *Fantastic!*

A more in-depth look shows that while the population has increased across the United Kingdom & Republic of Ireland; the breeding range of roseate terns has become even more restricted to only three main breeding colonies. Azores have suffered population declines, with their numbers being the lowest recorded since 2005. On a positive note, while France's population has declined, wardens observed a slight increase, with the 2016 breeding figures reaching numbers close to those in 2009. Across in North America, the Canadian population experienced its first increase since the early 2000s, while Great Gull Island (USA) had the highest total since 2000s. Buzzard Bay (USA) also recorded their second highest number of roseate terns breeding.

So, while this year has been filled with both highs and lows, I would just like to thank everyone for their contributions and good luck with the 2017 season. Will it be another record year?

Kind Regards,

Chantal Macleod-Nolan, Roseate Tern LIFE Project Assistant

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Roseate Tern LIFE Recovery Project

The LIFE Programme “Improving the conservation prospects of the priority species roseate tern throughout its range in the UK and Ireland” began in November 2015 and will run for five years, ending in 2020. The projects will focus on the Republic of Ireland and all four countries in the United Kingdom, with a total of 8 project sites (Figure 1). Three sites are active breeding colonies, while the



Figure 1 Roseate Tern LIFE Project Sites

other five are historical nesting sites with intermittent breeding attempts recorded in the last 20 years. The partnership involves the following organisations: Royal Society for the Protection of Birds, BirdWatch Ireland and North Wales Wildlife Trust.

Our demography study (see below) suggests that birds breeding on Rockabill and Lady's Island Lake in Ireland have best productivity and survival chances and therefore the conservation strategy should be focused on improving nesting conditions in these colonies as long as it is possible. Meantime, while the management of the roseate tern colonies continues, it is important to

focus on the historical and other potential sites, which are still of interest to roseate terns. We are expecting that density dependence on main colonies will eventually kick in and we need to be ready for the consequent expansion. Evidence of roseate tern scoping for sites was visible across most sites in 2016, including in the Solent and Southampton Water SPA, where a trail camera on a common tern nest briefly captured sightings of a passing roseate tern and in the Forth Islands in Scotland, a single roseate x common pair nested on Long Craig Island.

Site Restoration Work

The loss of breeding roseate terns from several of these sites has been attributed to the expansion of large gull species and probably changes in sardine management in West Africa. While the population on main colonies increase, the project will improve the quality of the potential receptor sites, by providing enhanced habitat management/ restoration and management of predation and large gulls. This in turn will provide more nesting opportunities for common terns and increases the likelihood of roseate terns recolonising. Planned restoration will include recharging shingle on cheniers, repairing an eroding artificial island, trialling rafts and placing platforms on breakwaters. Additionally, across the island sites, biosecurity plans will be drafted identifying the likely vectors onto the islands and protocol on what steps should be taken in removing them.



Figure 2. Eroded tern islands at Cemlyn Bay in Wales (left) and Blue Circle Island in Northern Ireland (right) to be restored as part of the project.



Figure 3. Shingle recharge area and breakwater for the installation of nesting platforms in Solent and Southampton Water SPA in south England.

Vegetation

Another common threat on roseate and common tern sites is extensive vegetation growth. The nesting areas are streamed every year before the breeding season, but by the time chicks hatch, there is a thick carpet of vegetation impeding feeding and ability of chicks to keep warm (especially in combination with cold and wet weather). We are going to try a few methods, including building artificial surfaces and weakening the vegetation using sea water, but if anyone has good ideas how to suppress the vegetation, they would be more than welcomed.

Predation from large gull species

Gull predation has been one of the main issues for site managers over the years and it does not seem to lessen, quite contrary. We are testing various laser devices (Aero- and Agri laser for example), which seem to be very effective in flashing roosting gulls from sensitive areas. <https://birdcontrolgroup.com/agrilaser-handheld/>. We found a much cheaper Agri-laser sufficient to work on islands, where the hazing distance is no further than 100-200 meters. The devices work best in dull light, so it is important to wear high-visibility vest when hazing, idea is that gulls would associate this outfit with hazing, even without using the laser.

Another device worth mentioning is an electronic gull scarer developed by Wesley Davies of Coquet consisting of a mobile phone with a ringtone set as alarm call of the lesser black-backed gull, which is hooked to a loud speaker. The system can be called every time gulls come too close to tern terraces. We are working on the next generation of these scarers, which will be able to emit alarm calls of various species in semi-automatic mode.



Figure 4: Paul Morrison from Coquet Island presenting the Aero-laser

Demography study

Apart from productivity, the growth of the population is influenced by immigration/emigration, juvenile recruitment and survival of different age groups. This can be estimated from long series of ringing and ring-reading data as almost all chicks are ringed every year and intensive ring-reading is carried out each year on roseate tern colonies. This kind of study was undertaken as part of the project, considering population survey data, productivity and capture-mark-recapture data from Rockabill (ROC), Lady's Island Lake (LIL) and Coquet (COQ) for the period between 1992 and 2015 (Seward *et al.* in prep).

The population projection matrices suggested that the persistence of the populations at LIL and especially COQ are dependent on immigration; at zero immigration COQ population is forecast to decline, at a range of productivity levels. However, Coquet has in recent years become slightly, less dependent on immigration with 51% of all breeding adults in 2016 originating from Coquet. This shows again that the Western-European meta-population of roseate terns require comprehensive international conservation strategies, where focus should be on improving source populations until density dependence effect force birds to disperse.

Ringling is fundamental to understanding these demographic processes, however it adds to the disturbance. To address this issue, we have worked with the British Trust for Ornithology to develop "one ring" comprising both BTO address and special four letter code for easy reading. This will shorten the time required for ringling (previously two rings had to be fitted – BTO and special). So, from 2017 British and Irish birds will wear one ring with four-letter code starting AAAA, AAAB and so on.

Winter mortality

The wintering grounds of roseate terns in Western Africa have historically been an important threat with declining availability of sardines and the presence of trapping by children and fishermen in Ghana. Although trapping of terns was made illegal and a larger proportion of children are now in school, there is a distinct lack of data and therefore it is necessary for the project to determine if this persecution is still ongoing and if so at what scale. The Centre for African Wetland have been undertaking the field surveys in Ghana and currently one incidence of tern trapping has been recorded in September 2016. However, from demography study, we have not detected that the survival of any age groups has changed between 1992 and 2016 and it seems at acceptable levels.

GPS tags and geolocators

There has been a lack of experience in attaching GPS tags on terns, predominantly due to the technological limitations in size of the GPS devices. The remote download, solar-powered tags from Pathtrack (2.5-2.8g) were trialled on 10 Arctic terns in 2016, effectively perfecting the use of technology and attachment techniques. The GPS tags were attached to the upper back using muslin, super-glued to heavily trimmed back feathers. To allow the level of data capture to balance well with recharging, the tags were set to 5-minute interval fixes for a period of 3 hours each day. This was combined with the simultaneous boat tracking in collaboration with Econ Ecological Services Ltd to compare both methods of tern tracking. It is worth noting that there was a decrease in provisioning rates by tagged birds, which was compensated by an un-tagged partner to equal pairs which were not handled at all. Therefore, only one bird per couple should be tagged at the time in this kind of studies. The data from both the behavioural observations and comparison methods are currently being analysed and will be published later this year.

This season, 20 geolocators will be fitted on roseate terns breeding on Rockabill. In 2018, GPS/ boat tracking study will be conducted on Rockabill.

Tern Diet

The Project is currently also collating and reviewing information on the diet composition of terns and potentially analyse spatial and temporal differences, if the long-term data exist for the same species. The conclusion from this work will ideally inform our strategy on potential diet monitoring and develop recommendations for marine management particularly with regards to the sandeel and alternative prey situation in relation to climate change and fisheries. As part of this work over 20-years of diet data from Ynys Feurig and the Skerries will be analysed and published later this year.

Beneficial Use of Dredging

Currently, most dredged material is deposited out at sea, effectively removing sediment from coastal areas, and thereby reducing the ability of shingle islands, shingle beaches, salt marsh, peninsulas and mudflats to accrete material, and thereby keep pace with expected climate-driven rises in sea level rise. The focus of Sea-change in the Beneficial Use of Dredgings project (SeaBUDs) to create a new precedent whereby dredged materials are routinely used to re-charge eroding islands, salt marsh, mudflats and other areas of the coast, and through this provide multiple benefits (for priority species/habitats, flood defence and fisheries). Contact Rosie.Miles@rspb.org.uk.

EU LIFE+ Little Tern Recovery Project

The EU LIFE+ Little Tern Recovery Project is an 11 organisation partnership working together to ensure the little tern's long term future with enhanced management and habitat restoration carried out over 20 sites across England and Wales. This is approximately 75% of the little terns nesting in the UK. The project began in 2013 and will run until 2018. The Little Tern and Roseate Tern LIFE Projects work alongside each other and share experience of similar areas for instance; habitat restoration and predator management. For more information, please contact the project manager: Susan.Rendell-Read@rspb.org.uk

Roseate Tern LIFE Website

The Project website (www.roseatetern.org) has been operational since January 2016 and there have been nearly 2500 visits from over 1500 individual visitors recorded so far. We have also

set up a Facebook page (<http://facebook.com/Roseate-Tern-LIFE-Recovery-Project-1047539198669761/>) and Twitter account (<https://twitter.com/RoseateTernLIFE>).

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2016 Roseate Tern Breeding Figures

Breeding Locations	Breeding Pairs	Productivity
Europe		
Rockabill, Republic of Ireland	1556	0.66
Lady's Island, Republic of Ireland	209	0.93
Dalkey Island, Republic of Ireland	1	0
Larne Lough, Northern Ireland	1	1
Skerries, Wales	1	0
Coquet Island, England	104	0.88
<i>Roseate LIFE Project Site Total</i>	<i>1872</i>	
Brittany, France		
Brittany, France	49-51	0.43
Azores, Portugal	532	nd
<i>Europe Total</i>	<i>2453</i>	
North East America		
Two Brothers, Canada	50	nd
County	18	0.82
Staple Island	3	nd
Other sites in Nova Scotia	2	0
<i>Canada Total</i>	<i>73</i>	
United States of America		
Buzzards Bay, United States of America	2050	1.33
Great Gull Island, United States of America	1858	1.36
Other USA sites	350	
<i>US Total</i>	<i>4258</i>	
<i>North America Total</i>	<i>4331</i>	

nd =no data

Europe

Rockabill (Republic of Ireland)

Rockabill is a small island (0.9ha) situated 7km off the coast of north County Dublin, east-north-east of the coastal town of Skerries. It consists of two small granite islets separated by a narrow channel. The Lighthouse Island (larger of the two islets, also known as The Rock) lies to the south and has, to date, supported the majority of breeding roseate and common terns, while the other islet, The Bill, has held the majority of Arctic terns. Rockabill also supports a small colony of breeding kittiwake and a regionally important colony of black guillemots.

Rockabill Island was designated as a Special Protection Area (SPA) under the EU Birds Directive, and a Statutory Refuge for Fauna under the 1976 Wildlife Act. It is privately owned, however the Rockabill Tern Project (managed by BirdWatch Ireland) has been running since 1989, with 2016 being the 28th season of full-time wardening.

At the beginning of the season, the wardens set up various sections, hides and study enclosures and deployed a total of 759 nest boxes. The removal of vegetation was carefully carried out (as to prevent further soil erosion) throughout the island in order to clear space for nest boxes and open habitat for common terns. In 2016, three new main terraces were

constructed increasing the nesting opportunities for roseate terns. The lower terrace was constructed using a dry stone wall method, and the upper terraces made using steel rebar to hold long wooden boards in place. This work made the substrate much more stable, thus facilitating easier and safer monitoring later in the season. Both the roseate tern and common tern nests were continually monitored and ring reading was carried out at the start of the season from the hides.



Figure 5: Terraces and hide on Rockabill ©Brian Burke

Herring and Great Black-back Gulls were responsible for a relatively high level of predation on Rockabill in 2016 resulting in lower productivity of all tern species. Gulls were also responsible for the very low hatching success of Kittiwakes. Gulls were disturbed and 'moved on' whenever possible, usually by clapping and shouting, though the .22 rifle was used (non-lethal) to disperse gulls from the Bill throughout the season once a license had been issued. This was more or less futile however, as any gulls congregating on the end of the Bill simply flew to the back (northside) when the .22 rifle was used, despite attempts to vary the timing and location of shooting. The predation from other species, most importantly from peregrine falcon and kestrel were lower or similar level compared to other years.

A total of 1556 Roseate Tern primary nests were counted on Rockabill in 2016, the highest recorded to date and an increase of 218 nests on last year's total. The mean clutch size (1.68) was higher than the recent average and hatching rate was high at 88%, however the productivity of roseate terns was the poorest recorded on Rockabill at 0.66 (especially when compared to the 5-year average of 1.08). An important observation is that in the last 10 years Rockabill's productivity has been steadily declining (except for 2009).

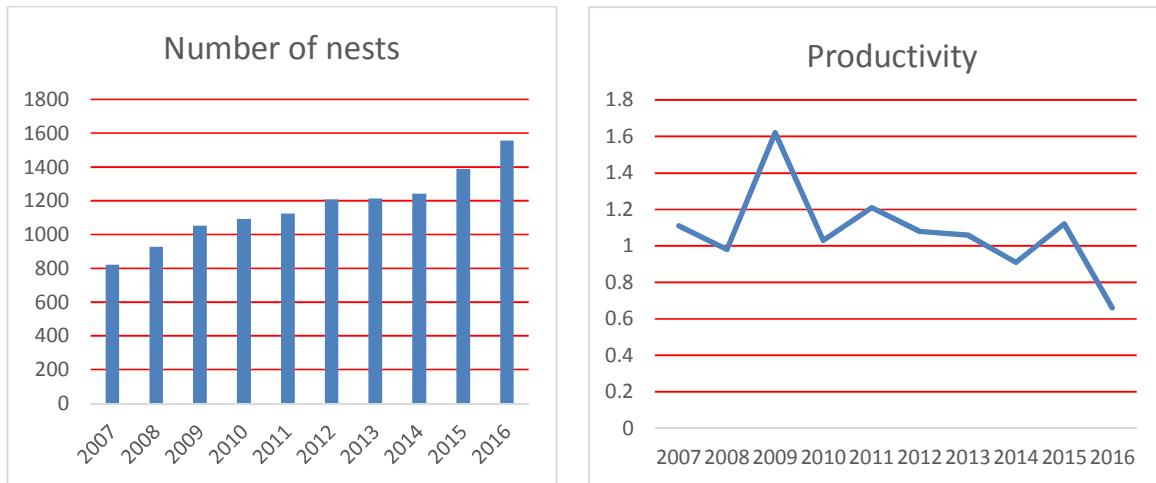


Figure 6: The last 10-year snapshot on trends of the number of roseate tern pairs and productivity on Rockabill

The rings of 1,040 individual Roseate Terns were read and 1,018 of these have been traced. Of those ringed as pulli 96.85% were ringed on Rockabill, with 2.96% from Lady's Island Lake and 0.2% from Coquet Island. Three-year old birds comprised the largest cohort, followed by 4- and 5-year olds. The oldest bird sighted in 2016 was 24-years old (from 1993).

Three all-day (17 hour) watches of roseate tern chick provisioning (nests covered included a mix of one- and two- chick brood sizes) was carried out in a study area, totally 51 hours of observation. Although sandeels tend to be the secondary species group provided to the roseate tern chicks, with clupeids being the primary; in 2016, sandeels were identified as the most numerous prey by 51.3%. Although provisioning rates have been higher in previous years (2012), 2016's rate of 1.20 was considerably higher in comparison to 2015 (0.85). However, given productivity was poor, and virtually no B-chicks survived, it seems likely that there was a food shortage in this part of the Irish Sea even though provisioning rates at successful nests were about normal. At the moment we are looking at this apparently anomalous data in more detail.

The overall nest box uptake was 90.51%, which is the highest ever recorded on Rockabill. This is particularly significant when it is taken into account that there were an increased number of boxes deployed this year. As a result it bodes well for future plans to significantly increase the number of nestboxes deployed on Rockabill in the coming years.

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Lady's Island Lake (Republic of Ireland)

Lady's Island Lake is situated in the extreme southeast of Ireland (County Wexford) and is comprised of a shallow, brackish coastal lagoon separated from the sea by a 200-metre wide sand and shingle barrier. The lake is 3.7 km in length and 1.3 km at its widest southerly point, and covers an area of 466 hectares.

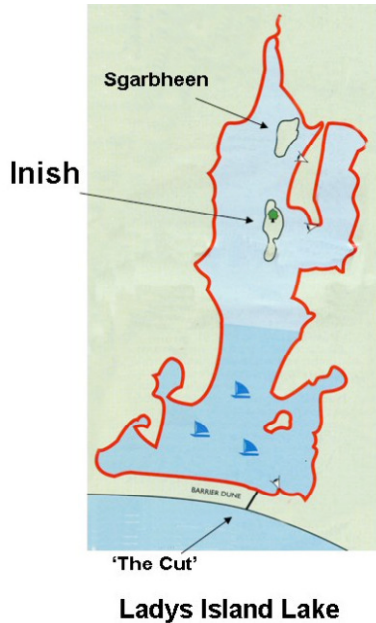


Figure 7: Map of Lady's Island Lake and the two islands, Inish and Sgarbheen ©NPWS

The lake and its two islands, Inish and Sgarbheen, are designated Special Protection Areas (SPA), holding 5 Special Conservation Interest Species; Gadwall (*Anas strepera*), Black-headed Gull (*Larus ridibundus*), Sandwich Tern (*Sterna sandvicensis*), Roseate Tern (*Sterna dougallii*), Common Tern (*Sterna hirundo*), and Arctic Tern (*Sterna paradisaea*).

Lady's Island Lake has also been designated as a Special Area of Conservation (SAC) and Ramsar site. The Inish is privately owned and Scarbheen is assumed state owned and the Tern Conservation Project is managed by National Parks and Wildlife Services (NPWS) of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

The wardens annually place a three-foot high wire mesh fence in the middle of the island, topped with a single electrified wire in order to prevent mammals gaining access to the colony of nesting terns. Wooden nest boxes were deployed and three enclosures were set up to facilitate the collection of biometric data on roseate tern chicks. Three observation hides were also put in place for behavioural and ring reading observations.

Vegetation on the island has been controlled through the management of the water level in Lady's Island Lake. This is done through annually draining the lake uncovering sections of the islands which the breeding terns use. In addition, prior to the breeding season, rat bait was placed in open ended clay and plastic pipes. Under license, the eggs from black-headed gulls, oystercatchers and lesser black-headed gulls were removed from the vicinity of the roseate tern colony to reduce the likelihood of predation. Other predators which have been recorded taking tern chicks and adults include peregrine falcon and great black-backed gulls.

Table 1 Roseate Tern Pairs and Productivity 2004-2016 on Lady's Island Lake © Daly et al., 2016

Roseate Tern Productivity 2004-2016

	nests	eggs	cold depredated eggs	fledged chicks	dead chicks	clutch size	hatching success
2016	209	299	42	225	32	1.43	85%
2015	215	316	29	248	39	1.47	91%
2014	174	293	36	214	42	1.68	88%
2013	150	230	39	159	32	1.53	83%
2012	126	196	58	91	47	1.55	70.4%
2011	155	263	32	231	25	1.7	78%
2010	118	195	10	182	11	1.65	92%
2009	125	210	57	91	62	1.68	72%
2008	109	146	27	119	23	1.34	81.5%
2007	89	153	13	140	33	1.72	76.42%
2006	93	142	13	129	3	1.52	88.7%
2005	74	131	6	125	19	1.77	80.9%
2004	66	118	17	101	19	1.79	69.5%

In 2016, there were 209 breeding pairs of roseate terns at Lady's Island Lake with a productivity of 0.93 and a mean clutch size of 1.43 per egg laying pair. This was six nests less (2.8% decrease) from 2015. Throughout the breeding season 322 special rings were read; of which 200 (62%) nesting terns had been born at Lady's Island Lake, while 122 (38%) roseate tern's natal site was Rockabill.

Tony Murray, NPWS Conservation Ranger – Tony.Murray@ahg.gov.ie

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Dalkey Island (Republic of Ireland)

For the last 25 years, Roseate Tern conservation action in Ireland has focused on management and monitoring at Rockabill Island (Dublin) and Lady's Island Lake (Wexford) and this effort has been rewarded with significant growth in both colonies to a combined total of about 1750 breeding pairs.

Conservation wisdom suggests we should attempt to avoid 'having all our eggs in two baskets' and if possible encourage the expanding population to colonise more sites. This is where Dalkey comes in Dalkey lies between the two main colonies, at the southern end of Greater Dublin Bay, and for a long time it has supported a small colony of mixed Common and Arctic Terns.



Figure 8: Wooden nest boxes deployed on Dalkey Island © S. Newton

The terns use two small ‘satellite’ islets known as Maiden Rock and Lamb Island. The former is bare granite and usually has small numbers of both species whereas the vegetated Lamb Island is definitely preferred by Arctic Terns. Numbers of nests have varied between 20 and 110 with no obvious trends, and up the mid 1990s they were visited by a fair number of Roseate Terns in the post-breeding season (late July – August). Since then we have attempted to attract Roseate Terns to nest, largely by the deployment of wooden nest boxes in the areas used by the other two species.



Figure 9: Roseate Tern pair on Dalkey Island ©S. Newton

Very little happened until 2002 when we discovered a late clutch on Maiden Rock that was thought to be on laid by Roseate Terns. The following summer we definitely had five pairs nesting in boxes and eight chicks were ringed and thought to have fledged. In 2004 we had 11 pairs and 16 young were reared. Unfortunately, numbers dropped to two pairs in 2005 (4 young ringed). Subsequently, a single pair has nested in most years though there were absences in 2007 and 2015, and although pairs laid in 2014 and 2016, these attempts were unsuccessful.



Figure 10: BirdWatch Ireland staff undertaking tern count on Dalkey Island ©S. Newton

As part of the Roseate Tern LIFE Project (2015-2020) we will renew efforts to ‘persuade’ more terns (all three species) to nest at Dalkey and boost their productivity. Action will be focused on habitat management, minimisation of human disturbance, social attraction and control of predators, particularly brown rats (present on Lamb) and large gulls.

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Larne Lough (Northern Ireland)

Roseate terns were lost from Carlingford Lough as a regular breeding species by the early 1990s, with the remaining Northern Irish population at Larne Lough fluctuating in numbers since the mid-1990s. However, there was a steady decline here from 2003 onwards, with just a single pair recorded nesting each year from 2009 to 2013 (Figure 11). In 2014, there were two (possibly three) pairs that nested on Swan and Blue Circle Islands in the lough. In 2015 and 2016, Blue Circle Island supported one pair of breeding roseate terns, both years successfully fledging one chick.

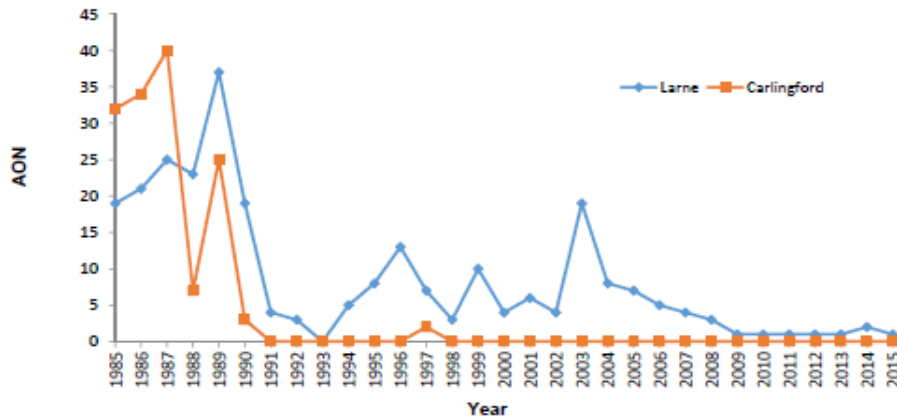


Figure 11: Roseate Tern populations in Northern Ireland (1985-2015) ©BTO

Larne Lough has been designated a Special Protection Area (SPA) for its internationally important breeding seabirds (as well as its wintering light-bellied Brent geese). It is also designated an Area of Special Scientific Interest and Ramsar site. The two islands (Blue Circle Island and Swan Island) within the SPA are managed by the RSPB and also supported 1229 pairs of Sandwich terns and 333 pairs of common terns in 2016.

The warden monitored bird numbers on Blue Circle and Swan Islands and a biosecurity assessment was completed. Monitoring for presence of rats (with wax blocks) and mink (with rafts) was carried out. During the breeding season, numerous tern corpses carrying signs of mammal predation were found, most likely caused by otter or mink. 18 new nest boxes were deployed and vegetation management was carried out towards the end of the season to create more open conditions for terns in 2017.

Currently Blue Circle Island, which was artificially created, is in pressing need of restoration. It no longer functions as an intact island as the lower-lying western section is regularly inundated at high tides. This inundation results in increased erosion, which in turn allows more water to flood the island.

Matthew Tickner, Reserves Ecologist – Matthew.Tickner@rspb.org.uk

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The Skerries (Anglesey)

In 2016, for the first time in 10 years, a pair of roseate terns bred on the Skerries. The Skerries are a group of sparsely vegetated islets, 17 ha in extent. The roseate tern pair was discovered very late into the season and they produced a single chick which was found by the wardens on the 6th August. This juvenile was 15 days old on the day the wardens left, but two subsequent visits to the island indicate that it is almost certain to have been abandoned by the parents before fledging. The previous recorded breeding attempts on the Skerries were in 2006 with one pair and two pairs nesting in 2003. On both occasions, there were of either one or two roseate tern pairs. In 1990, there were 7 pairs recorded.

Regarding the breeding Arctic tern population, as of 2016, there were 3816 nests recorded along with 290 pairs of breeding common tern on the Skerries. Mortality was highest ever recorded at the site, including high levels of predation, with great black-backed gull, herring gull and raven taking large numbers from the colony. This season saw the mortality of 471 adult Arctic Terns almost certainly from botulism, the source of which has not been ascertained. At least 355 juveniles (3 weeks old and above) were also found dead in similar circumstances to the adults.

Prior to the breeding season in 2016, the wardens built 6 small terraces by levelling ground by hand and surfacing with shingle or loose material (mainly rubble and clinker) and placed about 43 roseate tern boxes on them. In addition 7 roseate tern decoys were made by hand from clay, painted, and placed on one of the terraces. A roseate tape lure was also borrowed from Natural Resources Wales and operated during the early part of the season; however it failed after a week or two and was never successfully repaired.



Figure 12: Roseate Tern decoys and nest boxes on newly created terraces on the Skerries © I. Sims

The Skerries is part of the *Ynys Feurig, Cemlyn Bay and the Skerries SPA* and all three areas are designated for the four internationally important breeding tern species present. They are all Site of Special Scientific Interest as well. Cemlyn Bay is also designated as a Special Area of Conservation.

Ynys Feurig

Ynys Feurig consists of a series of low-lying islands extending about 1 km out to sea from a sandy shore. Roseate terns last bred on Ynys Feurig in 2012 with one pair producing two fledglings. They previously nested in 2006 (one pair), 2002 (7 pairs), 2001 (7 pairs), 2000 (three pairs) and 1999 (3 pairs). From 2010 to 2012, there were over 500 pairs of Arctic terns nesting on Ynys Feurig, however in 2016 they estimated that there were only between 238-287 breeding pairs. This year, on Ynys Feurig, the estimated range of breeding pairs of common terns was 116 and 165, which was less than the 190 pairs in 2015. The site is managed by the RSPB.

Cemlyn Bay

At Cemlyn Bay, a shingle storm beach forms a bar between a tidal lagoon and the open shore and managed by North Wales Wildlife Trust. Roseate terns have not bred at Cemlyn since 1994, however in 2015 a single pair spent some time on the reserve, displaying and inspecting nest sites. Over the last five years Arctic terns have averaged 40 pairs and common terns 119 pairs; the recent trend has been downwards. On the other hand Sandwich terns are on an upward trend with a five year average of 2135 pairs with 2595 estimated in 2016.

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Coquet Island (England)

Coquet Island is located about one mile off the coast of Northumberland in north-east England. It is a small, flat-topped island with a plateau extent of c. 7 ha. The island is surrounded by low sandstone cliffs and a broad rock platform at low tide, partly the result of former stone quarrying. Coquet Island is a Special Protection Area (SPA) and a Site of Special Scientific Interest (SSSI) designated for its inter/nationally-important populations of breeding seabirds. The island is managed by RSPB, to benefit the four tern species (roseate, common, Sandwich and Arctic), puffins, eiders, kittiwakes, fulmars and a few pairs of Mediterranean gulls.

At the start of the season, the roseate tern terraces were prepared with the re-instating of nest boxes into their allocated locations and adding new boxes into additional nesting spaces. The terrace is resurfaced with shingle collected from the island foreshore annually to restrict parasitic life cycles and reduce vegetation growth. The common tern nesting plots around the terraces were cleared of broad leaves, strimmed and mown to a low sward.



EU LIFE funding provided a trial of recycled plastic boxes (longer lasting) and associated subsurface

Figure 13: Resurfacing the roseate tern terraces © P. Morrison

of recycled interlocking plastic paving slabs (weed suppressing).

The subsurface suppressed all vegetation, and while the plastic nest boxes appeared successful, they are to be monitored for occupancy and temperature (temperature probes) over a trial period of several seasons. Overall 216 nest boxes (wooden sloped roof, wooden straight roof and plastic sloped roof) were put out Coquet.

Predation was comparable to previous years in the most part, and the pressures from large gulls were monitored as part of a PhD through Newcastle University. The tern/gull exclusion zone was well defined with only a few pairs venturing into the tern area and gull control was carried out under licence on several occasions. An Aerolaser was made available to the wardens from mid-season, and proved effective at lifting the large gulls from north of the island, however this was problematic as some displaced gulls then intruded on the tern areas. Some prospecting/nesting gulls responded to the 'dot', but disturbance using Aerolaser was not continued as it interfered with the large gull study. It is thought that the laser would be of great use in the pre-season gull disturbance.

Throughout the season, 24-hour surveillance over the colony was maintained, including continuous CCTV coverage. There were many 'low level' day time incidents involving recreational canoeists which were dealt with amicably, causing minimal disturbance to nesting seabirds.

In 2016, the seabird population remained in good numbers, although poor weather across the spring and early summer held back some adults from nesting and led to poor productivity throughout. The tern plots were in good condition at egg laying stage, with a low sward and small bare patches throughout. The wet and humid conditions led to a strong early growth, and by mean hatching the sward was 20cm leaving little room for chick mobility and hindering many adults from taking flight. Dud eggs and small chick mortality was high in the vegetated colonies this year, while the beach colonies did notably better.

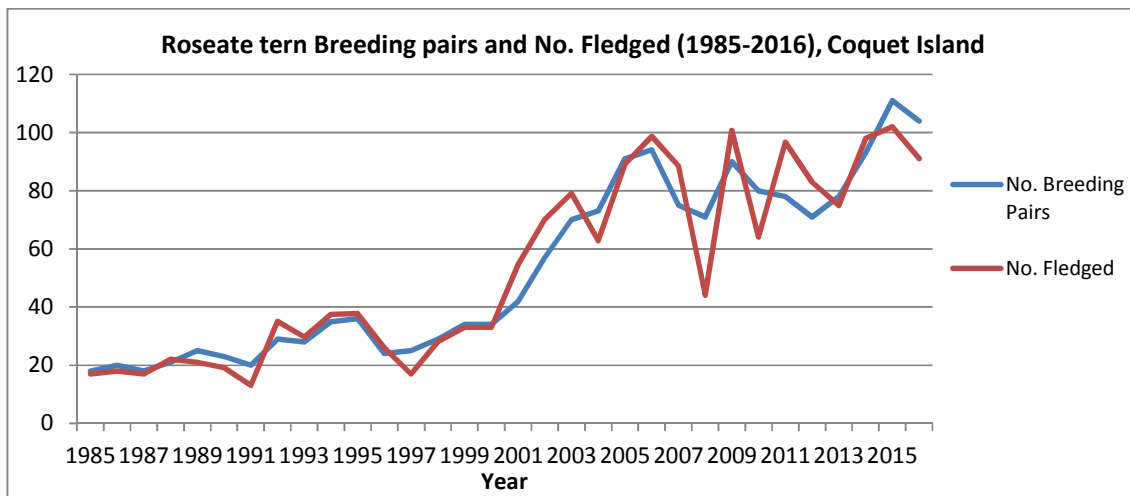


Figure 14: Roseate Tern Breeding pairs and No. Fledged (1985-2016) on Coquet Island

In 2015, Coquet had over 111 pairs of roseate terns nesting on the island, which was the first time it had surpassed the 100 pair mark in 40 years. Although it was a 6.3% decrease, this success was repeated in 2016, with 104 roseate terns. The decrease in population is most likely due to the high northerly winds and precipitation throughout the spring and early

summer. Figure 14 shows the number of breeding pairs of roseate terns at Coquet and the number of fledglings produced between 1985 and 2016.

In 2016, the productivity was 0.88, which was lower than its productivity in 2015 (0.92), however the mean productivity on Coquet (between 1994 and 2016) for most years has been quite stable at 1.01. The mean clutch size in 2016 was 1.2 which was the second lowest recorded in modern records with many nests containing only a single egg. There were no records of 3 clutch nests and few pairs managed to fledge two young.

197 unique ring sequences of adult terns were recorded nesting on Coquet, and for the first time the proportion of Coquet fledged birds exceeded the adults from other sites (53% to 47%).

The common tern population increased from 1,160 in 2015 by 3.5% to 1,201 pairs. The Arctic tern population increased from 1,472 in 2015 by 1.3% to 1,490 pairs. Both species had clutch sizes below average, and a below average productivity of 0.6 chicks fledged per pair.

Although there is no public access onto the island, boat trips run from Amble by a local boat company which allows all species to be seen and enjoyed from a safe distance offshore. As of 2016, close views of the roseate terns live are now able to be viewed during the breeding season remotely on the internet (www.rspb.org.uk/coquetlive). In addition, a company called From the Notebook produced a Roseate Tern Pale Ale, to celebrate exceeding a 100 nesting rosy pairs last year. The beer was brewed locally by Credence Brewers and was launched at the event along with a beer tasting experience, with 10p from every bottle sold being donated to the RSPB's work on Coquet Island.



Figure 15: Live Webcam on Coquet Island © RSPB

Paul Morrison, Coquet Island Warden - Paul.Morrison@rspb.org.uk

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Brittany (France)

In France, the breeding roseate tern population has historically only been located in the region of Brittany (Bretagne). The population followed a similar declining trend to the rest of the Europe, however it continued to decline whereas several other countries' breeding populations stabilised/increased. France had an average of 360 breeding pairs in 1954-1973, however after 1980, there were between 90-100 breeding pairs. In 2005, there were only 70 pairs breeding in France, the majority located on Ile aux Dames in the bay of Morlaix, which has been their main nesting site since 1986.

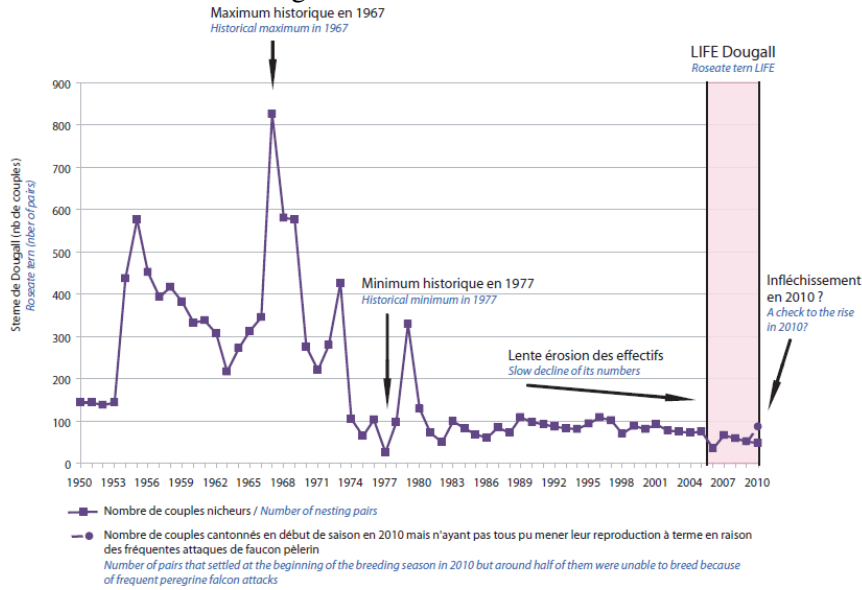


Figure 16: Number of Breeding Roseate Tern pairs in Brittany 1950-2010 ©Bretagne Vivante

Between 2005 and 2010, the LIFE Nature Programme ‘Conservation de la sterne de Dougall en Bretagne,’ which focused on roseate terns in Brittany, was carried out across five project sites where historically roseate terns had nested (Figure 10). The project partners were the NGO Bretagne Vivante – SEPNEB, the Conseil général des Côtes d'Armor (county council) and the Phares et Balises in Concarneau (departmental management of the territories and the sea of Finistère).

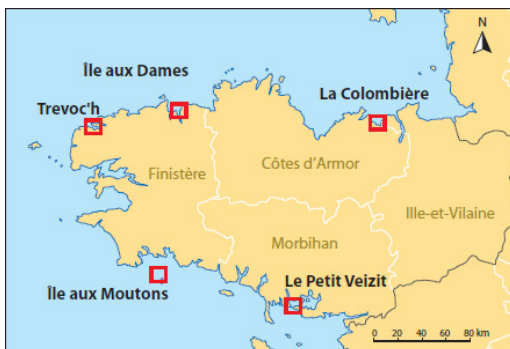


Figure 17: The project sites for the LIFE programme in Brittany, 2005-2010 ©Bretagne Vivante

The LIFE project concluded that L’Ile aux Dames, La Colombière and L’Ile aux Moutons were favourable to the species, with the latter site having successful breeding attempts from one pair in 2010 and a couple in 2011. The last breeding attempt had been 2006 (Hennique, S & Quemmerais-Amice, G, 2010). However from 2012 onwards the number of breeding roseate terns on L’Ile aux Moutons and La Colombière increased. It is possible these terns were displaced as no roseate terns nested on their main breeding site Ile aux Dames in 2011 (Yann Jacob, pers. comm., 2016).

Table 2. Location of Roseate tern breeding sites

	Location	Habitat	Other species present	Designation	Managed
Chausey	-1,829166667 48,87361111	Marine island	?	IBA FR2510037	GON
La Colombière	-2,206111111 48,62361111	Marine island	<i>Haematopus ostralegus</i> <i>Thalasseus sandvicensis</i> , <i>Sterna hirundo</i> , <i>Anthus petrosus</i>	IBA FR5310052 Protected area by law	Conseil départemental Côtes d'Armor Bretagne Vivante
Trégor-Goëlo	-3,056934788 48,86717786	Marine islands	?	IBA FR5310070	GEOCA
Sept-îles			?	IBA FR5310011 National Nature Reserve	LPO
Île aux Dames	-3,894444444 48,69166667	Marine island	<i>Egretta garzetta</i> <i>Phalacrocorax carbo</i> <i>Phalacrocorax aristotelis</i> <i>Larus argentatus</i> <i>Larus fuscus</i> <i>Larus marinus</i> <i>Thalasseus sandvicensis</i> , <i>Sterna hirundo</i> , <i>Haematopus ostralegus</i> , <i>Anthus petrosus</i>	IBA FR 5310073 Protected area by law	Conservatoire du littoral Bretagne Vivante
Banneg	-5,012552468 48,42807046	Marine island	<i>Hydrobates pelagicus</i> <i>Puffinus puffinus</i> <i>Phalacrocorax carbo</i> <i>Phalacrocorax aristotelis</i> <i>Larus argentatus</i> <i>Larus fuscus</i> <i>Larus marinus</i> <i>Haematopus ostralegus</i> , <i>Charadrius hiaticula</i>	IBA FR5310072 National Nature Reserve	Bretagne Vivante Iroise Natural Marine Park
Kemenez	-4,899276143 48,37523713	Marine island	<i>Larus argentatus</i> <i>Larus fuscus</i> <i>Larus marinus</i> <i>Thalasseus sandvicensis</i> <i>Sterna hirundo</i> <i>Sternula albifrons</i> <i>Charadrius hiaticula</i> <i>Oenanthe oenanthe</i> <i>Anthus petrosus</i> ...	IBA FR5310072	Conservatoire du littoral Iroise Natural Marine Park Bretagne Vivante
Île aux Moutons	-4.02918602340368 47.775161725284789	Marine island	<i>Thalasseus sandvicensis</i> <i>Sterna hirundo</i> <i>Sternula albifrons</i> <i>Haematopus ostralegus</i> <i>Charadrius alexandrinus</i>	IBA 5310057	Bretagne Vivante Conservatoire du littoral

Wardening: On La Colombière, Île aux Dames, Île aux Moutons, there is regular wardening from May to August, while permanent wardening is set up on Sept-Îles, Banneg, Kemenez

The management of gulls has been carried out on three sites; with the destruction of nests on both La Colombière and Île aux Moutons; destruction of nests and killing adults on nest with poison until 2013 on Île aux Dames.

Avian and mammalian predators have been recorded on several of the above sites; with foxes on La Colombière and American mink on Île aux Dames. Brown rats have been discovered on Chausey (Gallien F. 2011), Trégor Goëlo (Geoca) and there are permanent bait stations targeting rats on La Colombière and île aux Dames. Peregrine falcons have also been present as predators on La Colombière, Sept-îles, île aux Dames and Banneg ; while great black-backed gulls only on Banneg and lesser black-backed gulls on île aux Dames.

The wardens at La Colombière, île aux Dames and île aux Moutons annually manage the vegetation and place nest boxes out. Shingle has also been added to the nesting habitat on île aux Moutons.

Table 3: The last 10-year snapshot on trends of the numbers of pairs and productivity

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Chausey	P.	0	0	0	0	6-7	0	0	0	1	0
	Y.	-	-	-	-	0	-	-	-	0	-
	Y/P.	-	-	-	-	-	-	-	-	-	-
La Colombière	P.	7	1	0-1	(10)	3-5	11-16	15	17-18	0	0
	Y.	4-5	0	0	0	0	12	15	10-12	-	-
	Y/P.	0,64	-	-	-	-	0,88	1,00	0,63	-	-
Trégor-Goëlo	P.	0	0	0	0	0	0	0	0	0-2	0
	Y.	-	-	-	-	-	-	-	-	0	-
	Y/P.	-	-	-	-	-	-	-	-	0,00	-
Sept-îles	P.	0	0	0	0	1-2	0	0	0	0	0
	Y.	-	-	-	-	0	-	-	-	-	-
	Y/P.	-	-	-	-	0,00	-	-	-	-	-
Île aux Dames	P.	56-62	57	50-54	47	0	0	0	0	0	0
	Y.	31-34	13-22	32-38	15	-	-	-	-	-	-
	Y/P.	0,55	0,31	0,67	0,32	-	-	-	-	-	-
Banneg	P.	0	0	0	0	0	0	0	0	3	0
	Y.	-	-	-	-	-	-	-	-	0	-
	Y/P.	-	-	-	-	-	-	-	-	0,00	-
Kemenez	P.	0	0	0	0	0	0	0	0	0	3-5
	Y.	-	-	-	-	-	-	-	-	-	0
	Y/P.	-	-	-	-	-	-	-	-	-	0,00
Île aux Moutons	P.	0	0	0	1	1	21	13	13	26	46
	Y.	-	-	-	1	0	20	6-8	5-6	16	13-30
	Y/P.	-	-	-	1,00	0,00	0,95	0,54	0,42	0,62	0,47
Total France	P.	63-69	58	50-55	48	9-11	33-38	28	30-31	30-32	49-51
	Y.	35-39	13-22	32-38	16	0	32	21-23	15-18	16	13-30
	Y/P.	0,56	0,30	0,67	0,34	0,00	0,90	0,79	0,54	0,52	0,43

2012: 1pair Roseate tern x Common Tern at Gravelines (2,136332989 ;51,01839561)

Y = young fledged; P = breeding pairs

Roseate tern monitoring in Brittany is coordinated by the Orom (Observatoire régional des oiseaux marins en Bretagne / Seabird Monitoring Programme in Brittany) lead by Bretagne Vivante (Bernard Cadiou: all species of seabirds and Yann Jacob: terns).

In 2016, Kemenez supported 3-5 pairs of roseate terns and there were 49 pairs on île aux Moutons. The mean clutch size for île aux Moutons was 1.84 egg/pair. This was calculated

from a total of 85 eggs for 46 pairs of which 7 nests had 1 egg and 39 nests contained 2 eggs. For Kemenez there was no data. Productivity was determined as 0.43 with a range of 13 to 30 young fledged from 46 pairs. As a result the minimum survival rate was 0.15 and the maximum was 0.35.

There was no predation in 2016 and weather was fair. It is probable that a lack of food resource and possible lack of experience of some of the breeding adults could be affecting the productivity. A study of foraging ecology and diet has been conducted during 2012 to 2014 seasons (Cadiou et al. 2015).

On the 22/06/2016, only 31 chicks were ringed (Bernard Cadiou, Yann Jacob). A lot of young chicks seemed to die during or just after hatching. We have had a lot of difficulties to estimate the number of fledged young because of the vegetation development.

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Azores (Portugal)

“Population trends in Europe and North America are well documented, but in the Azores annual monitoring only started in 1989; the population in the archipelago has fluctuated since then between 400 and 1,200 pairs (Neves, 2005).”

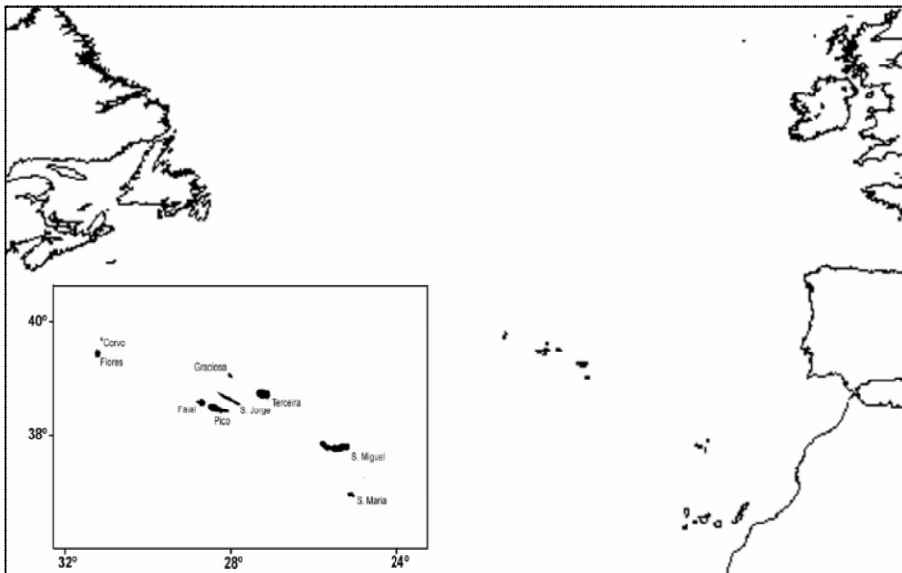


Figure 18: Location of the Azores archipelago in the North Eastern Atlantic © Neves, 2005

“The Azores archipelago is located on the Mid-Atlantic Ridge (36°-39°N', 25°-31°W) and lies c. 1500 km from the Portuguese mainland and c. 1900 km from the most westward point of Newfoundland, Canada. The climate is subtropical and oceanic (Monteiro 2000). It comprises nine volcanic islands forming three groups: “western” (Corvo and Flores), “central” (Faial, Pico, São Jorge, Graciosa and Terceira) and “eastern” (São Miguel and Santa Maria). Over 600 km separates the most easterly and westerly of the island chain. All the islands are of volcanic origin, dating from the Miocene to the present (Neves, 2005).”

Table 4 Roseate tern breeding pairs in the nine islands of the archipelago over the period 1989-2005 ©Neves, 2005

	CVU	FLW	FAI	PIX	SJZ	TER	GRW	SMI	SMA	Total
1989	0	480	0	23	5	93	275	0	116	992
1990	19	455	60	50	2	95	150	0	220	1051
1991	**	694	90	21	135	5	74	0	102	1121
1992	**	316	20	6	10	**	119	**	279	750
1993	**	122	0	0	0	21	13	**	223	379
1994	**	249	0	3	0	11	24	**	241	528
1995	**	599	70	32	0	114	13	**	200	1028
1996	83	419	138	17	37	84	30	**	389	1197
1997	0	489	0	28	0	120	27	**	315	979
1998	**	432	0	22	**	188	34	**	198	874
1999	0	215	0	8	0	125	1	**	167	516
2000	0	262	0	15	5	351	31	**	114	778
2001	0	315	0	7	30	342	25	0	95	814
2002	8	372	0	0	2	269	133	6	201*	991
2003	0	185	19	0	0	58	231	125	134	752
2004	0	391	17	0	17	32	402	33	**	892
2005	0	141	1	9	0	0	130	16	92	389
Mean	10	361	25	14	15	119	101	23	192	826
StDv	25	158	41	14	34	113	112	43	88	249

* This value is probably an over estimate. There was much egg predation by Starlings and some nests counted later in the breeding season were probably second attempts.
 ** No data available

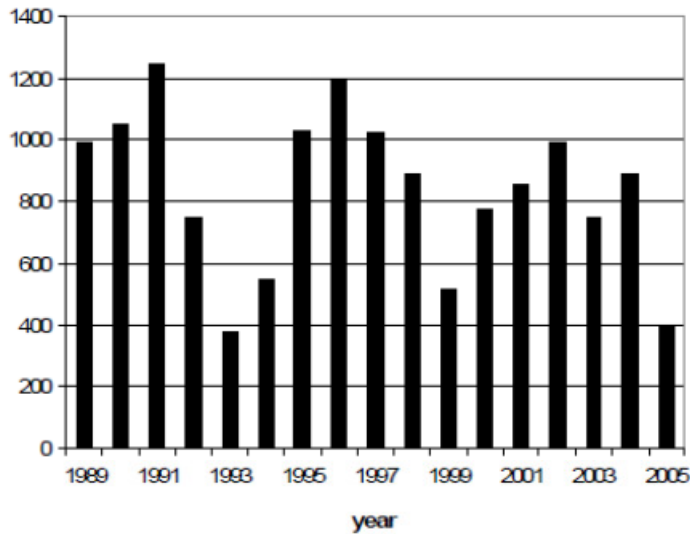


Figure 19: Breeding Number of Roseate Terns in the Azores over the period 1989-2005 (Neves, 2005)

In 2016, 532 Roseate Terns breeding pairs were estimated in the Azores archipelago. Due to adverse weather conditions, the census couldn't be conducted at the best timings in all the islands and in some cases this might have resulted in some underestimation. Numbers of Roseate Terns were the lowest recorded since 2005 and were down 42% from the average of the last three years. The largest colony, Praia islet (Graciosa island), held 180 pairs; however, at this colony, predation by the European Starling (*Sturnus vulgaris granti*) remains intense. High levels of human disturbances and egg and chick predation (cats and rats) were also detected at two colonies in Terceira, Serreta and Contendas.

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North East America

Roseate tern summary for Canada

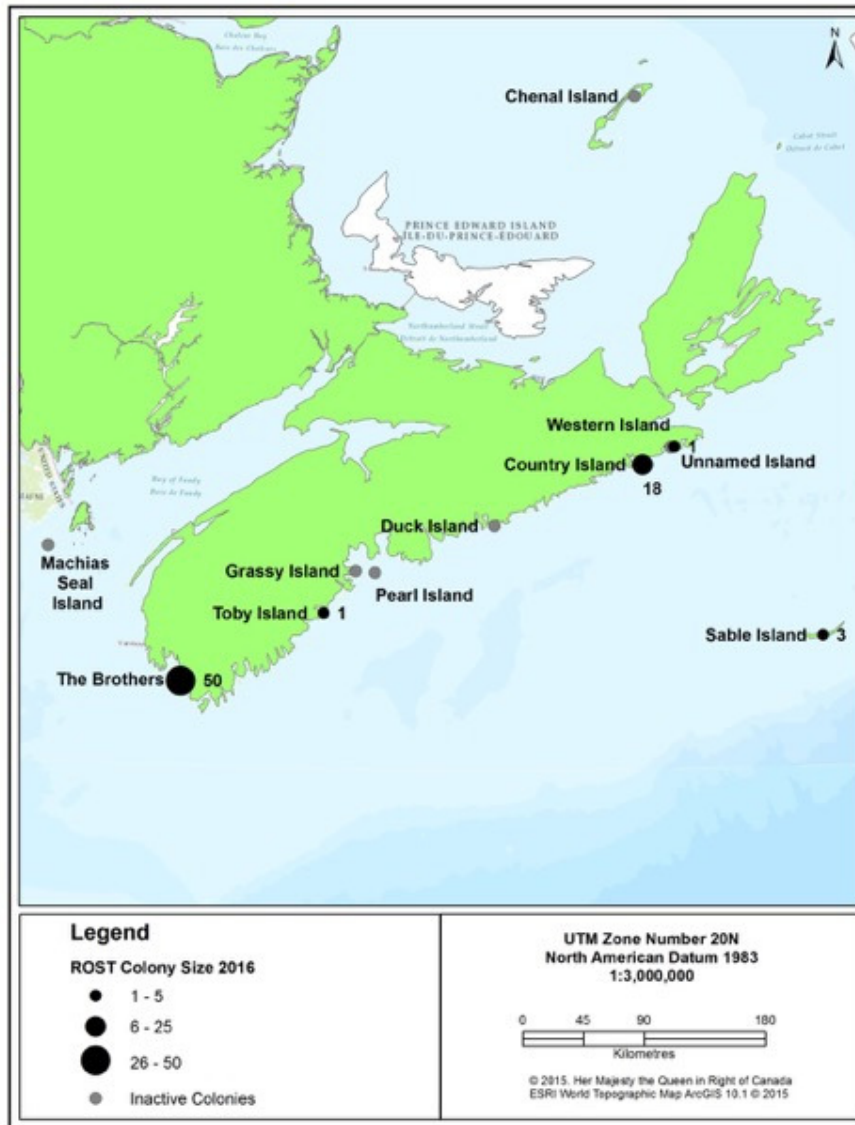


Figure 20: Canadian Colonies with Roseate Terns in 2016 (black) and inactive colonies (grey).

Roseate Terns are listed under the Canadian federal Species at Risk Act (SARA) and under provincial legislation in Nova Scotia (the Nova Scotia Endangered Species Act) as Endangered and the species is likely to be designated under the Quebec Act respecting Threatened or Vulnerable Species. A recent federal Critical Habitat Order applies prohibitions against the destruction of critical habitat at The Brothers, Country, and Sable Islands.

Colony descriptions

North Brother Island is the primary breeding colony for Roseate Terns in Canada. The island lies approximately 0.7 km offshore, is low-lying, and is formed of sediments from sand to

boulder size cobble with a small vegetated area on remnant till and guano. A small tidal pond in the central depression of the island rarely dries out. North Brother Island provides approximately 1,200m² of nesting habitat for Arctic, Common, and Roseate Terns and Common Eiders. The Brothers Islands (North and South) are designated as a provincial Wildlife Management Area, an Important Bird Area, and are identified as critical habitat for Roseate Terns under SARA. Ted D'Eon stewards the island in partnership with the Canadian Wildlife Service - Environment and Climate Change Canada (CWS-ECCC) and the Nova Scotia Department of Natural Resources (NSDNR).

Country Island is managed by CWS in partnership with NSDNR and is located in Guysborough County, five kilometres offshore. It is a federal property and identified as critical habitat for Roseate Terns. The island is 19 hectares in size and surrounded by cobble beach and rocky shoals. Organic soils support pasture grasses, herbaceous plants, and small copses of White Spruce. The island is fairly flat, ranging from 0 to 6.3 metres above sea level. There is a lagoon on the north end of the island and a small, tidal-influenced pond on the south end of the island. In addition to Arctic, Common, and Roseate Terns, a number of migratory birds nest on the island, including: Leach's Storm-petrel, Common Eider, Willet, Red-breasted Merganser, Spotted Sandpiper, Black Guillemot, Canada Geese, and various passerines.

Sable Island is a remote crescent-shaped island located in the Atlantic Ocean, more than 150 kilometres off mainland Nova Scotia. It is characterized by extensive beaches and sand dunes and is about one third vegetated with a number of freshwater ponds. Sable Island is a Migratory Bird Sanctuary and a National Park, managed and protected by Parks Canada, and is also identified as critical habitat for Roseate Terns. A number of species nest on the island in addition to Common, Arctic, and Roseate Terns. The island supports large populations of nesting Great Black-backed and Herring Gulls, several species of waterfowl and shorebirds, and is home to the endemic Savannah Sparrow *princeps* subspecies ("Ipswich Sparrow").

In addition to the colonies above, Roseate Terns have nested at a variable subset of other sites off the Atlantic coast of Nova Scotia, on Machias Seal Island in New Brunswick, and on a handful of islands in the Magdalen Islands, Quebec (Figure 1). The population nesting in the Magdalen Islands may be extirpated as the species has not been recorded in three years.

Last 10-year snapshot

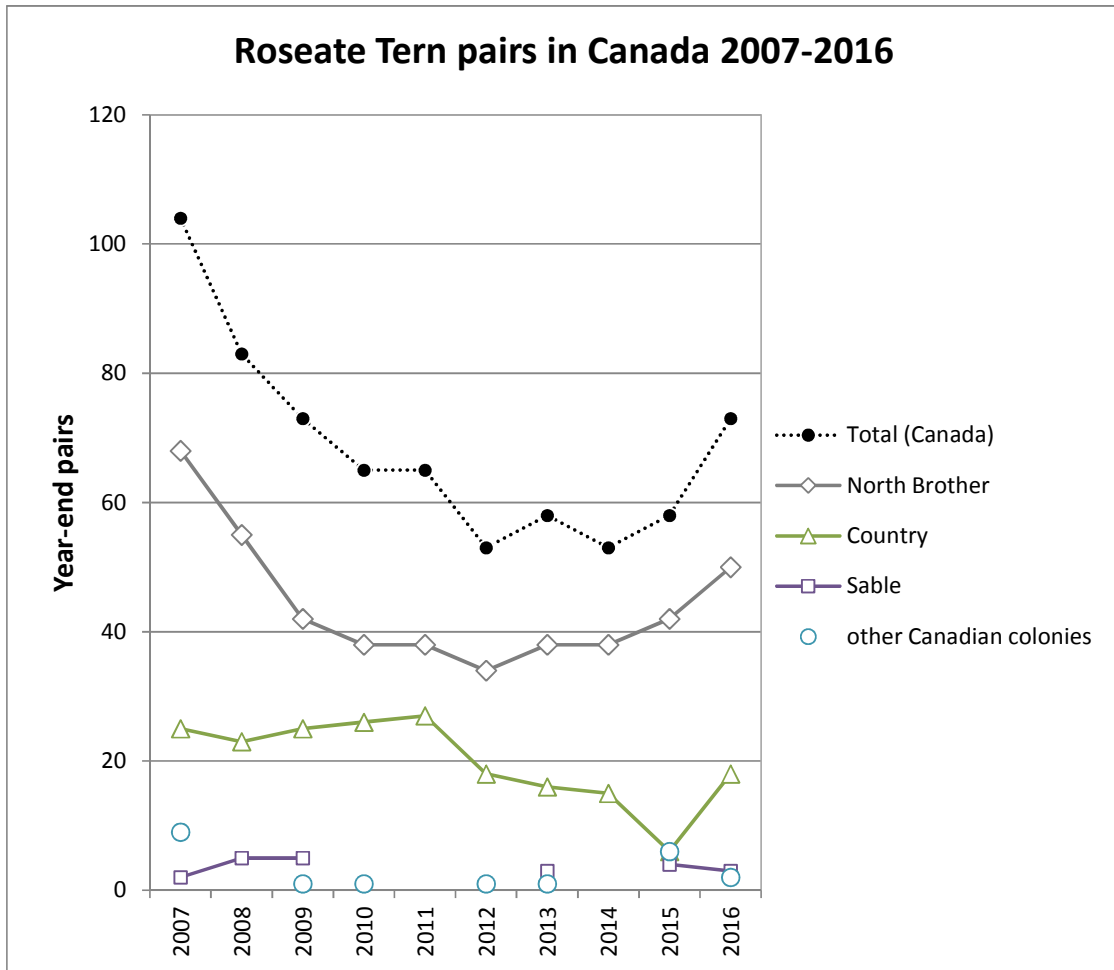


Figure 21: Roseate tern pairs at Canadian colonies over the last ten years (2007-2016)

Colony recovery efforts

North Brother is accessed by steward, Ted D'Eon, and staff from CWS, Université Sainte-Anne, NSDNR, and community volunteers at least once per week over the tern breeding season to implement recovery measures. These include enhancing habitat (e.g., through vegetation management, placing weed barrier and providing suitable substrate for nesting, and provisioning the island with nest shelters for Roseate Terns), undertaking non-lethal control for gulls, and maintaining vigilance for predators of adults (e.g., American mink, Great Horned Owl) and dealing with these swiftly when they are identified.

The Country Island tern restoration project is based on non-lethal predator management, which includes deterrence and harassment via human presence, pyrotechnics, and avian predator egg or nest destruction. Limited lethal control is permitted when non-lethal measures are ineffective and predators pose a serious threat to the colony. Since 1998, predator management has prevented successful nesting by gulls and corvids on Country Island and is effective at deterring other avian predators from the island. Mammalian predators were first detected on the island in 2007 and since then, predation of seabirds by mustelids (e.g. American mink and recently, river otter) is an ongoing threat. Meadow voles were first reported in 2011, although it is possible that the species was present previous to this in low

numbers and undetected. Meadow voles are now abundant and predation on seabird eggs and nestlings has been documented annually. The presence of a field crew throughout the nesting period and predator management activities are considered essential aspects of this project. Since predator management was introduced, the mixed species tern colony on Country Island has grown from 340 pairs in 1998 to 1,489 pairs in 2016. Nest shelters and chick shelters are placed in areas with historical Roseate Tern use and suitable substrate is placed under each shelter at the start of each season. Wooden debris present on the island is also placed strategically throughout the colony to provide alternatives to nest shelters.

Recovery measures for Roseate Terns are currently not underway at Sable Island. Tern colonies in the Magdalen Islands are inventoried annually to look for Roseate Terns and to identify threats. Foxes are an ongoing problem at active colonies and require swift removal once observed.

2016 Report

Our objective is to prevent the extirpation of Roseate Terns from Canada by implementing recovery measures prescribed in the Action Plan for Roseate Terns in Canada¹. Recently, recovery work has focused on breeding colonies through population monitoring, protecting critical habitat, reducing threats, and developing a better understanding of basic population dynamics and potential limiting factors. At the same time, data from US colonies support the hypothesis that Roseate Terns experience high mortality during the nonbreeding season. Once birds leave our borders, threats are mostly unknown and are likely the primary cause of recent population declines observed across the northwest Atlantic population. Management of this species only during the breeding season may do little to aid its recovery. In 2016, the Canadian population experienced its first increase since the early 2000s. Despite this increase, Canada has 50% fewer Roseate Terns than in 2000 and for the most part, we do not understand the underlying cause Roseate Terns are a management-dependent species and our recent “status quo” recovery measures are not enough to recover the species in Canada.

Ground surveys for nests in Nova Scotia

An aerial tern census was conducted for the province of Nova Scotia in 2016 and was followed by ground counts in areas with historical Roseate Tern presence. In the east, Roseate Terns (at least 2 individuals) were detected on an unnamed island south of Cooks Island in Tor Bay. In the southwest, Roseate Terns (2 individuals) were detected on Toby Island. Both colonies were revisited after peak hatch and both were decimated by unidentified predators.

North Brother Island (The Brothers Island Wildlife Management Area)

Winter storm damage to North Brother Island was extensive, especially on the southeast side of the island. The entire island appeared to have been over washed in at least one event (nearly all nest shelters and debris were found in the central tidal pond). Large boulders were thrown over the far southeast corner of the island, an area that was densely occupied by nesting Common Terns in 2015. We estimate that approximately ¼ of the Common Tern habitat used in 2015 was unsuitable for terns in 2015. Many nest shelters from previous years were destroyed. We salvaged what we could and also provisioned the island with 40 new “shelter trap” boxes. We were unable to place as many shelters as in 2015 (110 in 2016, 150 in 2015) because of habitat constraints and a lack of manpower. A significant amount of

¹ http://www.sararegistry.gc.ca/virtual_sara/files/plans/ap_roseate_tern_e_final.pdf

marine debris and lumber washed up on the island last winter and was deposited in the central tidal pond.

The tern census was conducted on North Brother Island on 11 June with five observers. In total, 661 nests were counted of which 42 were Roseate Terns. Eight additional Roseate Tern nests were found over the season bringing the year-end total count to 50 pairs. Forty-seven of 50 Roseate Tern nests were located in nest shelters (26 in typical three-sided box shelters, eight in the “Coquet Island-style” shelters, 12 in the new “shelter trap” boxes, one under salvaged plywood, one in a derelict lobster crate, and one completely in the open).

Predation was light this year. Three adult carcasses were discovered: a decapitated Arctic Tern and one Common Tern (no obvious signs of mortality) were found on 22 June and one dead adult Roseate Tern (originally banded as an adult on Country Island) was discovered on North Brother Island on 11 July. The bird will be sent for necropsy but damage to the back was apparent as if struck by an avian predator.

Nest success was high in 2016. Of 46 nests with known outcomes, 80% successfully hatched at least one chick. Nest success varied by location on the island and was highest (87.5%) in the area heavily enhanced in 2016 (i.e., by placing weed barrier, suitable nesting substrate, and nest shelters). Two nests were abandoned when strong winds blew nest shelters off the island. One nest (in the open) was accidentally trampled during a nest check.

One Great Black-backed Gull nest with three eggs was found on South Brother Island on 13 May and all eggs were destroyed. One Great Black-backed Gull nest with two eggs was found on North Brother Island on 18 May and all eggs were destroyed.

We captured 22 adult Roseate Terns; five unmarked individuals and 17 recaptures. Breast feathers were collected from tagged birds and will be used to determine sex. One of the recaptures was originally banded as a chick on Great Gull Island, NY in 1998. This is the third year in a row that a double metal-banded (with USGS and metal field-readable bands) bird was encountered missing its USGS band. An additional 20 individual Roseate Terns were resighted on North Brother Island in 2016 for a total of 42 “known” individual adult birds. 40 Roseate Tern chicks were banded with USGS and 39 of these received plastic field-readable bands as well (1 was deemed too small).



Figure 22: GPS tagged Roseate Tern ©Ted d'Eon

We deployed 12 PathTrack GPS archival data loggers on 12 adults from 12 nests on 16 and 17 June. We were able to recapture eight of these birds and retrieved seven tags. Data analyses are not yet started but some interesting information is already apparent. One retrieved tag was programmed without a shut off period and captured two nocturnal foraging trips (during a full moon) lasting hours. One foraging trip was to an entirely unexpected location (near Big Tusk Island). Numerous trips were made to locate the four “missing”

tags and birds were not observed carrying them. It is likely the tags were dropped earlier than expected, but we can't confirm this.

Overall it was a very successful season on North Brother Island. Precipitation rates for June and July were far below normal. This, in addition to habitat changes due to winter storms and our habitat enhancement efforts, kept the invasive vegetation from proliferating as in previous years. The depressed vegetation along with all the hard work by staff and volunteers in late April meant that all the provisioned Roseate Tern nest shelters remained accessible to terns throughout the season. We believe this contributed to the apparently high productivity.

See www.teddeon.com/tern16.html for a full account of the tern season.

Country Island

Two tern censuses were conducted on Country Island; a first census conducted June 17-20 (during peak nesting) resulted in 1,489 tern nests, and a second census (to account for late nesters) conducted July 6-7 resulted in a colony total of 1,697 nests. This is the highest number of tern nests counted since monitoring began. Tern colony species composition was similar to previous years; comprising 60% Arctic, 39% Common, and 1% Roseate Tern. The final Roseate Tern nest count for Country Island was 18. Roseate Tern numbers were relatively stable over the past five years, apart from 2015 when only six pairs nested on the island.

For all three tern species, productivity was slightly lower compared to the past five years; however for Arctic, Common, and Roseate Terns the number of chicks fledged/nest was equal to the long-term average (Arctic and Common Terns: 19 year; Roseate Tern: 15 year).

One American Crow nest and one Great Black-backed Gull nest were destroyed. No adult predators were removed during the 2016 season. A River Otter was present on the island and was suspected to be responsible for predation events resulting in the death of 48 nesting birds including 33 Leach's Storm Petrel, four adult terns (two Arctic, one Common, and one unconfirmed species – not Roseate), seven tern chicks (Arctic and Common Tern) and four Black Guillemots. The crew attempted to harass the otter from the island but no directed trapping efforts were employed. Predation events were restricted to a few occurrences.

In 2016, three adult Roseate Terns and fifteen chicks were marked with USGS bands and red plastic field-readable bands.

Sable Island

Tern surveys were conducted on Sable Island in 2016 to coincide with Nova Scotia surveys. Three Roseate tern nests were observed in the "East Light" colony.

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North East United States

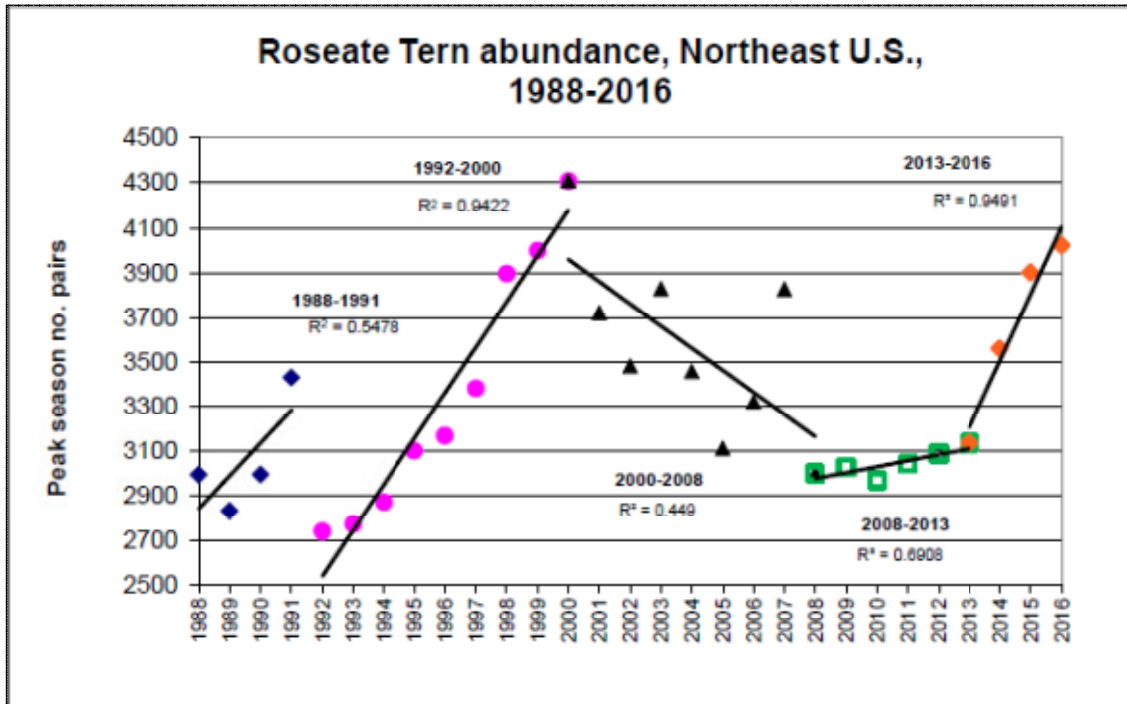


Figure 23: Roseate Tern abundance, Northeast US, 1988 - 2016 ©Carolyn Mostello

Buzzard Bay (Massachusetts)

In Buzzard Bay, the Massachusetts Division of Fisheries and Wildlife protect, manage and monitor colonies of roseate and common terns on Bird Island (Marion), Ram Island (Mattapoisett) and Penikese Island (Gosnold).

Bird Island has been intensively managed since the late 1960s and is the stronghold for these endangered seabirds. It is a small island, 0.6 hectare in size, located at the mouth of Sippican Harbour and less than a mile off the mainland coast of the town of Marion.

Ram Island has been managed since 1990 and is located 0.8 km southeast of Mattapoisett Neck. As a consequence of this, roseate terns returned and began nesting on the island for the first time in twenty years.

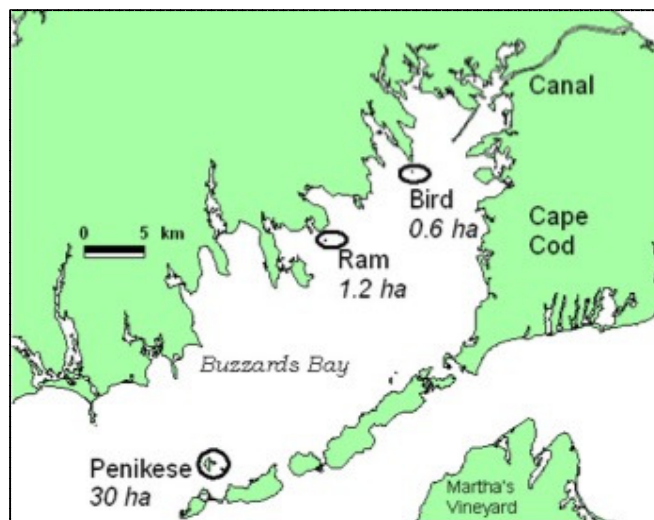


Figure 24: Location of Bird Island, Ram Island and Penikese Island in Buzzards Bay, MA ©MassWildlife

Both Bird and Ram Islands, which lie just a few feet above sea-level, have been negatively affected by erosion and sea-level rise.

Penikese Island is 30 hectares in size and is one of the Elizabeth Islands, which make up the town of Gosnold. It has been managed since 1998 and after an oil spill in 2003, 250 pairs of roseate terns (likely displaced from Bird Island) nested on the island for the first time in decades.

Together, Bird, Ram, and Penikese Islands support nearly half the Roseate Terns in the endangered Northeast population.

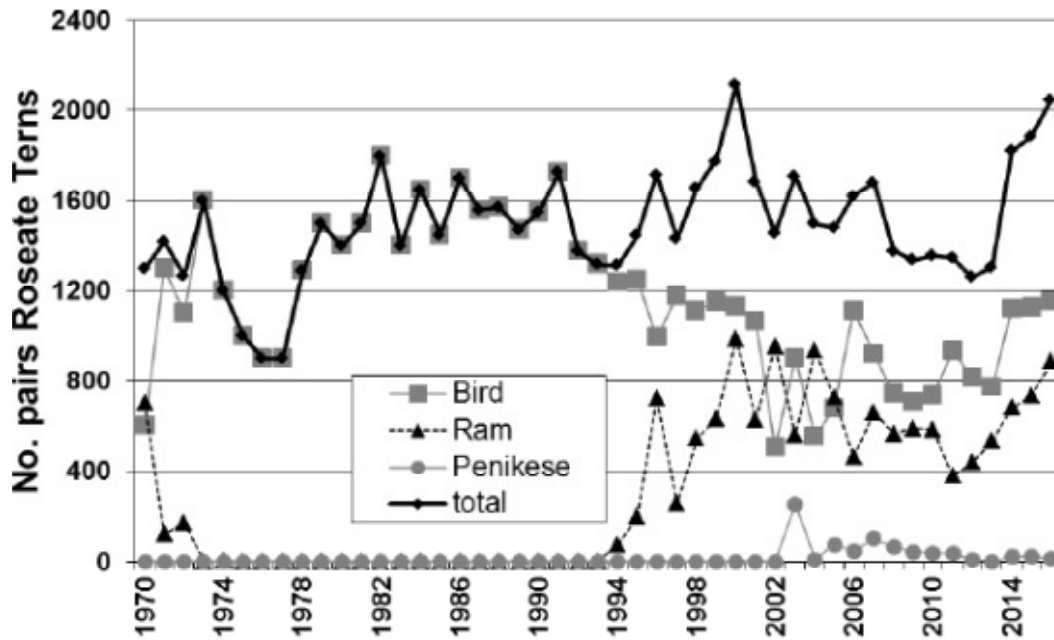


Figure 25: Number of peak-season nesting pairs of roseate terns on Bird, Ram and Penikese Islands (1970-2016) ©MassWildlife

In 2016, there was total 2050 ‘peak season’ pairs of roseate terns, which is the second highest number of roseate terns recorded nesting in Buzzard Bay. It was an 8.8% increase from the 1885 pairs recorded in 2015. The island also supported 6251 ‘peak season’ pairs of common terns, which was 8% (6794) less than in 2015.

The habitat restoration of Bird Island started in December 2015 and about a third of it was completed by April 2016 prior to the tern nesting season. This restoration project had been long-awaited due to the severe erosion that had been impacting Bird Island. The project involves enhancing the habitat and constructing a new seawall to protect the island.

Modifications were made to the design throughout the summer of 2016 in order to make it safer for terns (adding chinking voids to the revetment to preventing entrapments of common terns inside it), add a ring of cobble around the island to provided adult terns with a less-vegetated area on which to feed older chicks and raising the elevation of the north half of the island by a foot in order to reduce overwash. Construction on Bird Island resumed in September and is expected to be completed soon.



Figure 26: Construction of the new revetment on Bird Island, December 2016 © C. Mostello/MassWildlife

Prior to the start of the field season, staff and volunteers mowed, weed-whacked and raked dead vegetation. In addition they also set up most of the census grid markers. New nest boxes were also placed around the island, particularly in areas with a lack of cover.

Bird Island was visited 54 times between the beginning of May and end of July, while Ram Island was visited 29 times within a similar timeframe.

Roseate and common tern study plots were also set up with the purpose of recording their nesting chronology, hatching success and productivity. They were selected non-randomly in order to be representative of the colony as a whole. Peak census counts and monitoring of other breeding species in addition to that of roseate and common tern focused on gulls, American oystercatchers and wading birds.

Under federal permits, depredation activities included removing Canada goose nests on both Bird and Ram Island. In 2016, there was no need to manage gulls (herring and great black-backed) on any of the three islands. On Pekinese Island five night heron nests were depredated during the season and directly after the last nest was depredated, predation all but ceased for two weeks.

Ruddy turnstone predated both common and roseate tern eggs across all three islands (Bird Island, Ram Island and Pekinese Island) and a couple of dead adult roseate terns recovered were attributed to peregrine falcon. On Penikese Island, the tern chicks and eggs faced heavy predation and throughout the season, the continued presence of Black-crowned night heron determined it to be the primary predator. Herring and great black-backed gulls were also seen in the colony during the day and night as well.

In early May, four Havahart traps were deployed on Bird Island, in order to catch a potential mink or weasel (as scat had been located). This was unsuccessful; however there was no mammalian predators observed until the end of June. Rodenticide bait stations were put in place and due to the evidence of rat droppings and a dead raccoon (which likely to have ingested the poisoned bait); it was assumed there were two mammalian predators.

On Bird Island, the numbers of roseate terns were similar to last year at 1153 pairs (1127 in 2015). Food was relatively abundant for roseate terns and although predation by a rat and raccoon depressed productivity; it was still very good with 1.22 (versus 0.86 in 2015).

In 2016, the roseate tern numbers on Ram Island increased substantially (+20.5%) to 886 pairs, which was the highest estimates since 2004. Food appeared to be abundant and no major predation events were recorded in 2016. As a result productivity was excellent with

1.49 in comparison to 2015 (0.87). Common terns also increased to 3527 pairs (3330 in 2015) and had a productivity of 0.90 (0.69 in 2015).

This year the Penikese colony suffered greatly from predation, mainly by Black-crown Night Herons. Roseate terns dropped to 11 pairs (compared to 23 pairs in 2015) and productivity was 0.10 (1.12 in 2015). Common terns also declined to only 531 pairs (1216 pairs in 2015) which is lowest number since 2002 and productivity was equally poor with 0.04 (1.43 in 2015).

On Bird Island, of the 212 re-sighting entries, approximately 166 different individual roseate terns were identified. On Ram Island, approximately 131 different roseate terns were identified from the 155 re-sighting entries. Approximately 10 ringed roseate terns were able to be identified on Pekinese Island in 2016.

Adults of both species of terns were trapped (using treadle traps) and in addition to ringing them; a PhD student fitted 25 nanotags to common terns and 30 nanotags roseate terns on Bird Island. Nanotags were only attached if the tern weighed more than 111g. No adult roseate terns were trapped on Ram Island. During chick ringing on Ram Island, blood samples were also taken from 30 roseate tern chicks. No roseate terns were ringed on Pekinese Island in 2016.

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Great Gull Island (New York)

Great Gull Island, NY (41 12N, 72 07W) is a 17-acre island located at the eastern end of Long Island Sound. Great Gull Island, once a tern colony, then the site of an army fort, is now habitat for two species of nesting terns. About 8,000 pairs of Common Terns nest in the overgrown central sections of the island, using habitat along the edges of former asphalt paths as well as the exfoliating concrete of former gun emplacements and the edges of cement platforms and former building foundations.

When the government built the fort on Great Gull Island they placed large boulders around the periphery of the island to stabilize the shoreline. Here about half the nesting population of nearly 1900 pairs of Roseate Terns nest each season, and the remaining half occupy edge along retaining walls of the island and some are using the recently constructed sites on the terraced sides of the gun emplacements, part of a recent management effort to provide more nest sites for Roseate Terns.

Roseate Terns are a federally endangered species (December 1987). Common Terns are threatened in New York State because of noted decreases in nesting concentrations of this species at the western end of the state in the Great Lakes.

Gull Island is owned by the American Museum of Natural History and our monitoring studies of Roseate and Common Terns are done under the auspices of the museum. Helen Hays, director of the project, outlines and oversees management projects for both species. Grace Cormons leads the field team that follows the population of Roseate Terns.

Other species breeding on the island included Red winged Blackbirds, Spotted Sandpipers, Song Sparrows, Barn Swallows, House Finches, Starlings, Grackles.

YEAR	#NESTS	PRODUCTIVITY
2007	1636	0.90
2008	1359	0.98
2009	1524	1.10
2010	1375	1.4-1.8
2011	1500	1.2-4
2012	1596	0.80
2013	1543	1.16
2014	1610	1.00
2015	1849	1.25
2016	1858	1.36

Great Gull Island has the largest nesting population of Roseate Terns in the western Hemisphere.

Each year Helen Hays working with volunteers occupies the island from the end of April or early May through the first week in September. Management projects are undertaken on weekends in April or early May and throughout September.

Herring and Black-backed Gulls nest on nearby Little Gull Island, but not on Great Gull. During most of the season there are enough terns to mob the gulls and keep them out of the colony. Occasionally gulls take adult terns early in the season as the terns fish near Little Gull. On occasion Black crowned Night Herons, crows and hawks disturb the colony. In 2016, a Snowy Owl visited the island in May staying for a short period, later, during July a young Bald Eagle spent a week with us before leaving. Rats are not a problem.

Between 1984 and 1988, in an attempt to create areas where Roseates could nest we built terraces on both sides of the eastern gun emplacement, and put a series of nest boxes on the terraces. By doing this we hoped to expand areas that would attract Roseates and ultimately to increase the numbers of Roseate Terns nesting. Perhaps twenty pairs of Roseate Terns nested on the terraces the year after they were built. More moved in slowly over the next five years. It was apparent that we would need to build many terraces before we could realize a noticeable increase in the Roseate population on the island. This would be prohibitively expensive and in the late eighties we decided not to build more terraces.

In 2012 Hurricane Sandy changed everything. Sandy not only took out our dock, but it washed over many of the sites where Roseate Terns had nested in the rocks. During the summers of 2013 -2015 adult Roseate Terns flew over Gull Island all summer calling, something we had not seen them do before Sandy modified the shore of the island. It seemed to Hays that these birds might be looking for nest sites and it might be a good time to expand the terraces built in 1988-1991. In addition, she hoped we could build terraces along the south side of the eastern end of the island, a place where one year 100 pairs of Roseate Terns

nested. These sites had quickly become overgrown and were no longer used. Hurricane Sandy affected a number of tern colonies along the east coast of the U.S. Federal and State funds became available for projects directed at restoring areas in colonies where terns nested. Grants from the Cooperative Recovery Initiative (CRI) given through Stephanie Koch and Suzanne Paton, United States Fish and Wildlife Service employees, as well as support from The Long Island Futures Fund provided through Julianna Barrett enabled us in 2013-2015 to purchase 27,000 pounds of lumber and to pay for fuel for the Connecticut National Guard helicopter to bring the lumber to Gull. The grant money also enabled us to remove invasive plants which were covering some of the areas where Roseates nested and to build blinds overlooking sites occupied by nesting Roseates as well as Common Terns.

Peter Paton, a professor at the University of Rhode Island (URI) spear-headed the push to build the terraces. In 2013 and 2014 Peter, with crews of volunteers from Great Gull Island and URI built 137 terraces and completed 80 nest boxes to put on the terraces. The latter provided 870 compartments for Roseates to occupy.

2016 report:

The Roseate population on GGI has been monitored each year since 1988 by a team of 3-5 people led by Grace Cormons. (For more than 20 years previous to this, the Roseate population was surveyed in a somewhat different way, and in conjunction with the Common Tern surveys.)

Monitoring is done throughout the last three weeks of June. The Roseate Team marks each new nest with a numbered tongue depressor and records its nest number and clutch size. During subsequent checks, they record changes in clutch size, missing eggs, signs of predation or desertion. Weather permitting; all nests are monitored every other day. The procedure for monitoring the population is the same each year. The team checks under the top three layers of boulders on the western half of the island one day, the eastern half the next. They also check along the vegetated edges around the island as well as in managed areas: the nest boxes on the terraces. In addition, we looked for Roseate nests in odd sites on the island, i.e. under piles of lumber and occasionally in the midst of Common Tern nests.

Peak nest numbers each year for Great Gull Island Roseate Terns are determined in the same way as other Roseate colonies in the northeast. The number of nests marked by the time the first chicks hatch, or 23-27 days after nest initiation, is considered the peak number of nests marked in any particular season. As originally suggested by the Roseate recovery team, we consider that the number of nests marked by peak represents about 80 percent of the total nests on the island. This gives us our estimated peak number.

The estimated total number of nests is figured by using the peak estimate, adding the additional nests marked after the peak date, taking 10% of that number and adding it all together

Our peak count of marked nests by 18 June, 2016 was 1331.

Our estimated number of nests at peak: 1664.

Our total count of marked nests by 10 Aug. was 1506.

Our estimated total number of nests is 1858. (The numbers used in our 10 year summary.)

These 2016 peak and total numbers are only a few nests higher than our 2015 counts. Nevertheless, this makes it the highest total since 2000 (when we had an estimated total of 2028 nests, our all-time recorded high for GGI).

Clutch Sizes

Clutch sizes for 2016 are based on the first 1164 nests marked. Changes in clutch size were confirmed two or more days after marking. There were 246 (21.1%) one egg clutches, 845 (72.6%) two egg clutches, and 73 (6.3%) three and four egg clutches. Clutch sizes were low the last three years; this year's clutch sizes are much higher, similar to those for most years preceding 2013.

Chick banding

We band chicks on our daily check of the island. We record the chick's band numbers, nest number, and placement in the nest: S for single chicks; A the first of two or more chicks; B the second of two or more chicks.

In 2016 we banded a total of 1422 Roseate chicks; 965 of these received a BBL band on one leg and a Plastic Field Readable (PFR) band (dark blue with a white alphanumeric code), on the other.

Our estimated productivity this season was 1.36 chicks per nest. Because of the size of our colony, the difficulty of finding all the nests, and the difficulty of observing all fledged chicks, we estimate productivity as described below.

Nisbet notes in his 2005 memo *Estimating Roseate Tern Productivity* that “in the absence of predation almost all Roseate Tern A- chicks survive to fledging”. Given that 72.6% of the nests had two eggs and that apparently there was an adequate food supply, it seems reasonable to estimate that at least half the B chicks survived. If we take the total marked nests, 1506 (and assume this is also the total of A and S chicks) and add to it 546 (½ of possible Bs by figuring 72.6% of 1506), this = 2056 possible chicks. Subtract from this 38 dead: 2056-38 = 2018 possible chicks. Divide the 2018 possible chicks by 1506, the number of marked nests, and get a productivity of 1.36 chicks per nest.

In the last two years we have been able to resight many hundreds of fledglings wearing our PFR bands. On Great Gull Island, twelve blinds are used for observations. Jeff Spendelow leads a resighting project in Massachusetts where many Roseates stage before heading south. Analyses of all these resightings should give us more data for accurately determining productivity and survival in the last two years.

Issues affecting the productivity: In 2016 the weather was generally good and apparently did not negatively influence productivity. There was no predation as far as we know. A peregrine sometimes roosting on the island may have caused the desertion of a few nests in one area. There appeared to be plenty of food throughout the season. The number of two egg clutches and the apparent success of second (“B”) chicks appear to confirm that there was a good food supply. Bait fish included lots of Sand eels in June, Round Herring in July and Bluefish in August (Hays pers com.).

Special initiatives, such as diet monitoring, ringing, research projects, innovative use of technology, etc.

One student led a diet monitoring study. Ammodytes, abundant this year, were the major food item for the Roseates.

As described above, ringing of chicks is always a major part of our work. We ring adults as well. During our daily chick census, we place tape on rocks or boxes near nests with newly hatched chicks, if the nest is in a location where setting a trap is possible. We return later to set the traps. When we trap a bird, we record its nest number, its band numbers, or put on BBL and PFR bands. This year we weighed and measured most as well. We trapped 240 adults: 162 of these were retraps; 78 were unbanded.

Catherine Neal continued the GPS mapping project she began in 2014. With the help of the rest of the Roseate team, GPS locations were taken for each nest; maps show comparative nest distributions 2014 – 2016.

In addition to the above, we cooperated with Pam Loring and Peter Paton, as did Common Tern trappers, for the second year on their nanotag project. Pam and assistants placed nanotags on 30 of the adult Roseates and 30 of the adult Common Terns trapped. Subsequently observers recorded prey delivery to the Roseate nests. Nests were selected that were close to blinds which made it easier for observers to watch the nests.

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