

Annual Roseate Tern Newsletter 2018



Roseate Tern © Brian Burke

Compiled by Chantal Macleod-Nolan
RSPB, Nature Recovery Unit
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Supported the LIFE funding as part of the project “Improving the conservation prospects of the priority species roseate tern throughout its range in the UK and Ireland”

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Introduction

Welcome to the 12th edition of the Annual Roseate Tern Newsletter, which covers the 2018 breeding season.

I would like to say thank you to everyone who has contributed to this year's edition; the breadth of knowledge that is gathered here is remarkable. We've received great articles from site managers on their individual colonies, management approaches and habitat restoration. Scientists also supplied valuable information on their research projects focused on investigating key aspects of the tern's lifecycle including diet, genetics, staging areas and the results of trialling satellite tags. It is our hope that this cross-Atlantic collaborative newsletter will continue to bridge gaps across roseate tern colonies.

In 2018, the roseate tern population in North West Europe continued to grow with the main colonies having a record-breaking number of breeding pairs. After years of silence, the Skerries in Wales successfully fledged two roseate tern chicks for the first time since 2006. In North America, both the colonies on Great Gull Island and Buzzards Bay also had their highest records of nests. With the completion of the restoration on Bird Island (in Buzzards Bay), 2018 recorded that roseate tern abundance had increased from previous year and returned to its pre-construction levels.

On a more sombre note, the mixed tern colonies at both l'île de La Colombière (FR) and Dalkey Island (ROI), where roseate terns intermittently nest, suffered heavily from predation. A rat eradication programme has been implemented on both these islands to tackle this issue before the 2019 breeding season. Additionally, the roseate tern population in Florida (USA) is continuing to decline rapidly due to habitat loss, predation and unseasonable weather events. As a result, hardworking efforts are being made to alleviate some of these factors by creating an artificial nesting platform.

Meanwhile, other colonies are continuing to recover such as the Azores (PT) and Maine (USA) where the roseate tern populations increased or were stable compared to the previous year. Intensive effort to reducing nest-site competition at Maine in 2018 was successful in allowing common terns to reclaim the area and increase their population by 15%. Although the colony at North Brother Island (CA) failed in 2017 and 2018, the presence of other islands with suitable habitat has allowed the roseate terns to redistribute and start nesting on Gull Island (CA). New management approaches continue to make a difference with Bretagne Vivante's new terraces on l'île aux Moutons (FR) being occupied in the first year of installation and 43.8% of the island's breeding roseate terns nesting in them. As a result of the LIFE Project, restoration of Blue Circle Island in Larne Lough (NI) was undertaken in winter 2018 and with its completion, it is hoped that the tern population will respond favourable in 2019.

Although each colony faces a multitude of threats and pressures; it is heartening to hear about the positive impact from the continued management efforts from site managers and data yielded by scientists across countries.

Good luck with the 2019 season!

Kind Regards,

Chantal Macleod-Nolan, Roseate Tern LIFE Project Assistant

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Roseate Tern LIFE Recovery Project

This is the third year of the LIFE project, and we are eighteen months from its completion in September 2020. You can read below about the work completed or under development in 2018, namely a major island restoration project on Larne Lough, Northern Ireland and several scientific studies.

We will be wrapping up these projects to produce outputs in a form of publications in the coming months. As we are approaching the final phase of the project, we are focusing now on networking and development of regional management plans for potential target areas around the UK and the Republic of Ireland. We are also collating lessons learnt and good practice guidance in preparation for “After-LIFE Strategy”. Armed with the new knowledge we have gained during the project; we would like to update the EU Action Plan for the Roseate Tern.

Meantime, we are anticipating another breeding season and hopefully a new record for all the colonies, which I would like to wish to all of us involved in protecting this beautiful species.

Daniel Picc, Roseate Tern LIFE Project Manager – Daniel.Picc@rspb.org.uk

Demography Paper

As part of the Roseate Tern LIFE project, we have analysed ringing and recovery data for the three main roseate tern colonies in NW European metapopulation i.e. Rockabill and Lady’s Island Lake in Republic of Ireland and Coquet in the UK. French colonies could not be included for the lack of sufficient data. The aim of the study was to determine which demographic parameters were responsible for the growth of the colonies.

The study, which was published late October 2018 in the Journal for Animal Ecology, was led by Adam Seward and Mark Bolton from RSPB Centre for Conservation Science and funded by EU LIFE Programme and Natural England.

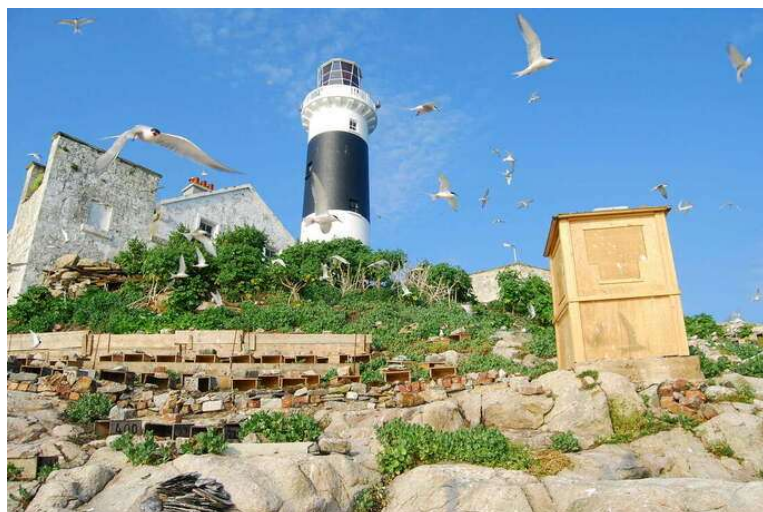


Figure 1: Roseate tern terraces on Rockabill © Brian Burke

Authors found that Ireland’s Rockabill colony, where 1,642 pairs of roseate terns nested this year, is the only site in the UK and Ireland which is currently effectively “exporting” roseate terns to other colonies and its growth has relied on good productivity and survival. On the other hand, for over 20 years the growth of the roseate tern colony on Coquet Island was sustained by birds from the Rockabill. This meant that Coquet Island was, between 1992 and 2016, a “cryptic sink”, attracting more young birds to nest there than have fledged from it and survived to breed at the species’ other colonies.

Despite the reliance of the Coquet Island colony on immigration from Rockabill, Coquet Island has played an important role in maintaining the species in the UK, achieving yet another record of 118 nesting pairs in 2018. Having an additional nesting colony, the UK and Irish population is better protected against catastrophes like severe weather events, disturbance or disease that might hit any one colony. Moreover, since the research was carried out, it appears that the Coquet Island roseate terns are now beginning to sustain their own numbers. In 2016, 50% of terns nesting on the island had been hatched there, and this year the number had climbed to 60%.



Figure 2: Roseate tern terraces on Coquet Island © Paul Morrison

Without demography data, it is tricky to choose and invest into sites, where roseate terns could eventually disperse to. We now know that where coastal colonies of other tern species, such as common terns, are doing well and feeding predominantly in the marine environment, there is probably enough food and safe nesting areas for roseate terns to thrive there too. The next step is to look for such potential nesting sites and consider 'Coquet-style management' to give Roseate Terns a helping hand to colonise them.

Seward A, Ratcliffe N, Newton S, et al. 2018. Metapopulation dynamics of roseate terns: Sources, sinks and implications for conservation management decisions. *J Anim Ecol.*2018;00:1–16. <https://doi.org/10.1111/1365-2656.12904>

Roseate Tern Geolocator Tracking Study 2017-2018

Rockabill

On 13 and 14 June 2017, twenty-five adults Roseate Terns were trapped in the 4BN study area. Twenty of these birds were fitted with geolocator tags attached to green darvic leg rings; the remaining five were processed as controls and given a darvic ring without a tag. Many of these birds were ring read in late May and early June 2018 indicating a fairly good return rate. No birds showed any sign of handicap associated with bearing the tag for a period of one year.

Retrieval of tags from surviving birds was scheduled for the week commencing 11 June 2018 but was not started until 13 June following completion of the main census. Six tagged birds were re-trapped on the 13 June, four on 14 June and 2 on 15 June. A further effort was made later in the month and a further three tags were retrieved, two on 28 June and one on 29 June. This total of 15 represented a 75%

recovery/ annual adult survival rate that is close to the 84% derived from re-sightings over the last 25 years or so (Seward et al., 2018). There is a possibility that more tags may be retrieved in 2019 having eluded detection in 2018. None of the 15 birds showed any sign of damage/abrasion on the tarsus bearing the darvic plus GLS tag. Four out of five control birds were re-sighted during this period.

Coquet

After the success of the deployment of geolocator devices put on Rockabill Roseate Terns, another 20 were deployed on Coquet birds this season (26-27th May 2018). There were three subsequent re-sightings once they left the island. All 20 individuals successfully reared/fledged chicks.



Figure 3: Roseate tern with a geolocator on Coquet by Chris Redfern

Data from Rockabill birds is now being analysed and this will be compared with the data extracted from devices retrieved from Coquet birds in 2019. This data will give a fascinating insight into the overwintering movements of the species as well as looking at colony differences between birds from the Irish Sea and those from the North Sea.

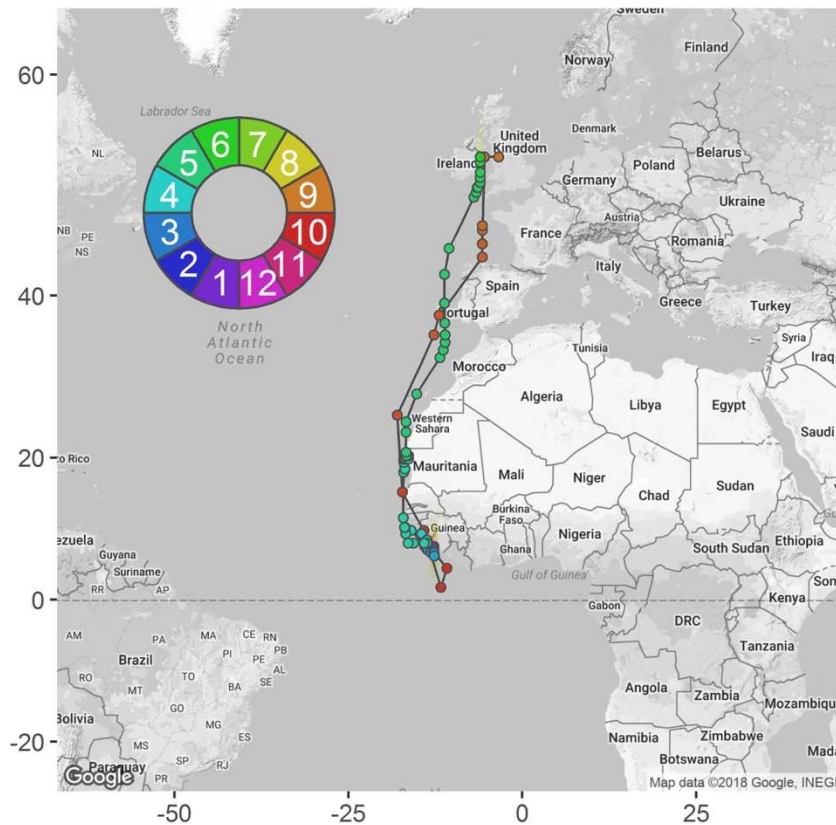


Figure 4: An initial map from the 2017-2018 Rockabill deployed geolocators © Chris Redfern

Spatial utilisation of marine resources and foraging ecology of Roseate Terns around Rockabill colony

In 2018, the Roseate Tern LIFE commissioned ECON Ecological Consultancy Ltd, led by Dr Martin Perrow, to undertake boat tracking surveys of roseate terns leaving the colony to investigate the spatial utilisation of marine resources around Rockabill colony, specifically temporal and spatial patterns of foraging trips; and foraging behaviour at sea, including frequency of feeding, prey type and association with other species. The collected data will be analysed and presented in two manuscripts, first of which has been submitted to British Birds.

Bibliography:

Acampora, H., Ní Dhonnabháin, L., Miley, D. & Newton, S.F. 2018. Rockabill Tern Report 2018. BirdWatch Ireland Seabird Conservation Report.

LIFE+ Little Tern Recovery Project

In November 2018, the Roseate Tern LIFE Recovery Project had the pleasure of attending the EU LIFE+ Little Tern Recovery Project Conference. It was absolutely inspiring to hear about the range of work that has been achieved during the five years; including research (e.g. colour ringing, tern diet), monitoring and public engagement. The Little Tern and Roseate Tern LIFE Projects have been working

alongside each other and share experience of similar areas; habitat restoration and predator management.



Figure 5: LIFE+ Little Tern Recovery Project Conference © Chantal Macleod-Nolan

The LIFE+ Project is a partnership of eleven organisations working together to secure long-term prospects of little terns through enhanced management and habitat restoration carried out over twenty sites across England and Wales. The project covers approximately 75% of the little terns nesting in the UK. The project began in 2013 and will finish 31 March 2019.

For more information, please contact: Susan.Rendell-Read@rspb.org.uk

LIFE+ Little Tern Recovery Project website: <http://www.littleternproject.org.uk>

EU LIFE Little Tern Recovery Project - LIFE12 NAT/UK/000869:

http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=4755

Azores Networking Trip

The Roseate Tern LIFE Recovery Project includes several international networking opportunities with organisations concerned in the conservation of roseate terns and associated species in Europe. As a result, three countries were visited: France, which holds the rest of the northwest European metapopulation (visited in 2017); the Netherlands, which contained extensive expertise on management of similar tern species (2016) and the Azores, Portugal (2018). Overall, the key aims of these networking trips were to exchange knowledge and experience in managing tern colonies, particularly roseate and common terns.

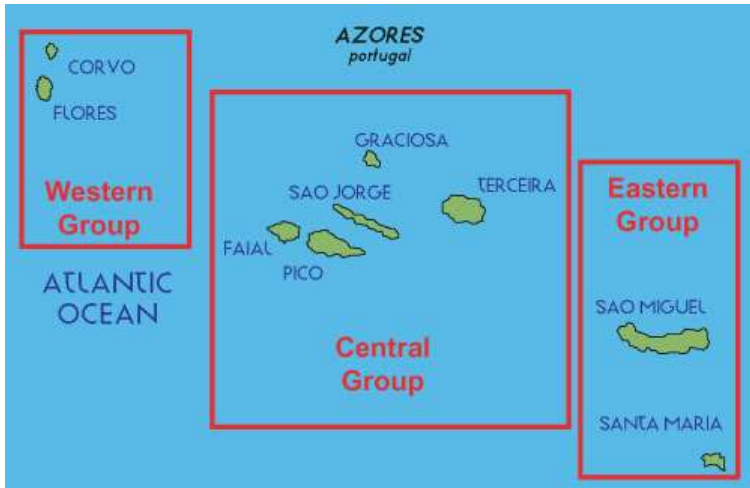


Figure 6: Map of the Azores © <https://msu.edu/~williss2/carpentier/part2/azores.html>

The Azores roseate tern metapopulation used to be the largest in Europe prior to the north-western European metapopulation recovery growth. Although there is perceived limited interchange between the two metapopulations in Europe, a percentage of Azores birds' winter in similar areas of western Africa.



Figure 7: L-R. Baixo do Moinho off Flores Island is the only colony of roseate terns nesting independently of any other tern species in the Azores. Baia das Contendas consists of three islets and supports the sole roseate tern colony near Terceira Island. Ilhéu da Praia (off the coast of Graciosa Island) is not only important for roseate terns, but also Cory shearwaters, Barolo shearwaters, Madeiran storm petrel and Monteiro's storm petrel). © Chantal Macleod-Nolan

In June, we had the pleasure of travelling to the Azores and meeting colleagues from the Regional Directorate for the Sea Affairs, Regional Directorate for the Environment, Directors and Wardens from Natural Parks of Terceira, Flores and Graciosa. In addition, we also met with Marine conservation officers from SPEA (Birdlife Portugal) and a postdoctoral researcher from the University of the Azores.

Site trips visiting several islets with breeding common and roseate terns just off the coast from the Islands of Terceira, Flores and Graciosa, allowed the LIFE Project to get familiar with local constraints

and conditions. The opportunity to network throughout the trip maximised the chances to discuss best practice of roseate tern colonies and improve collaboration between managers. In addition, a meeting was organised at each of the three islands to capitalise these discussions and provide added information on the work being undertaken through the Roseate Tern LIFE project.



Figure 8: Meetings held in Flores between RSPB, BWI, NPWS, Flores Natural Park and SPEA © Chantal Macleod-Nolan

Bibliography

Macleod-Nolan, C *et al.* 2018. Networking trip between LIFE Roseate Tern Project and Natural Park Directors, Wardens and Guards in the Azores, Portugal. EU LIFE Roseate Tern Recovery Project. *RSPB unpublished document.*

Restoration of Blue Circle Island

Larne Lough on Northern Ireland's east coast provides an important refuge for breeding seabirds owing to a small number of significant factors. The sheltered sea lough provides conditions that are relatively free from the worst of the coastal weather; offshore locations for ground-nesting birds mean that the effects of disturbance and predation are less than at other more vulnerable sites; finally, proximity to productive feeding areas allows breeding adults the best chance to raise chicks to fledging. The site is designated as a Special Protection Area, Area of Special Scientific Interest and a Ramsar site.

Swan Island in Larne Lough is a small, low-lying natural island that used to be the sole component of the RSPB Reserve here. However, its tiny (0.14 ha) size and low-lying nature limited the capacity and success of the colony through competition for space and vulnerability to tidal excesses.

In the late 1970's Dinah Browne (RSPB's erstwhile Regional Director) had the vision to bolster the potential breeding habitat for seabirds on Larne Lough by creating a new island. This new structure would allow for disposal of dredged material arising from the deepening of an access channel to Magheramorne on the shore of Larne Lough, where Blue Circle Industries PLC operated a quarry. An enterprising manager got behind the vision and started work to make Dinah's vision a reality.

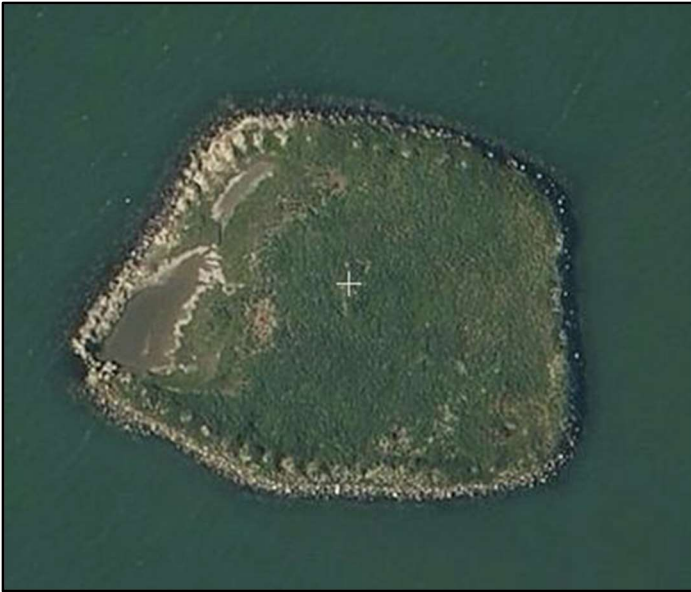


Figure 9: Aerial view of Blue Circle Island prior to restoration

The first attempt to create the island in the early 1980's was not a success due to settling of the original structure. However, in February 1989 Blue Circle Industries PLC restarted work to complete the island. These works involved rebuilding the basalt doughnut, relining the interior with geotextile sheeting, filling the interior with clay and quarry rubble and finally flattening and resurfacing the top layer. In the autumn of 1989 these works were finished but, after a year of settling the north-west corner was identified as needing further attention. This area and the gradually lowering local perimeter of the island remained the primary areas of concern ever since and at high tides water passed through the north-west corner and overtopped the perimeter here, eroding the interior of the island.

This c.0.6 ha island was artificially created through depositing quarry spoil from Magheramorne Quarry by Blue Circle Cement (now Tarmac). Construction was completed in 1990 and consisted of placing a ring of basalt blocks on the (shallow) seabed to above the mean high-water mark, before lining with a heavy geotextile, and infilling with two materials that were locally available in large amounts: dredged seabed sediment and inert kiln dust.



Figure 10: Blue Circle inundated ©Daniel Piec

The restoration of Blue Circle Island came to the fore once again as part of the Roseate Tern LIFE Project. The RSPB identified Blue Circle Island as a priority site for restoration in preparation for a potential expansion of roseate terns from the core strongholds. There are several reasons why this island looks particularly promising for the establishment of a roseate tern colony. Apart from the previously mentioned good food resources and regular breeding attempts, Rockabill (the largest colony in Europe with 1642 pairs in 2018) is only a 'stone's throw' away from Larne Lough in tern travel terms. There is also a stable colony of common terns, which roseates depend on, as well as a large assemblage of

Sandwich terns and black-headed gulls, which help provide protection against predators. With the continued management from the RSPB, the restoration of the island was the main issue left to sort out.



Figure 11: Restoration of Blue Circle Island completed © Daniel Piec

Almost 50 years after its inception, following 18 months of preparations and two weeks of earthworks, the restoration was completed in the Autumn of 2018.



Figure 12: Restoration of Blue Circle Island completed © Daniel Piec

We are now looking forward to the 2019 seabird breeding season.

2018 Roseate Tern Breeding Figures

Breeding Locations	2017 Breeding Pairs	2018 Breeding Pairs	2018 Productivity
<i>Europe</i>			
Rockabill, Republic of Ireland	1603	1642	0.98
Lady's Island Lake, Republic of Ireland	219	227	0.98
Dalkey Island, Republic of Ireland	0	0	0
Larne Lough, Northern Ireland	1	1	2
Skerries, Wales	0	1	2
Coquet Island, England	111	118	0.92
<i>Roseate LIFE Project Site Total</i>	<i>1934</i>	<i>1989</i>	
<i>Europe</i>			
Brittany, France	53	36-38	0.42+
Azores, Portugal	595	798	nd
<i>Europe Total</i>	<i>2582</i>	<i>2823</i>	
<i>North East America</i>			
<i>Canada</i>			
Country Island, Nova Scotia	18	13	0.50
Sable Island, Nova Scotia	3	3	nd
Toby Island, Nova Scotia	1*	1	nd
Bear Point Thrums, Barrington, Nova Scotia		3‡	nd
The Brothers, Nova Scotia	26	2	0
Gull Island, Lobster Bay, Nova Scotia	5	35	†
Pinch Gut, Lobster Bay, Nova Scotia		1‡	nd
Peases Island, Nova Scotia		3‡	†
<i>United States of America</i>			
Maine Coastal Sites, Maine	245	236	0.68-1.25
Buzzards Bay, Massachusetts	2240	2290	
Great Gull Island, New York	2089	2200	
<i>Caribbean Population</i>			
Florida, United States	42	30	0.1

Key:

nd = no data available from the site

‡ = denotes a crude estimate

* = denote pairs believed attached to sites, but for which no nests were located

† = site known to be productive but for which a rigorous productivity estimate was not available or could not be properly calculated due to insufficient information

Europe

Rockabill (Republic of Ireland)

At the beginning of the season the various sections and study enclosures were prepared for the deployment of nest boxes. Vegetation management, principally the removal of mature Tree Mallow *Lavatera aborea* and Sea Mayweed *Matricaria maritima* was carried out throughout the island to clear space for nest boxes, open habitat for Common Terns and provide access for wardens to the sub-colonies. On 22nd April, a group of volunteers made up of Skerries Sea Scouts assisted in this work greatly increasing the speed it was carried out.

1642 Roseate Tern primary nests were counted on Rockabill in 2018, the highest recorded to date and a modest increase of 39 nests on last year's total. These nests were laid from the 22nd of May to the 21st of June.

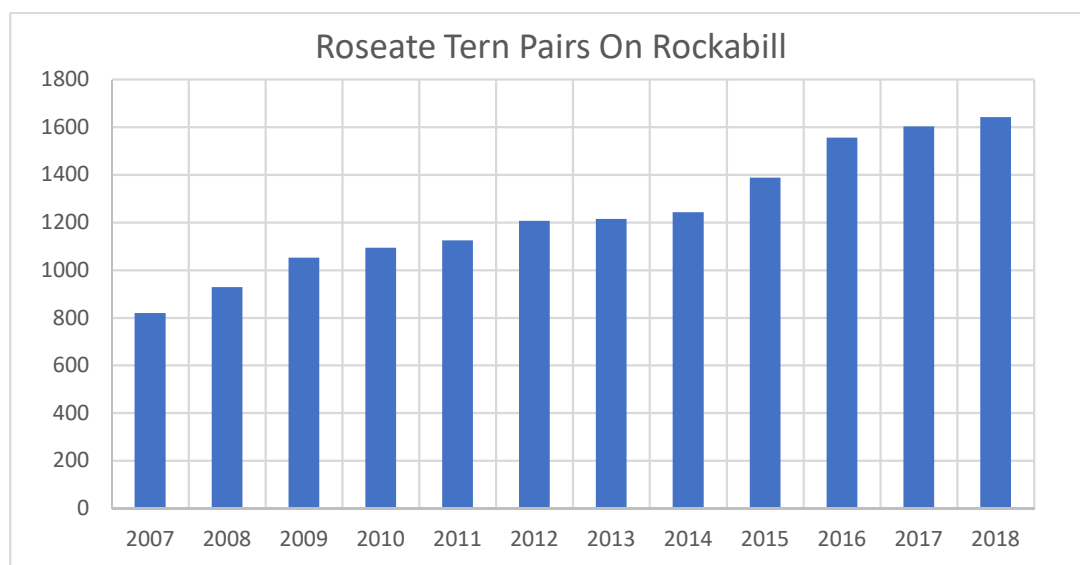


Figure 13: Roseate tern population trend on Rockabill (2007-2018)

The overall nest box uptake was 86.56%, ~3% lower than last year. A total of 848 boxes were deployed, 30 boxes less than last year. Approximately 50 new boxes were added this year, but a large number of boxes deemed beyond repair at the end of 2017 and were removed. Balbriggan Community School, who were this year celebrating their 25th year of collaboration with the Rockabill Tern Project provided 33 of the new boxes in 2018.

The mean clutch size for Roseate Tern pairs on Rockabill in 2018 was 1.72 eggs, slightly higher than 2017 and 2016 which were both 1.68. Mean clutch size was higher for pairs using nest boxes (1.77) than those nesting in the open (1.67) in keeping with the usual trend. Nestbox clutch size was the same as last year while being 0.05 higher for open nests. Both nest box and open nest clutch sizes were above average for the last ten years.

Overall productivity was 0.98 fledged young per nest – a 0.15 improvement on last year. This is above the mean for the past 5 years (0.91). 2018 has seen the largest numbers of chicks fledged on Rockabill yet. There was a very slight increase in nests, but this high number of fledglings is most likely attributed to better food availability than recent years, with provisioning parents seen carrying multiple sprat/herring at once regularly throughout the season. Despite the dry weather the open nest productivity was still much lower than that of the nest boxes, suggesting that shade could be as important as shelter from wind/rain, or perhaps that predation was an important cause of chick mortality.

The rings of 582 individual Roseate Terns were read and 564 of these have been traced. Of the rings traced, about 95 % were ringed on Rockabill, 4.8% were ringed at Lady’s Island Lake and 0.35% were ringed from both Coquet and Long Craig Island. Five-year old birds comprised the largest cohort, followed by 4- and 3-year olds. The oldest bird was 23 years old (from 1995).

Linear Growth Rates for Roseate Terns show a marked improvement compared not only to last year’s, but also to the five-year average. For Common Terns however, LGR have shown lower rates for A1 and B2 compared to 2017, but higher for A2 and similar in relation to the 5-year average. Asymptotic Mass for both Roseate and Common Tern chicks was higher than last year’s for all chick classes, with Roseate rates being the highest in 4 years.

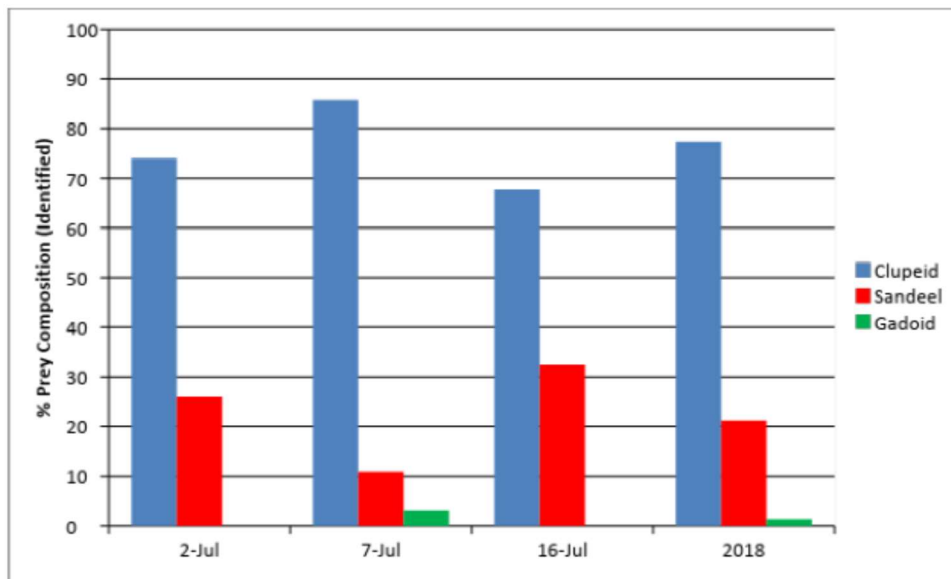


Figure 14: Percentage of identified prey items fed to roseate tern chicks in 2018 during 3 chick provisioning watches and the overall composition from all watches for 2018

As usual, Clupeids and sandeels dominated the prey items fed to chicks during 2018, accounting for > 98% of prey items identified across the three observation days (Figure 5). Sandeels tend to be the secondary species group provided to roseate tern chicks on Rockabill, as was the case this year with sandeels accounting for 21.2% of identified prey items, however last year sandeels accounted for 54.7% of prey items. Clupeids were by far the most common prey item brought back this year making up 77.4% of identified prey items. Gadoids, as expected, formed only a part only a minor part of the diet of the Roseate Tern chicks at 1.4%. Roseate Tern chick provisioning rates peaked during the 05:00-08:00 period.

The majority of disturbance during the season was caused by Great Black-backed Gulls. Depredation by GBBGs has intensified over the last three years and has had a significant impact on all three-tern species and Kittiwakes throughout the season despite greater prevention efforts. Further attention to combat this issue is required.

Other Tern Species:

In total, 2039 Common Tern clutches were laid in 2018 and productivity was 0.75, a large improvement on last years’ 0.36 productivity metric. B chicks did almost as well as A chicks this year (only a 4.8% difference), a marked difference to 2017 and 2016 in which B chick survival was less than 10%.

Fifty-one Arctic Tern (*Sterna paradisaea*) nests were found on the Rock and a further eight nests found on the Bill. Mean clutch size recorded for Arctic Terns was 1.83 and only eight chicks (productivity

0.16) are thought to have fledged with gull depredation of both eggs and chicks continuing to be a serious problem. Four Arctic Tern chicks were colour-ringed with black Darvics with white numbers.

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Lady's Island Lake (Republic of Ireland)

Management and monitoring of the Lady's Island Lake Tern Colony commenced on the 10th April and continued until the 10th August 2018. 467 wooden nest boxes were deployed on 10th April in Colony B and placed in approximately the same positions as those in 2017. Three wooden observation hides were placed on top of wooden pallets and tied down securely. Three enclosures were put in place, one on the eastern side of the roseate colony and two on the western side, to facilitate the collection of biometric data on roseate tern chicks. A three-foot high wire mesh fence (central fence), topped by a single electrified wire was put in place on the 9th May to prevent mammalian access to the southern colony. The water levels measured 3.71m OD. on the staff gauge following the 'cut' on the 7th April and fluctuated between 3.70 and 3.84 throughout the breeding season.

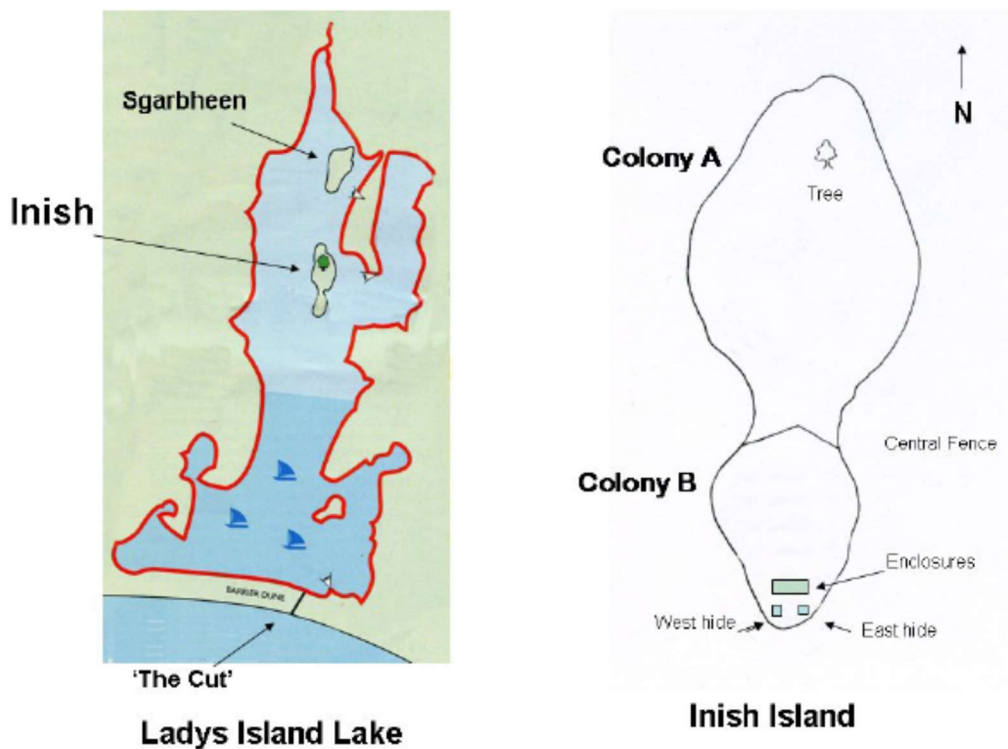


Figure 15: Map of Lady's Island Lake and Inish Island

227 breeding pairs of roseate terns were recorded nesting on the southern end of Inish at Lady's Island Lake. This was an increase of 8 nests on that recorded in 2017. The first roseate tern egg was laid on the 19th May, eleven days later than 2017. The main laying period was from 19th May to 21st June. A total of 213 roseate tern clutches were designated as primary nests, laid up to and including the 21st June, the cut-off date (34 days after the first roseate egg was detected). Following the 'cut-off' date on the 21st June, a further 14 clutches were designated as secondary nests, 13 which were single clutches and one double egg clutch. The overall mean clutch size was 1.46 per egg laying pair, with a hatching success of 77.3%. 223 chicks were recorded to fledge resulting in roseate tern productivity being 0.98 chicks per egg laying pair.

Table 1: Roseate Tern Pairs and fledgling counts 2004-2018 at Lady's Island Lake (Daly et al., 2018)

	nests	eggs	cold depredated eggs	fledged chicks	dead chicks	clutch size	hatching success
2018	227	331	75	223	33 (+1)*	1.46	77.3%
2017	219	343	33	222	88	1.57	90%
2016	209	299	42	225	29	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%

During the season, 282 special rings were read. Of these, 194 were ringed on the left tarsus, 88 right (indicating they were from Rockabill). This was confirmed with 69% recording their natal site as Lady's Island Lake and 31% originating from Rockabill. 51 ringed adults were identified as new or unrecorded at Lady's Island previously.

Sandwich Terns (*Sterna sandivensis*) increased by 106 pairs (6.3%) to 1780 with a mean clutch size of 1.38. Common and Arctic Terns (*Sterna hirundo/paradisaea*) were censused separately, with a total of 916 Common and 693 Arctic Tern nests recorded. This gave a combined total of 1609, an 4.79% decrease on that of 2017. The mean clutch size for Common and Arctic Terns was 2.33 and 1.95 respectively.

Depredation

On the 25th May an adult roseate tern was found dead at the entrance to box 11 showing hallmark wounds of a mustelid. On the 28th and 30th May & 2nd and 6th June, four more single adults, one per night, were found, in or close to nestboxes. Baited traps and three trail cameras were put in place. Images of a pine marten (*Martes martes*) were obtained on the eastern side of the roseate tern colony and it was subsequently shot on the night of the 6th June.

On the morning of the 7th July, evidence of another mustelid attack was visible with scores of tern carcasses littering colony B. A total of eight adults roseate and 27 chicks, along with 76 arctic and common tern pulli were counted. Trail cameras showed an American mink (*Neovison vison*) in the roseate colony. It is of note that majority of kills occurred where large boulders are situated. A three-foot-high, half inch chicken wire fence was placed around all the active roseate tern nest-boxes to prevent any further mortality. The mink was subsequently shot on the morning of the 10th July.

In 2019, wardens will be considering how best to tackle the vegetation as continued unchecked growth of grasses and bramble is likely to harbour predators such as mustelids and brown rats.

Wexford Harbour

Roseate Terns were noted during the season, but no behaviour suggesting any breeding was noted, however a pair of Common Terns may have bred.

Tuskar Rock Lighthouse

A more optimal timed visit was made in 2018, however no breeding Terns were noted.

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Dalkey Island (Republic of Ireland)

The Dalkey Island Complex is designated as a Special Protection Area for Common, Arctic and Roseate Terns. In line with this, the EU is currently funding a five - year project, the EU LIFE Roseate Tern Recovery Project, of which this season was its third year. The project aims to provide safe breeding habitat for all three species, with a particular emphasis on the Roseate Tern.



Figure 16: View of Dalkey Island from Coliemore Harbour

Common and Arctic Terns currently breed on Lamb Island, Maiden Rock and Dalkey Island and in the recent past, Roseate Terns have also bred at this site. Breeding pair numbers were low this season across all three islands, with similar numbers breeding on Maiden Rock and Lamb Island. In line with the last two years of the project, Arctic Terns were the predominant species nesting on the Dalkey Islands. Prior to this, the Dalkey colony was principally comprised of Common Terns.

Conservation measures began in March with a programme of rat monitoring and baiting across Dalkey and Lamb Island. Bait uptake was low across Dalkey Island and no consumption of bait was recorded on Lamb Island. It is thought that low bait uptake may be due to a combination of neophobic behaviour and the coinciding of the programme with a time of greater food availability. One visit was made to Maiden Rock on the 18th of May to create gravel scrapes for nesting, and the first counts of Terns present between Maiden Rock and Lamb Island were made on this date.

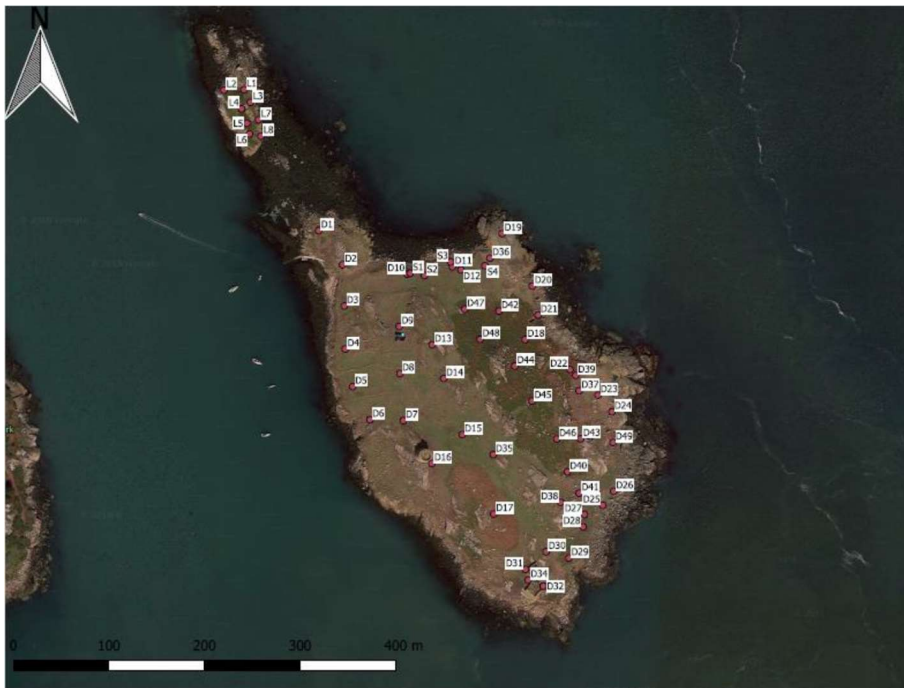


Figure 17: Map of bait stations on Dalkey Island and Lamb Island

An estimated 33 breeding pairs nested on the Dalkey Islands this season. Based on clutch sizes and the presence of a Common Tern chick, it is assumed that 6 of these pairs were Common Terns while the remaining 27 were Arctic Tern pairs. Seventeen nest attempts were made on Maiden Rock, 14 on Lamb Island and at least two on Dalkey Island. In total, 66 eggs and 9 chicks were recorded.

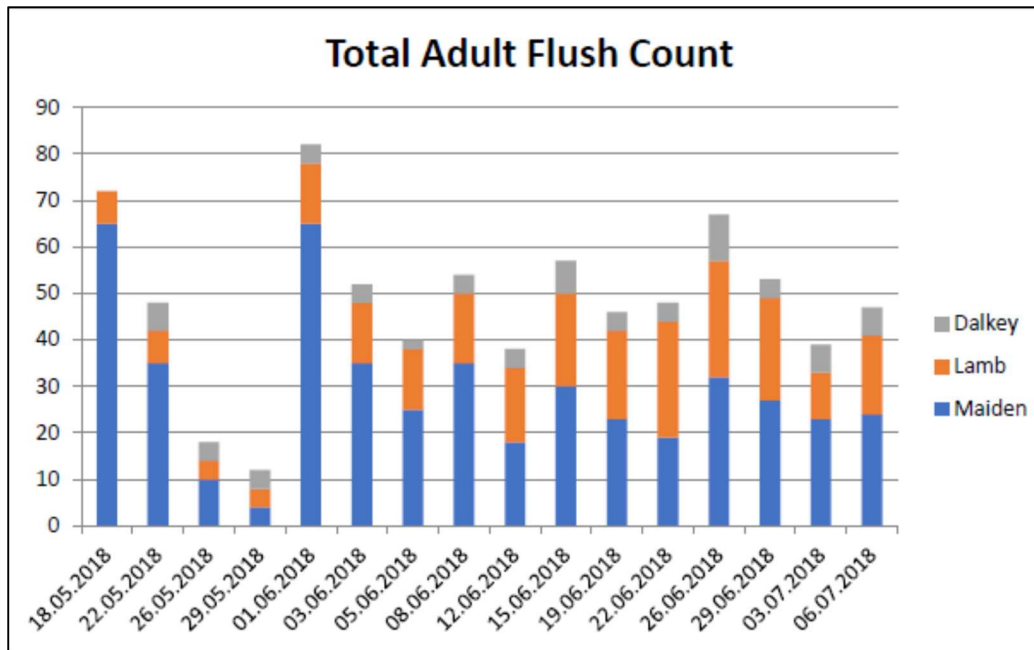


Figure 18: Maximum adult tern flock count at the Dalkey Islands Tern Colony 2018

Depredation by gulls appears to have been the principal pressure on the tern colony this season, although large flocks of starlings were seen at all three sub – colonies and rats were present on Lamb and Dalkey Island throughout the season. The low numbers of terns breeding at the site this year coupled with predation pressure from a number of potential predators unfortunately led to a complete failure of the tern breeding colony by the 10th of July. It is hoped that the information gained this season can inform conservation measures for the 2019 season.

Twenty – two public events were held from the 22nd of May to the 31st of July. In total, 533 people were engaged with about the Roseate Tern LIFE Project, the natural history of the Dalkey Islands and their environs and conservation efforts currently in place for seabirds.

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Larne Lough (Northern Ireland)

Larne Lough Islands Reserve, consisting of Blue Circle Island and Swan Island, is situated within Larne Lough. Larne Lough is designated as an ASSI, SPA and as a RAMSAR site. It is designated as a Special Protection Area (SPA) under the European Birds Directive because of its importance as a breeding site for Sandwich tern, roseate tern, common tern and Mediterranean gull, and for its light-bellied Brent goose wintering population. The breeding terns use both Blue Circle and Swan Islands. Over the last 7 years, one or two pairs of roseate terns have nested on both Blue Circle and Swan Islands.

The number of species breeding in 2018 on the two islands was 12, the same as in 2016 and 2017, and included: greylag goose, mallard, tufted duck, red-breasted merganser, oystercatcher, black-headed gull, common gull, Mediterranean gull, Sandwich tern, common tern, roseate tern and black guillemot.

The number of pairs of each of three of the key species reduced for the second year running. Black-headed gull has declined by 9.6% since 2016 (now at 2,895 AON), Sandwich tern has declined by 40.4% since the high of 2016 (now at 732 AON), and common tern has declined 7.8% since 2016 (now at 307 AON). None of these declines are particularly worrying individually, but together they could be significant. Fortunately, roseate terns have bred again, but again there is only one pair.

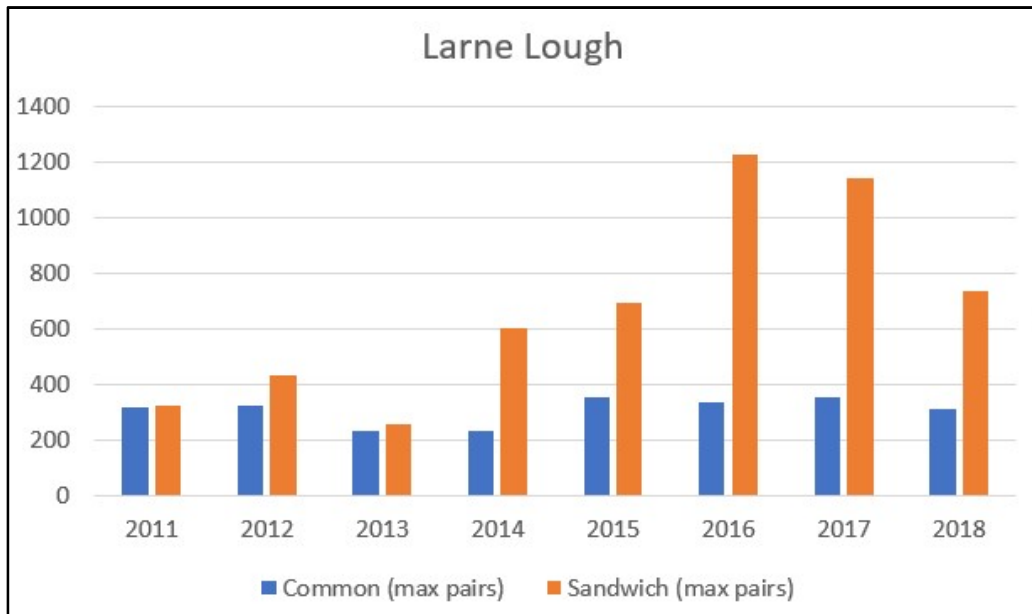


Figure 19: Breeding figures of common and Sandwich tern at Larne Lough

For the first time, a reasonably accurate measure of productivity for common, roseate and Sandwich terns has been made using a mix of productivity enclosures and ‘mark and recapture’ methodology. Sandwich terns had good productivity of 0.78 on Blue Circle, but virtually zero on Swan. Common terns had very mixed productivity, with a good level of 0.8 on Blue Circle, while on Swan Island there was a pre-Storm Hector batch of nests with a good 0.71, but an overall moderate productivity of 0.34. The single pair of Roseate terns had an excellent productivity of 2.0.

Productivity of common and Sandwich terns was seriously affected on Swan Island by Storm Hector on 14/06. This was a severe low-pressure storm with high winds coinciding with a high spring tide, causing abnormally high-water levels and wave action for the time of year. Two thirds of tern nests on Swan were inundated and lost. Nests on Blue Circle were not affected.

The deployment of a series of three electric fences on Blue Circle before the start of breeding significantly reduced predation by otter (on both islands). Just 13 predated birds were thought to have been killed by otter, compared to 249 in 2017. The rather late deployment of sonic cat deterrents may also have helped with this reduction.



Figure 20: Electric fences on Blue Circle Island ©Shane Wolsey

Recommendations for conservation and management in 2019 are included in this report. The major recommendations relate to the repair of Blue Circle Island to maintain it as a viable seabird breeding site (the key aim of the LIFE project), and the control of predation of eggs and young by otter.

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Skerries (Wales)

The Skerries (Welsh: Ynysoedd y Moelrhoniaid) are a group of sparsely vegetated rocky islets, lying three kilometres offshore from the northwest corner of Anglesey, Wales. The islets are particularly important for Arctic Terns and support a variety of other seabird species including: Atlantic Puffin, Great Black-Backed Gull, Common Tern, Herring Gull, Lesser Black-Backed Gull and occasionally Roseate Terns.

Due to the breeding seabirds, particularly the terns, the island has been designated as part of the Ynys Feurig, Cemlyn Bay and The Skerries Special Protection Area (SPA) along with two other nearby sites, Cemlyn Bay and Ynys Feurig. It has also been designated as a Site of Special Scientific Interest (SSSI).



Figure 21: Aerial view of the Skerries, Anglesey © David Wootton

Early in the 2018 breeding season, nine decoy Roseate Terns were handmade using clay vinamould and waterproof plaster before being painted by the wardens. They were placed in zone 1a where common terns are abundant. These withstood weathering throughout the season however some were attacked by the terns and had their tails and beaks broken off. In addition, around 600 nest boxes were placed around the colony.

During the preliminary clutch count Roseate Tern calls were heard in the colony and on 5th of June, a pure Roseate Tern pair was seen. Judging by courtship behaviour the female had a metal ring on both legs whilst the male had none. This pure pair eventually laid two eggs overlooking the bay between two nest boxes. They then successfully fledged two chicks making it the first successful roseate tern pair on the Skerries since 2006!

There were two 'non-pure' pairings with Roseate Terns in 2018. A Roseate/Common pair successfully fledged two hybrid chicks and are believed to be the same pair that have nested here for several years. There was also a Roseate/Hybrid pair which is believed to be the same female/female pair that have attempted to nest here for a few years now. Both individuals were seen bringing fish back for courtship and taking both positions in mating. Roseate Tern females are known to pair up with other females in the absence of males which appeared to happen in this instance. It was hoped that the male from the pure pair would have also bred with this pair resulting in a Roseate 'super-clutch' but no eggs were ever laid.

It was also a good year for Arctic Terns with an increase of 665 pairs from 2017 resulting in a total of 3435 breeding pairs on the Skerries. This is the largest Arctic Tern colony in the UK. The first Arctic Tern chicks were seen on the 12th June and the first Arctic fledglings (i.e. approximately 3 weeks old and capable of flight) on 6th July. In addition, the sighting of c20 leg-flagged arctic terns which had been absent in 2017, coupled with the steep increase in breeding pairs, indicates that many individuals assumed lost to the botulism outbreak in 2016 (1046 pairs down in 2017) had stayed away from the colony or not bred, rather than perished.

Although it was the second highest number on record, 2018 showed a decrease in Common Tern pairs from 386 to 302. Common Terns have been, until now, steadily increasing in number at the site. The first Common Tern chick was seen on the 13/6 and the first Common fledgling on the 17th July.

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Coquet Island (England)

At the start of the season, the terraces were once again resurfaced with fresh shingle collected from the island foreshore to restrict parasitic life cycles and reduce vegetation growth. The nest boxes were reinstated into their allocated locations and new boxes were added to extensions to the nesting terraces. Coquet now has around 300 Roseate Tern boxes spaced across North, Central and South terraces.

The additional nesting space and boxes clearly paid off as the Roseate Tern population grew to 118 breeding pairs, an increase of 6.3% from 111 pairs in 2017. This season’s total represents the highest recorded breeding population since CQI became an RSPB reserve in 1970. Despite a largely dry season and a reasonable food supply, productivity of 0.92 was well down on last year’s record total of 1.5 chicks fledged per pair. The lower figure this season is still a strong result for the species and the difference is largely down to a lower average clutch size of 1.35. Single egg clutches were much more common this season which may have been due to the earlier wintry weather affecting the arrival body condition of the terns. From 123 Roseate chicks, 108 survived to fledging age which is a great result.

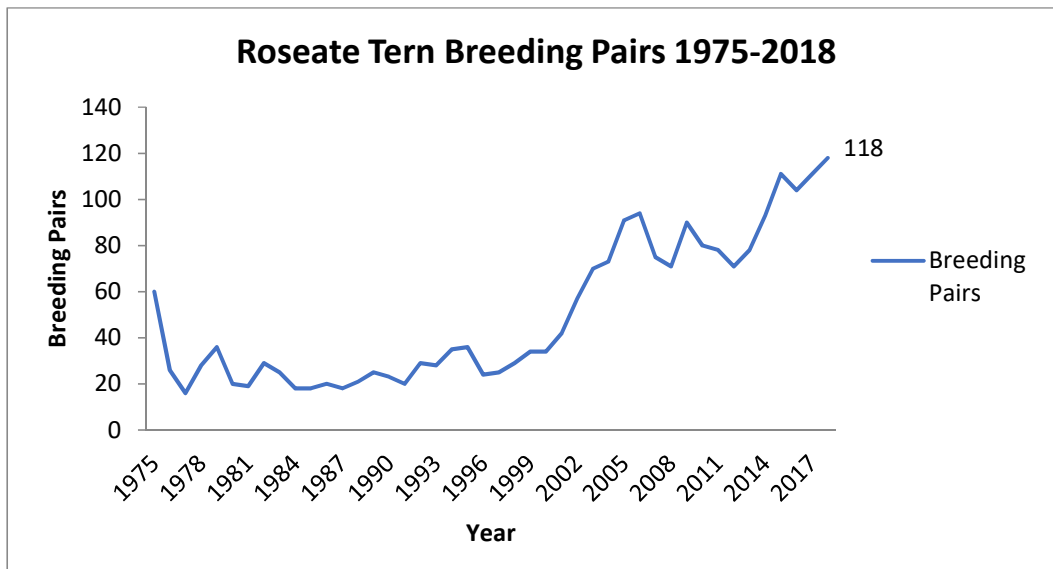


Figure 22: Roseate Tern breeding pairs on Coquet Island from 1975 to 2018

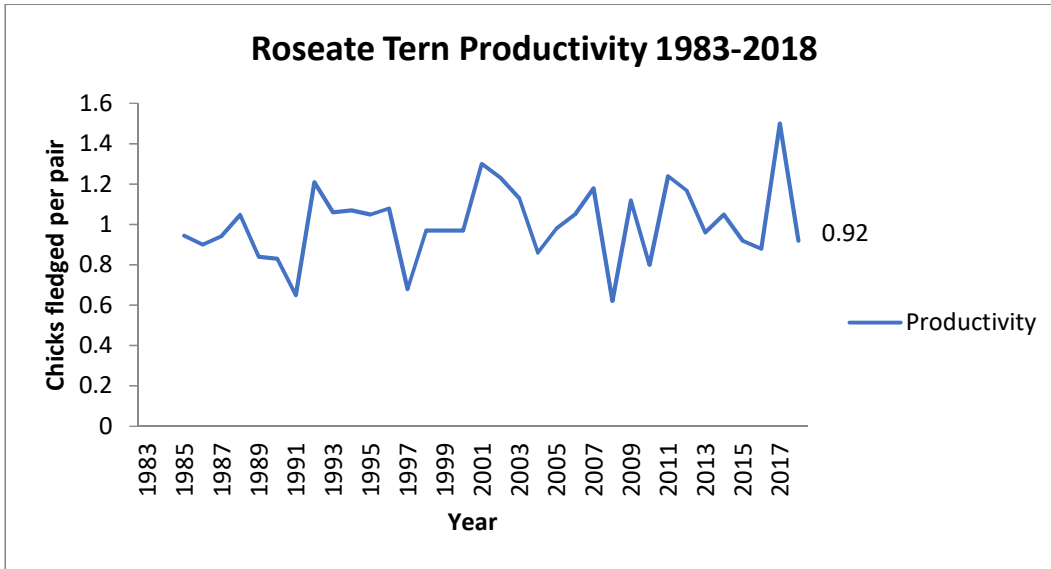


Figure 23: Roseate Tern productivity on Coquet Island from 1983 to 2018

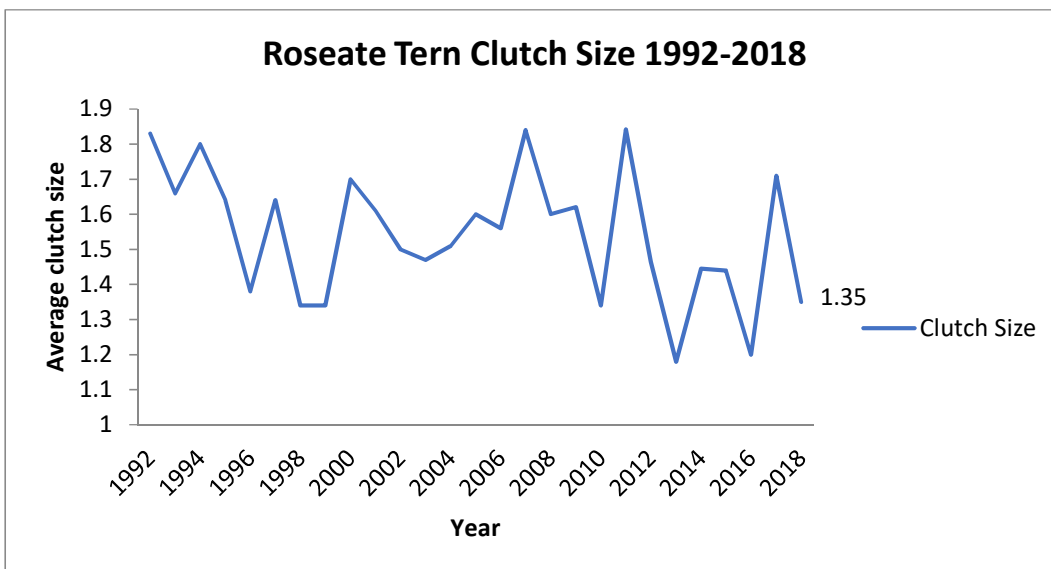


Figure 24: Roseate Tern average clutch size on Coquet Island from 1992 to 2018

All chicks were ringed with the new single ring scheme for the second season running. Ring reading of adult birds revealed 240 unique adult sequences. Of the 240 sequences read, the proportion of adults originally from Coquet compared with birds from other colonies increased to 59% (41% other colonies). This is really encouraging news, with the colony on Coquet gradually progressing towards sustainability.

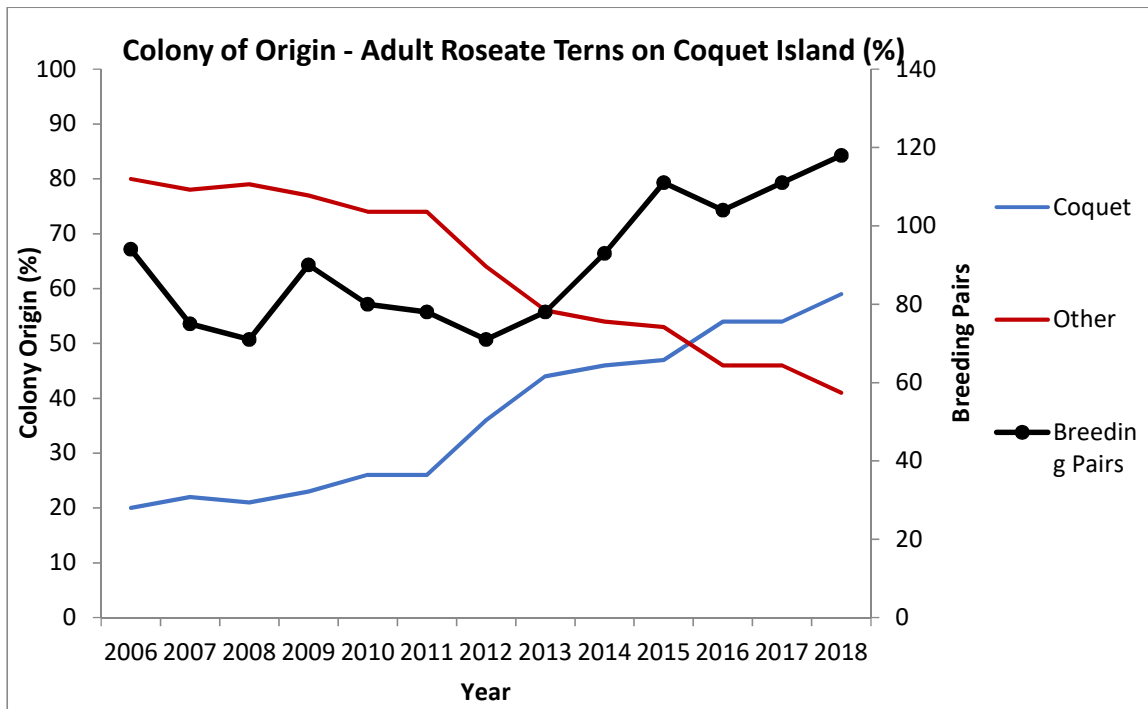


Figure 25: The colony of origin for all adult Roseate Tern rings read from 2006 to 2018

With the additional boxes added to the terraces, Coquet now has four different designs of box for the Roseate Terns to nest in. Nine pairs nested outside boxes this year which is relatively high and likely due to the warm summer months. For the 109 pairs which nested inside boxes, we calculated the proportion of each design that was occupied this season to see if there was any clear preference. This is all fairly arbitrary as two of the designs were new to 2018 and it may take time for these boxes to become fully established on the terraces. Intriguingly, the two new designs for this season showed both the highest proportion occupied for 'recycled rectangular' and the lowest proportion occupied for 'new rectangular'. It will be interesting to compare this year's results with future seasons and our findings may even eventually have management implications for the species.

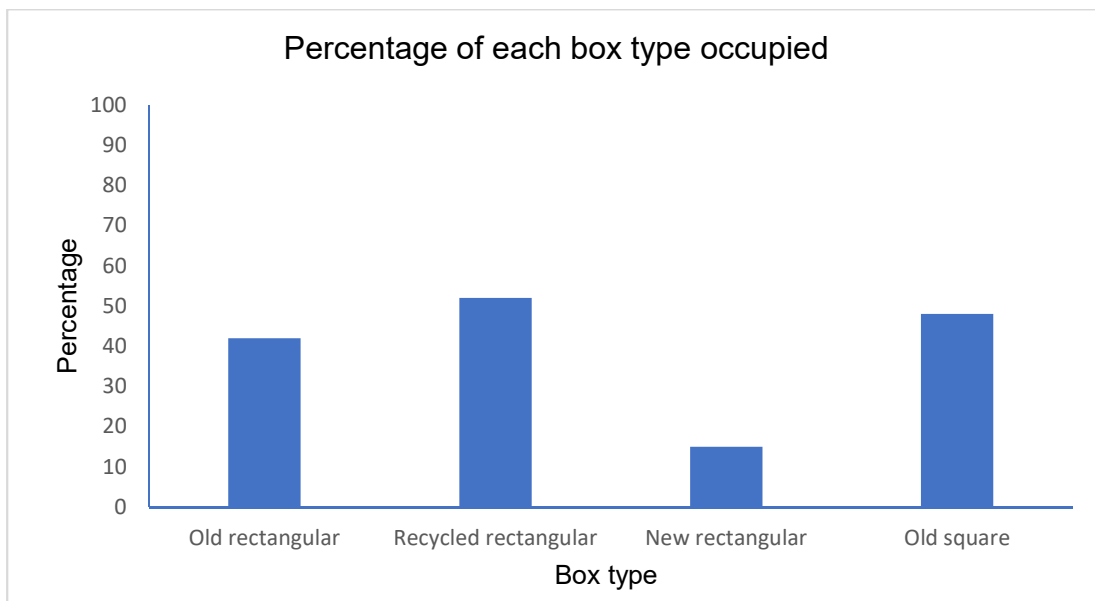


Figure 26: Bar chart showing the proportion of each Roseate Tern nest box design occupied by breeding pairs in the 2018 season

For the second consecutive season, five adult Roseates were discovered dead on the terrace or inside nest boxes. These deaths occurred on a similar part of the South terrace in an area with a number of Common Terns also nesting on the shingle. All but one of the Roseates had clear wounds and signs of ‘scalping’ on their heads and we suspect this was as a result of a particularly territorial pair of Common Terns attacking the birds, although we can’t be sure. For the two birds discovered dead inside boxes, one nest failed but in the other two chicks successfully fledged which shows some remarkable parenting from a single bird. We’re hoping that reviewing the footage of the live cameras may show evidence of Common Tern attack so that we can learn and hopefully avoid the same happening again.

24-hour CCTV surveillance of the colony was maintained throughout the season, with a Species Protection Assistant employed to prevent unauthorised landings during the night. There were a number of incidents from kayakers and other small watercraft which lifted the roosting assemblage on the beach but caused minimal disturbance to nesting seabirds. There were however three unauthorised landings during the day which were of more concern but were all dealt with quickly and affably before birds were lifted from the island.

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Brittany (France)

In 2018, there were 36-38 pairs of roseate terns breeding in France. This small population was distributed across three areas with the main colony present on l'île aux Moutons (Island of Moutons). L'île aux Moutons recorded 32 roseate tern pairs among 2356 pairs of Sandwich terns and 238 pairs of common terns. With the invaluable help from Steve Newton (Birdwatch Ireland), Paul Morrison and Daniel Piec (RSPB), 100 roseate tern nest boxes were installed onto the island in March 2018. 14 nest boxes were occupied by roseate terns, one of which had two eggs, while the others only had one.

On 19th June 2018, 15 chicks were ringed by Bernard Cadiou. While going through the colony many unhatched eggs and small dead chicks (less than a week) were found. A minimum of 15 chicks fledged this year. The colony was monitored daily by two volunteers, Maxence Ferrand and Marion Trinquesse. Their contract consisted of month on/month off between mid-April and mid-August under the guidance of Bruno Ferré, the site's project manager.

On the l'île de La Colombière (Island of La Colombière), four pairs of roseate terns laid eggs, but unfortunately the colony, which also had about 70 pairs of common terns and 15 pairs of Sandwich terns, were destroyed by brown rats (*Rattus norvegicus*) on the island. All tern clutches were predated during June and the colony was subsequently abandoned.

In early June, prior to the colony's abandonment, up to 13 roseate terns were observed near the island and the site was continually guarded and monitored throughout the breeding season by three volunteers: Violaine Gaudin, Maxence Ferrand and Marion Trinquesse. Additional support came through the help

of volunteers from Living Britain: Hubert Le Jeune, Philippe Autors, Bernard Goguel and Amaury Louvet. A rat eradication/control operation is currently underway on the island.

In the baie de Morlaix (Morlaix Bay), two pairs of roseate terns possibly nested on l'île Rikard (Rikard Island). This has a small colony of common terns; approximately 20-25 pairs. Unfortunately, this possible nesting attempt failed. The site is close to l'île aux Dames which used to be the main breeding colony of roseate terns until 2011. In previous years, l'île Rikard has a nesting pair of peregrine falcons in spring, however these failed in 2018, allowing terns to occupying the island in June.

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Azores (Portugal)

The Tern Census in the Azores Archipelago started taking place regularly from 2009, except in 2013 and then until 2015, under research projects of the Department of Oceanography and Fisheries of the University of the Azores (Neves et al, DOP-UAc and IMAR). From 2016 onwards, the Regional Government of the Azores assumed the Tern Census, still with some support of the seabird research experts. Since 2016 the seabird breeding population estimates have been coordinated the Regional Directorate for the Sea Affairs and operated by the Regional Directorate of the Environment (Government of the Azores) through each of the 9 Island Natural Parks, responsible for the management of the colonies and habitats in each island.

In the Azores archipelago, roseate tern colonies are spread around the coast of the 9 islands and some of the islets, often steep and cliff areas, inaccessible to *in situ* monitoring. The breeding pair counts of common and roseate terns are usually performed between the 25th of May and the 10th of June, each year. Nevertheless, a previous assessment of the tern colonies (either by visiting the accessible ones or by observing the behaviour of the birds with binoculars) determines the optimal period for the census, which is about 3,5 weeks after the first eggs. Some natural interannual spatial and temporal variability was detected in the reproduction of these species in the archipelago. Colonies vary in terms of occupation and are not necessarily spotted in the same place every year. Moreover, the timing of the reproduction peak varies slightly between years and islands within the same year.

Therefore, 3 different methods are applied for monitoring common and roseate tern breeding pairs in the Azores. If the colonies are accessible, *in situ* direct counting of nests, eggs and chicks is performed (Method 1). To avoid disturbance, visitation is limited to 20 min or less, preferably by 2 or 3 observers that count, photograph and register data, side by side. Abandoned and broken eggs, and predation evidence of eggs, chicks or adults are also registered, when possible. Method 2 is applied to inaccessible colonies that allow the counting of apparently occupied nests using binoculars or a telescope, from a vantage point. If possible, the number of individuals and/or the proportion of birds of each species is estimated. Inaccessible colonies with no visibility from land are monitored through flush counts from a boat (Method 3). Thus, a tern boat census around the 9 islands of the Azores is performed using a gas horn close to the colonies to induce flight. The total number of flying birds and/or the proportion of each species is estimated by averaging the estimates of the different observers. To determine the number of breeding pairs, a proportion of 3 flying birds to 2 breeding pairs is assumed, following the methodology developed by Monteiro, Neves et al, in the previous years. This correction index was calculated in the 80ies by Adrian del Nevo to account for the birds that do not react to the sound stimulus and the birds that are feeding away from the colony.

However, the already mentioned interannual variability, rough oceanic weather and sea conditions, the inaccessibility of most colonies and predation of eggs and chicks (by European starlings, yellow-legged gulls and ruddy turnstones) in the most accessible colonies (e.g. Praia and Vila islets) make data collection and research on breeding of terns extremely difficult.

The trend of the number of estimated breeding pairs of roseate terns in the Azores islands since 2009 is represented on the following figures:

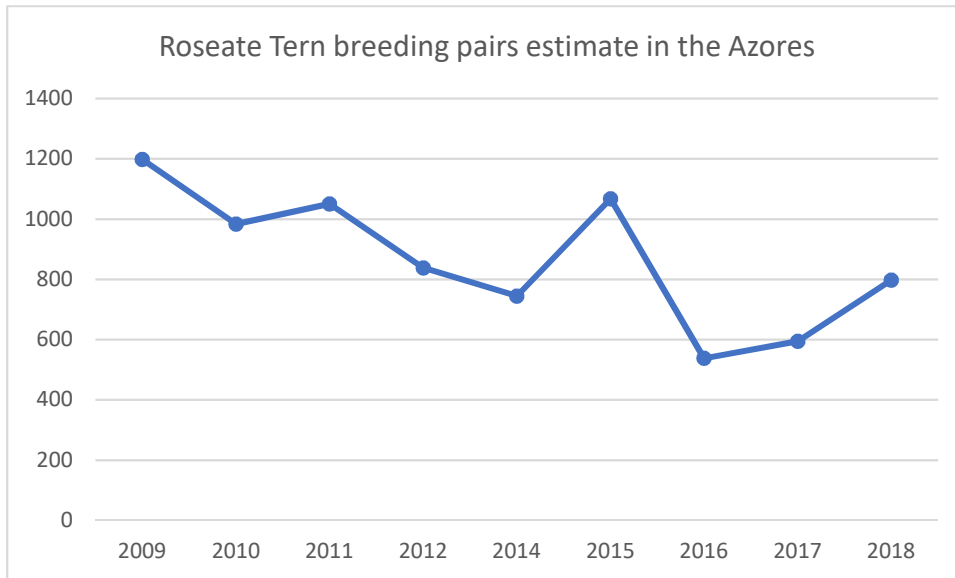


Figure 27: Roseate Tern Breeding Pairs (estimate) in the Azores

Table 2: Roseate Tern Population Estimate in Azores

Island/Group	Flores	Corvo	Faial	Pico	S. Jorge	Graciosa	Terceira	S. Miguel	Sta. Maria	Total Roseate Terns in Azores
Year	Western	Western	Central	Central	Central	Central	Central	Eastern	Eastern	All islands
2009	414	33	11	32	144	3	263	3	295	1198
2010	356	0	0	18	38	94	175	6	297	984
2011	310	2	0	25	0	501	5	108	99	1050
2012	289	0	0	30	0	280	170	1	68	838
2014	263	4	0	0	0	339	46	20	73	745
2015	155	3	8	10	0	600	12	6	274	1068
2016	242	0	5	19	12	180	75	5	0	538
2017	320	7	2	46	5	58	133	1	23	595
2018	327	7	14	18	6	250	139	4	33	798

Additionally, the results of the roseate tern census in 2018 are represented below:

Table 3: Number of Roseate Tern Colonies in 2018 across the islands in Azores

N Roseate Tern colonies	Flores	Corvo	Faial	Pico	S. Jorge	Graciosa	Terceira	S. Miguel	Sta. Maria	Total
2018	14	4	2	1	3	1	1	2	1	28

Table 4: Breakdown of the Roseate Tern colony census sites and results

Island	Date	Method	Colony	Number of Roseate Tern breeding pairs
S. Miguel	24.05.2018	1	Ilhéu da Cabra	4
S. Miguel	07.06.2018	3	Ponta do Cintrão	ND
Sta. Maria	13.06.2018	3	Baía do Cura 1	33
Terceira	26.05.2018	1	Contendas	139
Graciosa	11.06.2018	1	Ilhéu da Praia	250
São Jorge	06.06.2018	3	Baía Grande	2
São Jorge	06.06.2018	3	Ilhéu Topo N	1
São Jorge	06.06.2018	3	New colony	3
Faial	10.06.2018	3	Pesqueiro do Nunes	5
Faial	10.06.2018	3	Vulcão dos Capelinhos S	9
Pico	13.06.2018	1	Ilhéus de Santo António	18
Corvo	24.05.2018	3	Pão de Açúcar N	1
Corvo	24.05.2018	3	Ilhéu Ponta do Marco	3
Corvo	24.05.2018	3	Ponta do Marco	1
Corvo	24.05.2018	3	Cancela do Pico	1
Flores	25.05.2018	3	Pta Fernão Jorge (Norte)	1
Flores	25.05.2018	3	Falésia e Furna Fernão Jorge)	1
Flores	25.05.2018	3	Furna dos encharéus	8
Flores	25.05.2018	3	Falésia Fajã Lopo Vaz	7
Flores	25.05.2018	3	Ponta dos Ilheus (Narigão)	2
Flores	25.05.2018	3	Sul da Ribeira do Campanário (Rocha do Pico)	1
Flores	25.05.2018	3	Ilhéu João Martins	6
Flores	25.05.2018	3	Portinho	21
Flores	25.05.2018	1	Ponta do Burquilhão	113
Flores	25.05.2018	1	Alagoa #1 (Soldado)	6
Flores	25.05.2018	1	Alagoa #2 (Comprido)	82
Flores	25.05.2018	1	Alagoa #3 (Deitado)	ND
Flores	25.05.2018	1	Baixa do Moinho	76
Flores	25.05.2018	3	Entre Piscinas e Porto Velho	4

ND – present, but undetermined number of pairs of roseates;

Table 5: Average roseate tern clutch size in Azores

Island	Colony	Average number of eggs/nest
S. Miguel	Ilhéu da Cabra	1,75
Flores	Ponta do Burquilhão	1,69
Flores	Alagoa #1 (Soldado)	1,50
Flores	Alagoa #2 (Comprido)	1,51
Flores	Baixa do Moinho	1,63
Graciosa	Ilhéu da Praia	1,30
Pico	Ilhéus de Santo António	1,40

In 2018, about 798 breeding pairs were estimated around the Azores archipelago, spread between 29 colonies, which are concentrated especially on the western group of islands, and mean clutch size in the *in situ* monitored colonies varied between 1.30 and 1.75 eggs per nest in 2018. Nevertheless, the breeding population may be underestimated, due to bad weather and sea conditions during the census that prevented approximation to some of the colonies and difficulties in distinguishing this species from the common tern from far, especially in some of the mixed colonies that are unreachable and not possible to monitor entirely from a vantage point.

Flores

In fact, in 2018, in order to allow better monitoring and management of an important nesting area, the access to one of the main colonies of roseate terns in the Azores, the Alagoa islets, in Flores island was improved, by placing climbing hangers in the rocky slope. In 2016, the terns' nesting grounds in the smallest of the Alagoa islets, in Flores island, expanded to an area where the Natural Park has done control of invasive vegetation (namely *Rhaphiolepis umbellata*) earlier in February that year, which indicates that the conservation measures being applied seem effective.

Baixa do Moinho colony, also in Flores Island, is exclusive to roseate terns. In 2017, the nesting area expanded to the eastern side of the islet, which was not a nesting ground in previous years, but was densely populated by over 100 individuals in that breeding season.

The main colonies of roseate terns in accessible islets around the Azores archipelago are subject to annual habitat management (removing of exotic vegetation, control of predators, namely rats, cats and gulls).

Ilhéu da Vila, Santa Maria

However, the colony of Ilhéu da Vila in Santa Maria islet has suffered with intense predation problems by the European Starling (*Sturnus vulgaris granti*) on eggs and chicks, with significant reduction of the breeding pair numbers in the past few years, when compared with 2015. Predation by the European Starling also posed problems to the reproductive success of terns in Praia Islet (Graciosa Island). In 2016, a team including Dra. Verónica Neves (IMAR/DOP/UAc), SPEA and Graciosa Natural Park captured starlings using nets in the islet, ringed and freed them in the island, far away from the colony, but only a few hours later they returned to the islet. Possible measures to be implemented may include captivity during the critical reproductive period or lethal control, if extremely necessary, but require proper impact assessment.

Contendas Islets, Terceira

The history of the Contendas islets roseate and common tern colony was described in the Annual Roseate Tern Newsletter 2017. The colony continues to be sound and prosperous, though dealing with some issues. During the nesting season of 2018, there were 139 pairs of roseate terns and 256 pairs of common terns. The number of roseate terns remained stable, whereas the common terns almost doubled their number in comparison to the previous year.

The presence of rats was detected in the night images taken by wildlife cameras. Despite of the fact that rodenticide was placed out in early Spring and there was sign of consumption, some rats survived and didn't consume any poison later on. The remaining rodents didn't have any visible impact at the tern colony.

Since early spring, yellow-legged gulls' nests and eggs were continuously destroyed to deter them. During the tern nesting season, out of the four breeding pairs, only two remained in the margin of the islets. It seemed that the tern colony was numerous and strong enough to deter the remaining gulls from getting too close to their nests.

A dozen quail eggs was placed before and during the beginning of the nesting season as bait for avian or terrestrial predators. Although deployed at highly exposed sites, none of the quail eggs were predated.

There were numerous common starlings (*Sturnus vulgaris*) at the islets (images captured by wildlife cameras), however as of yet they have not created any disturbance nor preyed on the tern eggs. This has been a concern, as egg predation by starlings has been reported on other Azorean roseate and common tern colonies.

In 2018, 26 nesting boxes deployed at different sites of the nesting colony and they were used frequently, mostly as sun shelters by common and roseate tern chicks.

For the coming nesting season, more nesting boxes will be placed out, discouragement of gulls nesting will continue, and rat control will start during early spring. This will include the deployment of rat bait stations not only on the islets but also on the near shoreline, to prevent more rats from swimming over to the islets.



Figure 28: Plateau of Contendas Islets during the nesting season

Networking



The Roseate Tern LIFE Recovery Project team visited the main colonies in 3 islands of the Azores (Terceira, Flores and Graciosa) in a very enriching meeting in the past June, that joined the stakeholders involved in the management and study of the colonies to exchange experiences and perspectives about the trends and effective conservation measures of the colonies of roseate terns in different countries. The several teams that included RSPB, BWI and NPWS, regional administration (Regional Directorate for Sea Affairs and Regional Directorate for the Environment and Natural Parks - Azores Government, SPEA (Portuguese Society for the Study of Birds) and researchers/experts realized that the reality of the colonies are very different in the Azores and the UK and allowed a deeper understanding of the complexities across the different colony sites and to discuss the various management approaches.

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North East America

Roseate Tern summary for Canada

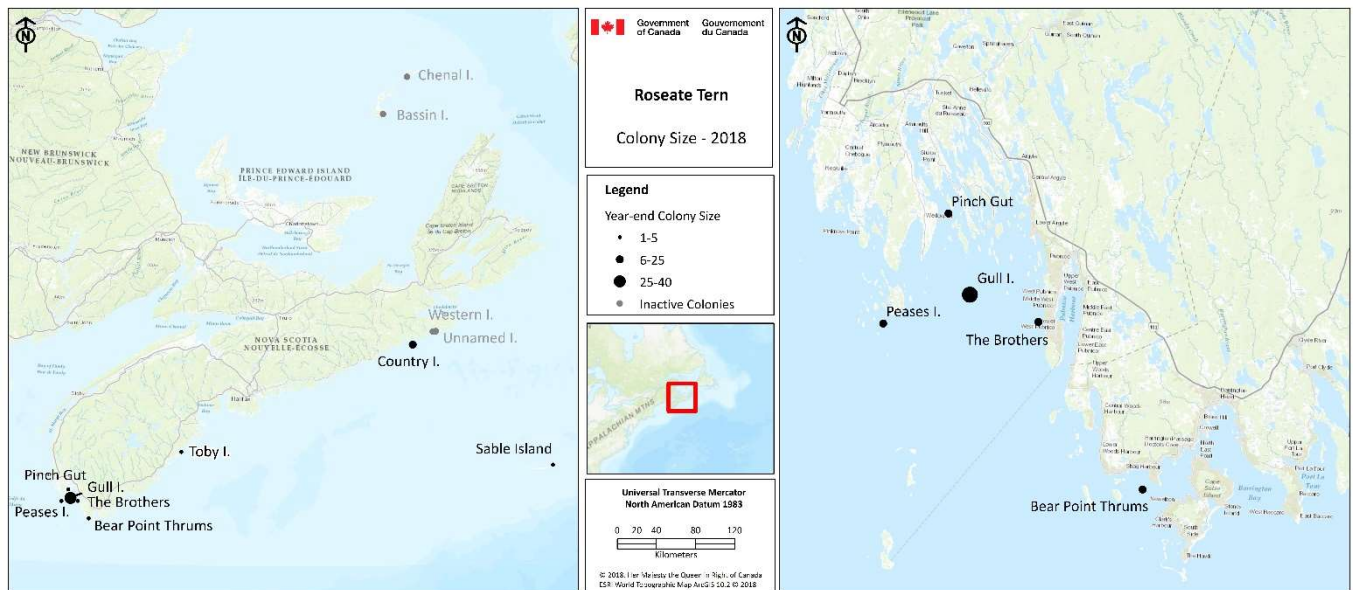


Figure 29: Canadian colonies with Roseate Tern in 2018 (black) and inactive colonies (2008-2018): grey).

Colony descriptions

North Brother Island, now essentially abandoned (2017), was once the primary breeding colony for Roseate Terns (ROST) in Canada. The island was determined to be unsuitable for further restoration efforts due to aggressive specialist avian predators (gulls, corvids) in addition to deteriorating habitat conditions (small size, significant erosion, winter and spring tidal inundation, invasive vegetation). 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 Terns (ARTE), Common Terns (COTE), and ROST 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 ROST under Canada's Species at Risk Act. 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 Lands and Forestry (NSDL&F).

ROST colonized **Gull Island** in Lobster Bay in 2017 after the abandonment of North Brother Island. Gull Island is a privately held island located approximately 8 km northwest of North Brother Island. This 3.5 ha teardrop-shaped island is ringed by a cobble beach. The island is relatively flat and low-lying, lacking trees, with a small (0.5 ha) tidally influenced pond in the southwest corner. In addition to terns, the island provides breeding habitat for a number of Common Eiders and is currently supporting a medium Great Black-backed Gull colony (~50 pairs in 2018).

Country Island, managed by CWS in partnership with the NSL&F, is located in Guysborough County, 5 km offshore. It is a federal property and identified as critical habitat for ROST. The island is 19 ha 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 ARTE, COTE, and ROST, 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 National Park Reserve is a remote crescent-shaped island located in the Atlantic Ocean, more than 150 km 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 Reserve, managed and protected by Parks Canada, and is identified as critical habitat for ROST. A number of species nest on the island in addition to COTE, ARTE, and ROST. 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, ROST have nested at 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 29).

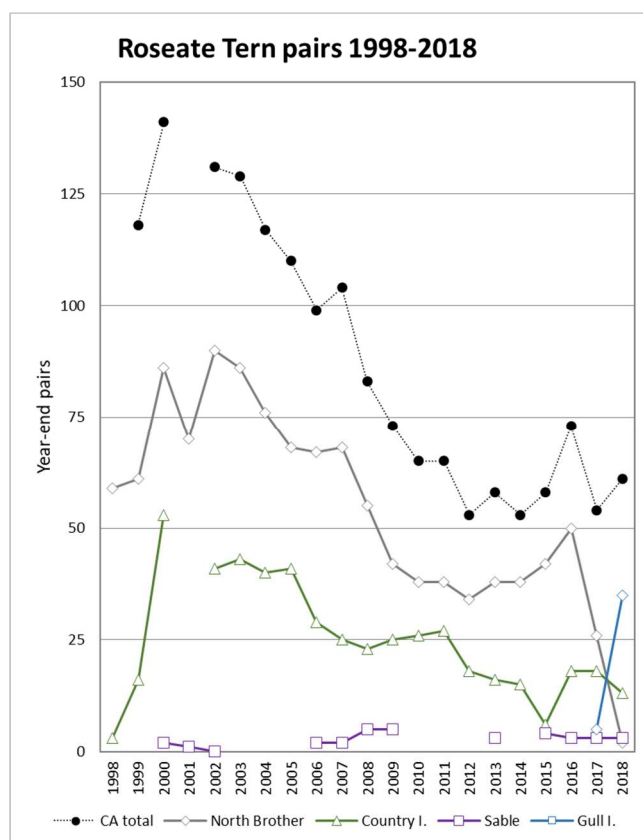


Figure 30: Pairs at Canadian colonies 1998-2018

Colony recovery efforts

We did not conduct predator control efforts on **North Brother Island** in 2018 due to logistics of removing crows (safety concerns, low chance of success). Only a few terns attempted nesting on the island this year and the colony failed early (due to persistent gulls and corvids). We switched our efforts to monitor the colony that formed on Gull Island in Lobster Bay.

Staff with Université Sainte-Anne, students, Ted D’Eon, CWS, NSDNR, and community volunteers visited **Gull Island** multiple times per week (May-August) to monitor terns and gulls. We decided to allow terns to settle without manipulation (i.e., habitat enhancement including nest shelters, gull nest removal) to determine whether the island could provide high quality nesting habitat and understand the habitat characteristics terns choose without intervention. We observed high predation on tern eggs by gulls nesting between two tern sub-colonies on the island.

We obtained a permit to remove the contents of these gull nests and subsequently removed 26 eggs from nine nests. Tern egg depredation declined thereafter. We observed many large tern chicks depredated by gulls. After two years of observations of terns on Gull Island, we are confident the Island provides suitable nesting habitat for ROST; however, nesting gulls will need to dissuasion in coming years.

The **Country Island** tern restoration project, based on non-lethal predator management, 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. Predator management has prevented (successful) nesting by gulls and corvids on Country Island since 1998. 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 previously in low numbers and undetected. Meadow voles are now abundant and predation on seabird eggs and nestlings is documented annually. The presence of a field crew throughout the nesting period and predator management activities are essential aspects of this project. Since predator management began, the mixed species tern colony on Country Island has grown from 340 pairs in 1998 to 2,049 pairs in 2018. Nest shelters and chick shelters are placed in areas with historical ROST use and suitable substrate is placed under each shelter at the start of each season. Wooden debris present on the island is also strategically placed throughout the colony to provide alternatives to nest shelters.

Tern colonies in the **Magdalen Islands** are inventoried annually to look for ROST and to identify threats. Foxes are an ongoing problem at active colonies and require swift removal once observed. Recovery measures for ROST are currently not underway at Sable Island or at other small colonies along the Atlantic Coast of Nova Scotia.

2018 report

Our objective is to prevent the extirpation of ROST from Canada by implementing recovery measures prescribed in the Action Plan for ROST in Canada. 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. Despite efforts, the population has declined by 80 pairs since 2000.

Ground surveys for terns in Southwest Nova Scotia

A. d'Entremont visited a number of sites in Southwestern Nova Scotia under contract with CWS-ECCC for tern surveys in 2018 and observed ROST on four islands (Figure 1). Pinch Gut and Peases Islands (both in Lobster Bay) were surveyed in Late May and the presence of ROST were noted at both. Pinch Gut was revisited in Mid-June and one ROST nest was confirmed. Peases Island was revisited in July and August and at least six adult ROST were observed. At least one recently fledged juvenile was documented in August. Seven ROST were observed on the western-most island in the Bear Point Thrums in early July. Some of these birds were seen carrying fish suggesting they had young to feed. On a return visit in mid-July, observers noted many of the almost 50 nests previously recorded were empty and evidence of depredation was observed (deceased chicks, one decapitated). For the third year, ROST were documented at Toby Island. Three individuals were observed, two of which were seen landing together and appeared to be nesting in late June. No follow up visits were made to Toby Island this year. Ten individuals were re-sighted on Pinch Gut Island, Peases Islands, and Bear Point Thrums; eight were originally banded on North Brother Island and two were from Country Island.

North Brother Island (The Brothers Island Wildlife Management Area)

High tides and winds swept all but one ROST nest shelter (#13!) from North Brother Island over the winter of 2018. Many were collected on the mainland but some were lost or destroyed. This made our decision to cease implementing recovery measures at this site much easier; we did not want to encourage terns to nest on the island. We set up trail cameras early in the season and these detected small numbers of terns scouting the island and setting up in early to mid-May. The cameras also documented abundant avian predators (gulls and crows). We conducted our tern census on 16-June and recorded 74 nests, two belonging to ROST. North Brother was abandoned shortly thereafter and no young were produced in 2018. After 30 + years with nesting terns, this island's time as refuge is over.

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

Gull Island in Lobster Bay

This is the second year a small colony formed on Gull Island. Many ROST (and likely ARTE and COTE) relocated after abandoning North Brother in 2017. A local fisherman observed the first terns over the waters around Gull Island during the first week of May. The first tern nests were documented on 22-May and ROST nests were confirmed by 30-May. A number of lobster traps washed up on Gull Island over the years and some are embedded in the cobble surrounding the island. During a visit on 6-June, we discovered a ROST entangled in the nylon netting of a lobster trap. We freed the bird from the trap and after a quick assessment, released it. We cut much of the remaining netting from this trap. The freed bird returned to nest in the trap and successfully hatched a chick on 4-July.



We conducted our tern census on 16-June and counted 317 tern nests including 26 or 27 ROST nests. The terns formed two sub-colonies on the island as they did in 2017. By year-end, we documented 35 ROST nests (distributed between the two sub-colonies) and an additional nest belonging to a COTE/ROST pair. ROST in the northern sub-colony experienced better nests success (81% vs 42% in the southern sub-colony) and better hatching success (75% vs 34% from the southern sub-colony). We attribute the low nest success in the south to depredation by gulls. Approximately 50 pair of Great Black-backed Gulls nested in 2018. The majority of these gull nests were quite a distance (10s of metres) from the tern colony but we removed (under permit) nine nests from within the tern colony boundary. No adult ROST were captured in 2018 given the terns were already dealing with potentially high nest depredation by gulls (minimize disturbance to prevent abandonment). We captured and banded 34 chicks with USGS bands and 27 of these received plastic field-readable bands (red with white 3-digit codes). We collected blood from 22 of the (non-sibling) chicks that received field-readable bands. Thirty-one individuals were re-sighted on Gull Island in 2018; 27 were originally banded on North Brother Island, NS and one each banded at: Mangue Seco, Brazil; Great Gull Island, NY; Bird Island in Buzzards Bay, MA; and Country Island, NS.

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

Country Island

This year, ROST numbers were at their second lowest in over fifteen years. Results show a general decline in the number of ROST breeding on Country Island after 2000. From 2012 to 2015, the recovery goal of 1.1 fledgling per pair per year was met; however, productivity in 2018 was below this target at

0.5 fledglings per pair. This low productivity is partly attributable to a high proportion of unhatched eggs. The first ROST were detected on 21-May and the first ROST egg was found on 04-June. Thirteen ROST nests were monitored; eight of which nested under nest box structures. Overall species composition for the colony was 55.6% ARTE, 43.8% COTE, and 0.5% ROST. All 13 ROST nests were monitored for hatch success; 52% of eggs hatched. Mean hatch success (\pm SE) was the lowest since monitoring began in 1997 with 0.58 ± 0.12 eggs hatched per eggs laid per nest compared to the 19-year average (0.8 ± 0.10). At ROST nests, 60% of chicks fledged and 40% of chicks died ($n = 10$ chicks). Reproductive success for ROST was low in 2018 with an average fledging success (\pm SE) of 0.63 ± 0.16 chicks fledged per egg hatched ($n = 8$ nests) and an average productivity (\pm SE) of 0.50 ± 0.15 chicks fledged per monitored pair ($n = 12$ nests). Linear growth rates (mass and wing chord) were determined for 38 ARTE, 38 COTE and 8 ROST chicks. For all three species, growth rates were below average (based on 18 years of data for ARTE & COTE and 9 years data for ROST). In 2018, seven ROST chicks were hand-captured and two adults were trapped and marked using red plastic field readable bands with alphanumeric codes. All 26 breeding ROST were checked for bands, 23 were banded, one was not, and two were unknown. Identifications were made for 20 of the 23 marked breeders and the three remaining unidentified birds had double metal bands (Table 15). During late incubation, the crew successfully trapped and marked one unbanded nesting bird and one bird with a single metal band. In all, 30 uniquely marked ROST were identified at Country Island and these consisted of a combination of birds marked originally as either chicks or adults at Country Island, one bird marked as a chick at North Brother Island in 2012, and one banded on Great Gull Island, NY in 1997.

Sable Island National Park Reserve

Parks Canada completed one survey at the “East Light” colony and confirmed three ROST nests. The colony was visited once just before peak-nesting and this is considered a minimum estimate.

Magdalen Islands, Quebec

Four colonies were partially surveyed for terns in 2018 but ROST were not observed. Predators continue to be a significant problem for tern colonies in the Magdalen Islands: Snowy Owl and Red Fox depredation was noted at colonies.

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North East United States

Maine Coast Islands (Maine)

The National Audubon Society Seabird Restoration Program (SRP) manages seven seabird nesting islands off the coast of Maine, USA, in cooperation with the Maine Department of Inland Fisheries and Wildlife and the Maine Coastal Islands National Wildlife Refuge (Figure 31). These seven islands provide habitat for mixed colonies of Common, Arctic, and Roseate Terns, with three islands supporting consistent Roseate Tern populations (Stratton Island, Jenny Island, and Eastern Egg Rock). Roseate Terns occasionally nest in small numbers on the other four islands. Other nesting species vary by island, but include Atlantic Puffins, Black Guillemots, Razorbills, Common Eiders, Laughing Gulls, and Leach's Storm-petrels. Each year during the seabird breeding season, field crews of 2-5 people live on each island to protect, monitor, and study the seabird populations.

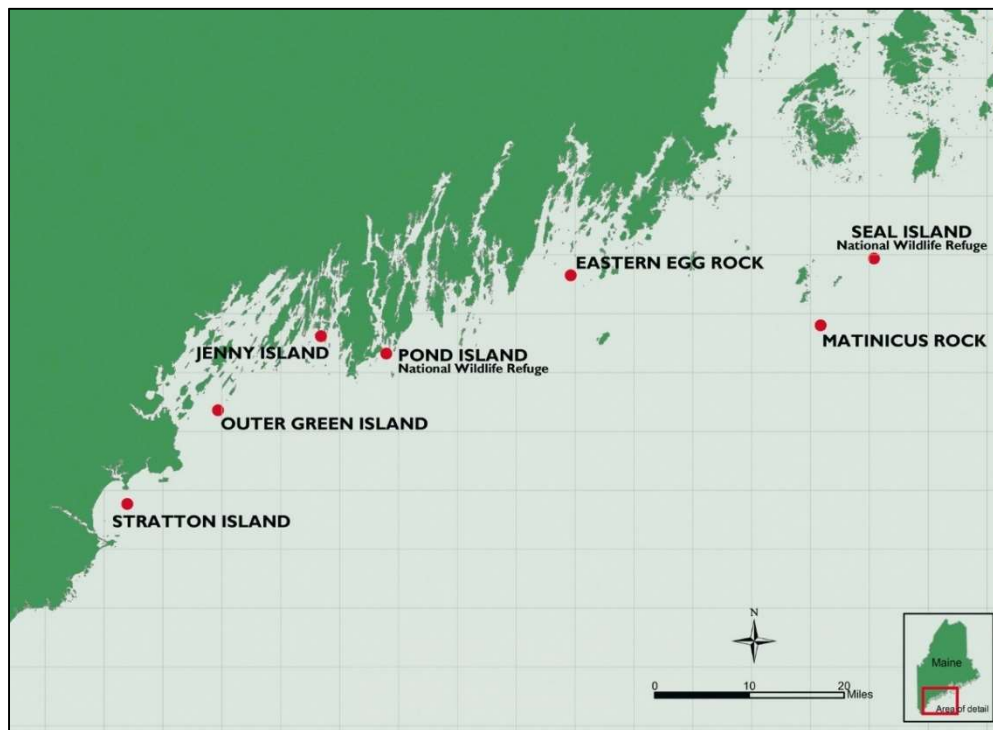


Figure 31: Locations of tern colonies managed by the National Audubon Seabird Restoration Program in the Gulf of Maine, USA.

Six of the seven tern colonies managed by SRP were restored between 1980 and 2002 using social attraction (decoys and playback of colony sound recordings) and intensive gull control. The remaining colony, Matinicus Rock, maintained its tern colony throughout the 1900s, likely due to protection provided by the presence of lighthouse keepers living on the island. Once restoration efforts in Maine began, Roseate Tern populations quickly increased, reaching a peak of 273 pairs in 2001. The population declined from 2001 to 2012, when the population stabilized for several years before increasing again in 2017 (Figure 32).

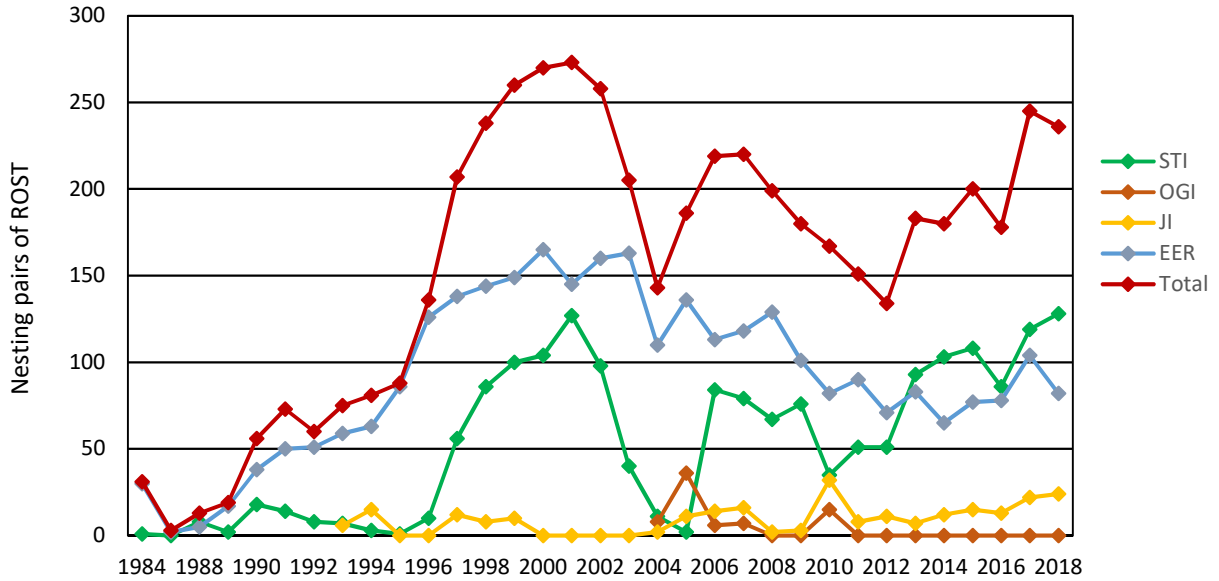


Figure 32: Population trends of Roseate Tern colonies managed by the National Audubon Society Seabird Restoration Program in the Gulf of Maine, USA, 1984-2018. STI: Stratton Island, OGI: Outer Green Island, JI: Jenny Island, EER: Eastern Egg Rock.

Management

Factors affecting Roseate Tern populations in Maine include predation by gulls, Black-crowned Night-herons, Great Horned Owls, and mink; nest-site competition with Laughing Gulls (at Eastern Egg Rock); and habitat degradation resulting from invasive vegetation. Predator management is conducted as needed (under federal and state permits) and includes lethal control, live-trapping and relocation, gull nest destruction, and non-lethal harassment.

To reduce nest-site competition with Laughing Gulls at Eastern Egg Rock, gull nests have been removed weekly in areas where tern and Laughing Gull nesting habitat overlaps. This effort reduced, but did not eliminate, nesting Laughing Gulls in the targeted area. In 2018, an effort was made to deter Laughing Gull nesting through harassment early in the season, before nests were initiated. This included prominent displays of dead Laughing Gulls on the island, loud noises, and occasional lethal control, and successfully prevented most Laughing Gull nesting, with the majority of the colony moving to a nearby island to breed. In response, terns reclaimed habitat that had not been available to them for many years, and the Common Tern nest count increased by 15%, to over 1,000 pairs.

Habitat enhancement projects have included placing vegetation barriers, experiments with planting native plants, and providing nest shelters for Roseate Terns. Use of nest shelters varies by colony, and the shelters tend to be used only when natural shelter (large rocks, logs, etc.) is lacking. Wooden nest boxes and rock “caves” have both been placed or built in suitable habitat to provide shelter. Rock “caves” are utilized at higher rates than wooden boxes.

Monitoring and Research

Annual monitoring of Roseate Terns in Maine includes nest counts, productivity estimates, banding and band resighting, and diet studies.

In 2018, the Roseate Tern population was similar to 2017, with a total of 236 breeding pairs, compared to 245 pairs in 2017 (Figure 32). While the Eastern Egg Rock colony declined by about 20 pairs from an unexpected peak in 2017, the Stratton Island colony grew to its largest size since restoration began, with 128 pairs. Productivity was fair to good, ranging from 0.68 chicks fledged per pair at Jenny Island to 1.25 at Stratton Island (Figure 33). Diet and growth observations for all tern species suggested that terns had trouble finding sufficient food for much of the month of July, when chicks were reaching fledging age and learning to fly. Large numbers of older Common and Arctic Tern chicks and fledglings were found dead in the colonies, apparently having starved. Fewer older Roseate Tern chicks and fledglings were found dead than the other two species, though that may be because Roseate Terns tend to stay well hidden under rocks and dense vegetation, making their detection less likely. Resightings of banded Roseate Terns at staging grounds during fall migration and in future years may provide more insight into the survival of fledglings in 2018.

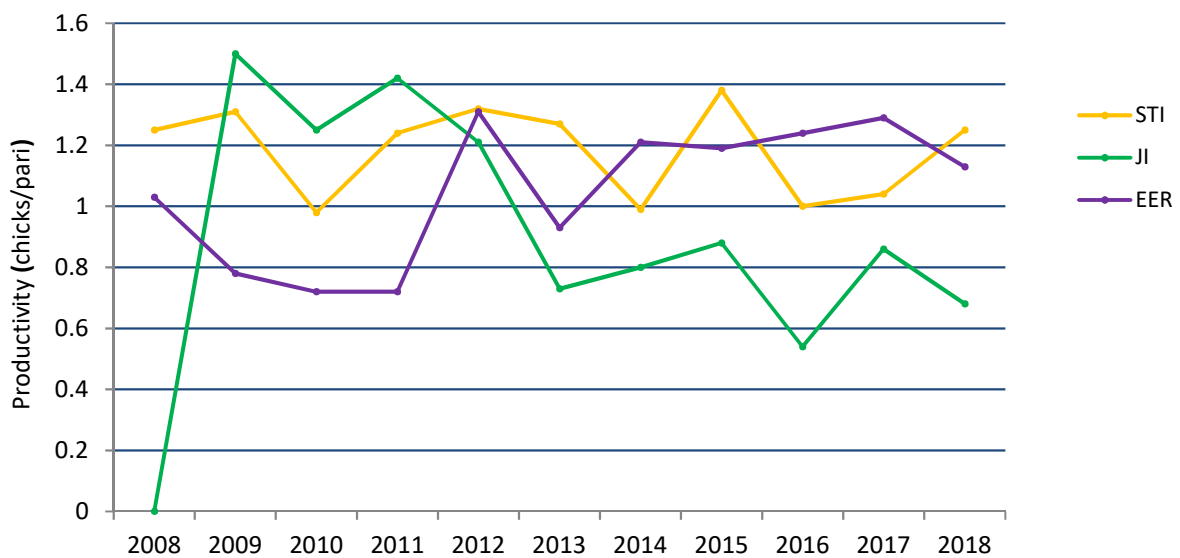


Figure 33: Productivity estimates for Roseate Terns at Stratton Island (STI), Jenny Island (JI), and Eastern Egg Rock (EER), Maine, 2008-2018.

Tern chick provisioning studies have been conducted on Maine coast islands since 1986. Each year, summaries of the diets of Common, Arctic, and Roseate Tern chicks are compiled at each colony. An analysis of this long-term dataset is being conducted by Keenan Yakola, a master’s student at the University of Massachusetts Amherst and the DOI Northeast Climate Adaptation Science Center (discussed in detail in the 2017 newsletter).

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Buzzards Bay, Massachusetts: Bird, Ram, and Penikese Island, 2018

In 2018, overall numbers in Buzzards Bay, Massachusetts continued to increase for the fifth year in a row, rising to 2,290 peak season pairs (vs. 2,240 pairs in 2017) – 50% of the endangered northwest Atlantic population. Before the 2018 breeding season, the Massachusetts Division of Fisheries & Wildlife (MassWildlife), which manages the Buzzards Bay colonies, and the U.S. Army Corps of

Engineers implemented measures to resolve drainage problems resulting from construction of nesting habitat on Bird Island, Marion. These measures – construction and augmentation of rock-filled drainage channels and the addition of a 6” coarse gravel cap across the island – appeared to be successful in eliminating the flooding-related issues responsible for the exodus of nearly half of the Roseate Tern population in 2017, when only 595 pairs nested.

In 2018, Roseate Tern abundance on Bird returned to pre-construction levels (1,185 pairs). Consequently, populations of Roseate Terns dropped on Ram Island, Mattapoisett (from 1,555 to 1,093 pairs) and Penikese Island, Gosnold (from 90 to 12 pairs) following a return of terns to Bird. Productivity at all three sites appeared to be good. In September 2018, MassWildlife planted about 1,500 seaside goldenrod (*Solidago sempervirens*) plants across Bird to replace vegetation that was destroyed during construction. These plants will provide appropriate cover for nesting Roseate Terns and Common Terns in 2019.



Figure 34: Bird Island, Massachusetts, April 2018. Island has been newly capped with coarse fill and drainage channels have been expanded and augmented. Cobbles have been distributed across the new fill to provide the surface heterogeneity that appeals to terns. C Mostello. MassWildlife

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Great Gull Island (New York)

This season was another exceptionally good one for the Roseates on Great Gull Island (GGI). We had an estimated 2200 nests, even more than last year's 2089 -which had been our highest count ever. Disturbance from predators was minimal and the weather was good. *Ammodytes* were plentiful: the terns were catching them just ¼ mile or less from the island on a daily basis. Observers noted parents bringing fish to their young every few minutes.



Figure 35: Terns foraging off Great Gull Island © Joseph Dicostanzo

Methods for nest counts, chick banding, and adult trapping were the same as those described in the 2016 Annual Roseate Tern Newsletter. Again this year GPS locations were taken for all nests. We ringed a total of 1171 Roseate chicks. Each received a Bird Banding Lab band on one leg and a PFR band, dark blue with white letters, on the other. Estimated productivity this season was 1.48 chicks per nest. Many of these were resighted on GGI and/or by Jeff Spendelov on Cape Cod.

Pam Loring reports that again this season 30 Roseate Terns and 30 Common Terns on GGI were fitted with digital VHF transmitters (nanotags) as part of a collaborative movement study with the USFWS Division of Migratory Birds, the University of Rhode Island, and the University of Massachusetts Amherst. This study is funded by the Bureau of Ocean Energy Management and aims to estimate the exposure of high-priority avian species to offshore wind energy areas in the U.S. Atlantic, from Massachusetts to Virginia.

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Using satellite transmitters on Great Gull Island

During the 2018 field season, we initiated a pilot study to assess the full life cycle movements of Roseate Terns breeding on Great Gull Island, New York. Our primary objective was to track individuals using the Argos satellite system for at least one full year to determine the phenology, migratory pathways, and stopover sites of Roseate Terns during fall migration, as well as assessing where key wintering areas were located off northeastern South America. In June 2018, Meyer attached 2.0 g Argos PTT solar-powered satellite transmitters (Microwave Telemetry, Columbia, Maryland, USA) to 10 adult Roseate Terns (8 females and 2 males) nesting on Great Gull Island. During the 2017 field season, Meyer had attached the same model transmitters to 5 Common Terns nesting Petit Manan in the Gulf of Maine, and two of these birds were successfully tracked for one annual cycle (Linda Welsh and Pam Loring, US Fish and Wildlife Service, pers. comm). One of the tagged Common Terns, whose signal was lost within a month of tagging, was captured a year later in the same breeding colony. At that time, the transmitter and harness were intact and in the same position as when deployed with no evidence of adverse effects. All transmitters used on Common and Roseate Terns were attached in the interscapular region using a modified wing harness attachment system (Thaxter et al. 2015).



Figure 36: Roseate Tern with 2 g solar-powered Argos PTT transmitter attached using a modified wing harness in 2018 on Great Gull Island, New York, USA.

We tracked the tagged Roseate Terns for only 1 to 72 days before transmissions ceased, with only 2 birds tracked for over 7 days. Unfortunately, one emaciated individual was recovered 31 km from the nesting colony in downtown Westerly, Rhode Island, which had the transmitter harness stuck between its upper and lower mandibles; this individual died en route to a local rehabilitation facility. One bird for which transmissions ceased was observed briefly soon thereafter in good condition on Great Gull Island. Two other individuals observed during blind stints had their bills stuck in harnesses but attempts

to recapture these birds were unsuccessful. Based on these observations, we believe it is possible that additional Roseate Terns tagged in this study may have died after getting their bills stuck under chest harness loops (transmitter failure may have also been a contributing factor to loss of signals). These results suggest that researchers considering tracking Roseate Terns should avoid using wing harnesses to attach external transmitters. Researchers interested in monitoring movements for less than six months could consider suturing transmitters to the interscapular region of terns, a technique that has been used successfully with digital 1.6 g VHF transmitters on over 266 Common Terns and 150 Roseate Tern with no apparent impact on productivity or survivorship (Loring et al. 2019). For biologists interested in tracking Roseate Terns for over 6 months another approach to consider is a leg loops harness system (Thaxter et al. 2015), which has been used successfully on Aleutian Terns (D. Lyons, pers. comm.).

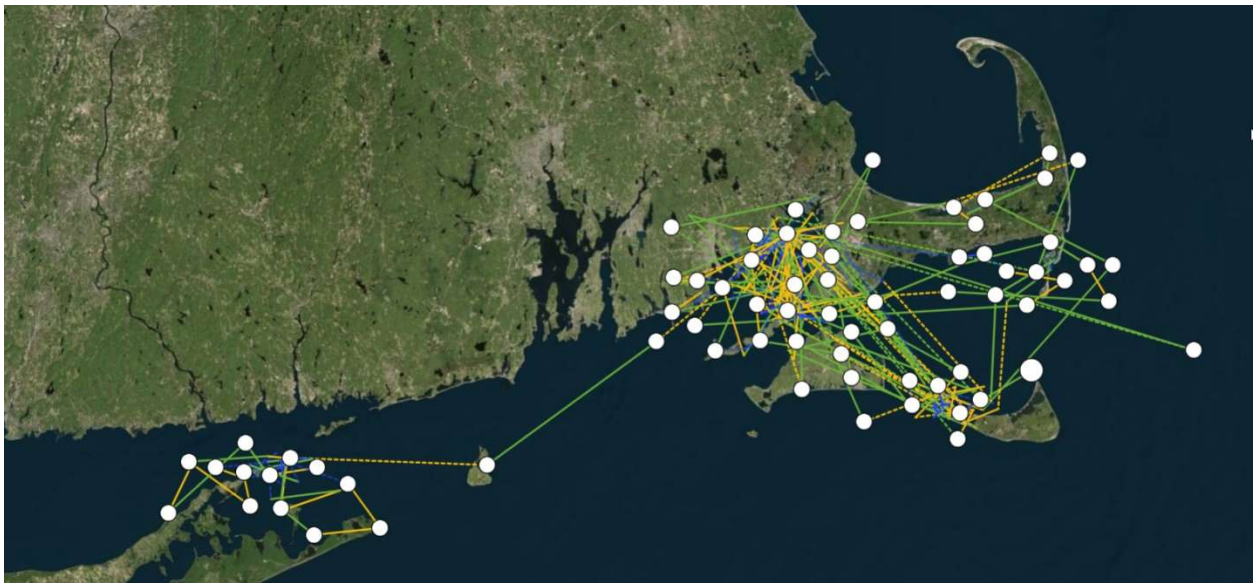


Figure 37: Locations (Argos location classes 0-3) where a female Roseate Tern (tag ID #81) was detected from 23 July to 3 Sept 2018. This bird emigrated from the nesting colony on Great Gull Island, New York on 28 July 2018 and moved to Buzzard's Bay Massachusetts during the post-breeding season before transmitter was last detected on 3 Sept 2018

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Caribbean Roseate Tern Population

Florida, U.S.

The roseate tern in Florida is a federally threatened species and is part of the Caribbean population. All nesting in Florida is in the Florida Keys and the Dry Tortugas National Park which are located at the extreme southern end of Florida. The roseate tern in Florida is designated a federally threatened species by the U.S. Fish and Wildlife Service. Their primary habitat is on sand and coral rubble on offshore islands, tar and gravel rooftops, and abandoned bridges.

Management for roseate terns on rooftops is difficult, especially when on private property. Emergency repairs of air conditioning units or the roof itself may cause the entire colony to abandon if the work is not done quickly or in the morning when temperatures are cooler. Further, strong rains can sometimes flood eggs on poorly drained roofs. Additionally, not all residents are sympathetic about having terns nesting atop their building. They frequently complain about the birds defecating on their vehicles and sidewalks. Predation from mammals is not an issue but terns are vulnerable to fish crows (*Corvus ossifragus*) which are abundant in urban areas.

Management for roseate terns at the Dry Tortugas National Park includes restricting park visitors from entering the nesting areas. Large educational signs and law enforcement are very effective. There is also ongoing control of domestic rats on all the islands. Unfortunately, erosion from strong summer storms as well as vegetation succession has led to loss of open sandy areas which are the main nesting areas for this species. Roseate terns in Florida do not like to nest in vegetation but prefer open areas. Over-wash from winter storms or hurricanes will occasionally create habitat on these islands. Laughing gulls (*Larus atricilla*) are occasional predators of roseate tern chicks but there is currently no gull control.

There is no management of the roseate terns on the abandoned bridge. The bridge is cut off on both ends and is over water. Further, the bridge is crumbling and no longer structurally stable so accessing it by boat would be dangerous. Fortunately, that makes it impossible to have human disturbance.

As a result of habitat loss, predation, and hurricanes, the Florida population of roseate terns has drastically declined in the last 10 years (Figure 38).

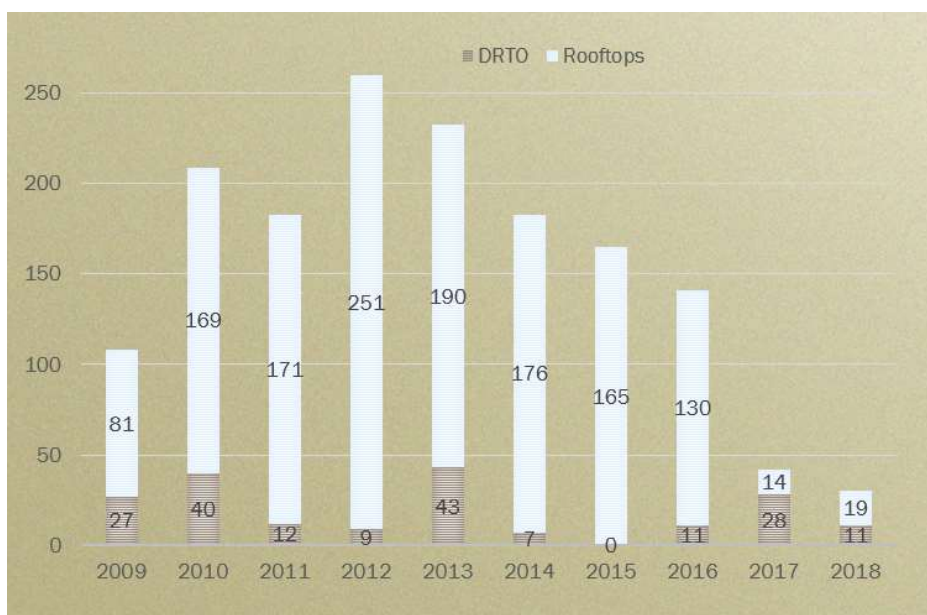


Figure 38: Roseate tern nesting pairs in Florida, 2008-2018 at the Dry Tortugas National Park (DRTO) and on rooftops and bridges (bridges are lumped under rooftops).

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In 2018, roseate terns nested on a sand and coral rubble beach at the Dry Tortugas National Park, one rooftop and an abandoned bridge (Figure 39).

- 1) The Dry Tortugas National Park is located 112 km west of Key West in the Gulf of Mexico. The park is managed by the National Park Service. Sooty terns (*Sterna fuscata*) and brown noddies (*Anous stolidus*) nest near the roseate terns but not within the section of the island.
- 2) Roseate terns nested on one roof colony on Vaca Key in the middle of the Florida Keys. The roseate terns nest with least terns (*Sternula antillarum*).
- 3) Roseate terns also nested on an abandoned bridge next to Bahia Honda State Park. The bridge contains concrete debris and asphalt from the buckling of the rails and road surface which provides a nesting substrate for least terns and the roseate terns.



Figure 39: Roseate tern colonies in Florida, 2018

The total nesting pairs of roseate terns in Florida were 30 and were located at three colonies. All counts are direct counts of nests on the ground and roof colony. Nests on the bridge are counted by counting incubating adults using a spotting scope. Nineteen of the pairs were on the ground colony (Dry Tortugas National Park) and 11 were on the bridge and rooftops. Unfortunately, productivity for the entire Florida population was low and estimated as a minimum 0.1 fledged young/nesting pairs. Mean clutch size and survival rates were not calculated since these colonies are only visited two to three times per season. The number of chicks or eggs on the bridge cannot be calculated because of the distance between the location of the nests and available viewing spot.

Due to the drastic decline of the roseate terns in Florida an artificial platform is being constructed within the Key Deer National Wildlife Refuge at Big Pine Key. The platform will be complete before the beginning of the 2019 nesting season and will hopefully attract roseate terns to nest using decoys and recorded calls.

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ROST genetic sampling in Florida

In 2017 and 2018 DNA samples were collected from colonies in Buzzards Bay, Massachusetts; Marathon and Dry Tortugas National Park, Florida; and the U.S. and British Virgin Islands. PhD student Paige Byerly at the University of Louisiana at Lafayette is currently analyzing these samples at the Smithsonian's Center for Conservation Genomics, and results are expected in 2019. The goals of this project are to investigate historical and current connectivity and relatedness of the Northeastern and Caribbean populations, in addition to evaluating parameters that can help in determining the genetic health and conservation status of these populations.

Paige Byerly, PhD Student, University of Louisiana at Lafayette – pabyerly@gmail.com

2018 Roseate Tern Staging Site Research in the Northeast United States

A report (Spendelow 2018) in the 2017 RSPB Newsletter reviewed the history of prior work done on staging Roseate Terns (ROSTs) as part of the U.S. Geological Survey's (USGS) Cooperative Roseate Tern Metapopulation Project (CRTMP). The goal of the new USGS study approved in 2016 was to use data from resightings of individuals with plastic field-readable (PFR) bands to examine temporal and geographic variation in use of staging sites by ROSTs of different ages and breeding status (e.g., Hatch Year [HY] birds; nonbreeding 1-, 2-, and 3-yr-old adults; failed and successful breeders that are not caring for an HY; and successful breeders giving postfledging care to HY ROSTs) from throughout the breeding range. However, USGS funding for summer fieldwork was not made available in 2018, so CRTMP Director Jeff Spendelow took a 9-week vacation to look for colorbanded terns on Cape Cod, Massachusetts (CCMA) in order to maintain the continuity of the long-term population dynamics work on the Northwest Atlantic ROST breeding population. Spendelow retired from US federal government employment on 31 Dec. 2018 and intends to continue his work on ROSTs as a volunteer Emeritus Scientist.

Information on 2018 encounters of colorbanded ROSTs had been received from many - but not all - CRTMP cooperators as of 15 Jan. 2019. Therefore this report will focus mainly on the banding done at the colony sites and the resights made on CCMA (Fig. 40.). It also will include selected information on encounters reported from other sites, but proper comparisons of some aspects of ROST staging behavior and population dynamics can't be made until all data has been received and summarized. Also, most likely because fewer late-season observations were made at other areas in 2018 than in 2017, we had only 14 cases of ROST going back-and-forth between CCMA and Stratton Island, Maine (ME) or Seavey Island, New Hampshire (SYNH) in 2018 after seeing 32 cases in 2017.

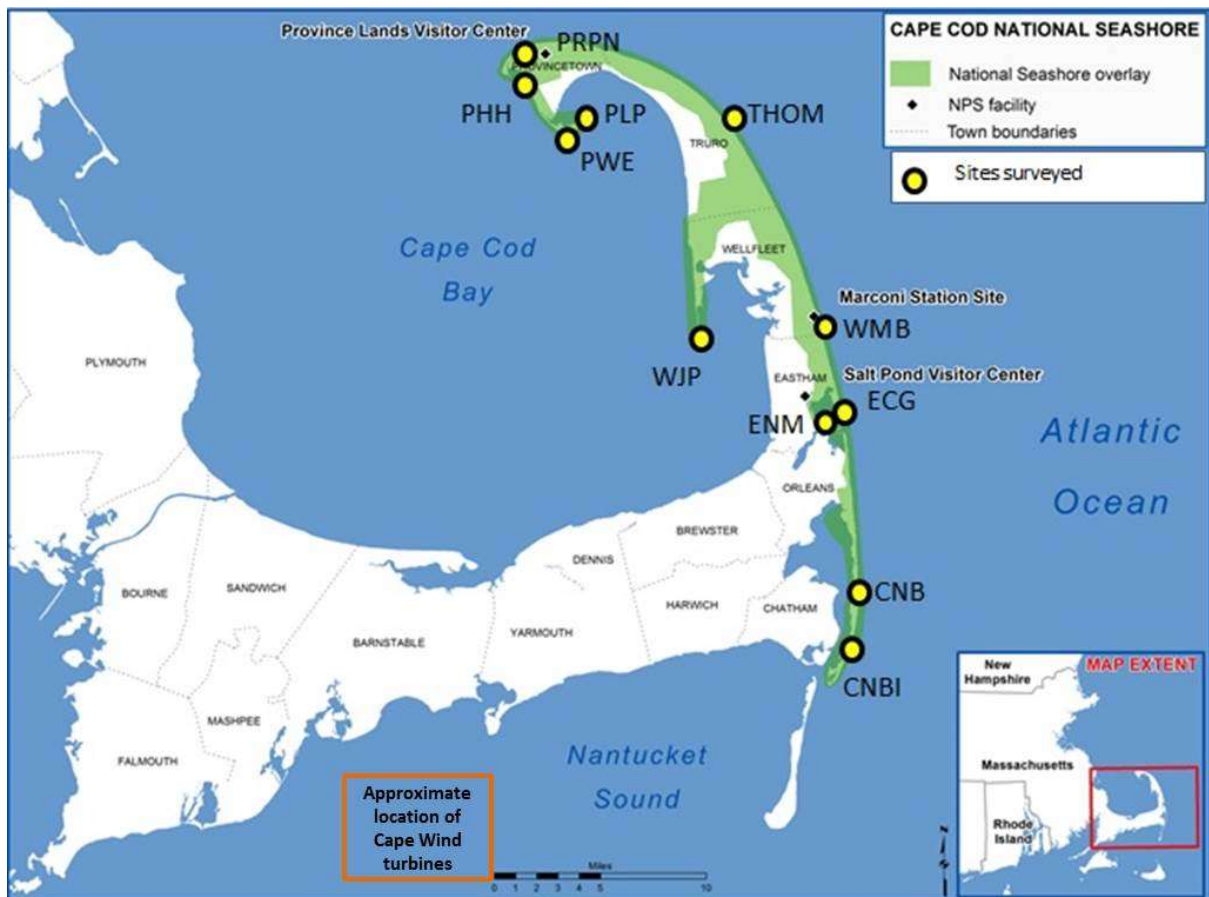


Figure 40: Roseate Tern (ROST) staging sites on the outer part of Cape Cod, Massachusetts (CCMA) within Cape Cod National Seashore (CCNS), and the approximate location of the proposed Cape Wind Energy Project in Nantucket Sound. Staging sites surveyed by the Parental Care Study Team for 2014-2015 included in the Provincetown/Truro area: Long Point (PLP), Wood End (PWE) Hatches Harbor (PHH), Race Point North (PRPN), and Head of the Meadow Beach (THOM); in the Wellfleet/Eastham area: Jeremy Pt. (WJP), Marconi Beach (WMB), Coast Guard Beach (ECG), and the Nauset Estuary Complex (ENM); and in the Chatham area: Chatham North Beach (CNB) and Chatham North Beach Island (CNBI). Although not labeled on the original figure produced by Kayla Davis for her MS thesis at Virginia Tech, other important CCMA staging sites outside of CCNS used by ROSTs include (a) the eastern side of Buzzards Bay off the southwestern part of the town of Falmouth, (b) the (ever-changing) area around what is now North and South Monomoy Islands (shown as a single long island south of the town of Chatham in this figure) and South Beach Chatham (south of CNBI), and (c) the Nantucket-Muskeget Shoals area that forms the southeast border of Nantucket Sound as shown in the “map extent” insert. The northern tip of Block Island also appears south of mainland Rhode Island in the insert.

In 2011 we started using 3-character PFR bands on ROSTs at 8 sites in the NW Atlantic from Nova Scotia (NS) south to Connecticut (CT); they now have been used at 12 sites. The use of other colors of PFRs on Common Terns began in 2013 in Massachusetts (MA), and they now have been used on COTEs at colony sites in Canada and in New Hampshire (NH), New York (NY), New Jersey, Maryland, and Virginia in the US. In 2018, red, yellow, or blue PFRs were put on ROSTs at 10 colony sites, and black or white PFRs on COTEs at 10 sites with both species being banded at three sites: Country Island (CYNS) and Lobster Bay (LBNS) and at SYNH in the US.

In 2018 Spindelov started late and had only 57 days of fieldwork from 25 July (about two weeks after the first HYs typically start to arrive on northern CCMA) to 22 Sep. However, he made almost 50% more identifications in 2018 than during his 68 days of fieldwork from 15 July to 27 Sep 2017. Catherine Neal and Ian Putnam came from Great Gull Island (GGNY) earlier in 2018 than they did in 2017 and spent 13 days from 29 July to 16 Aug making observations, Grace Cormons (who heads the ROST Team at GGNY) and her husband Matt made observations from 7-10 Sep., and several US National

Park Service staff and other volunteers also helped make observations at Cape Cod National Seashore in 2018. I thank them and the colony-site managers for all their work in 2018.

Following the atypical events of 2017, many aspects of the staging period in 2018 more-or-less returned to normal in the CCMA area. Table 6 shows the weekly average numbers of terns with PFRs identified/day by Spendelow over a 14-week period each year from 2014-2018. From Period 10 (starting in late Aug) through Period 12 (ending in mid Sep) in 2017, PFR-banded tern numbers were considerably lower than average on CCMA compared to what they were in 2014-2016. In 2018, however, I identified four to nearly six times as many individuals on a daily basis during those three periods as I had in 2017, and I had a record one-day high of 197 terns with PFRs identified on 3 Sep. 2018 at Hatches Harbor, Provincetown (PHH), southeast of the Race Point Lighthouse at the NW tip of CCMA. The seven highest counts of 100 or more PFRs identified were made in the 2-week period from 29 Aug to 11 Sep. Six of those high counts were made at PHH and the sixth highest count of 104 was made at Powderhole, South Monomoy Is. on 6 Sep.

Table 6: Weekly average observation statistics of staging terns with PFR bands on Cape Cod, MA. Shown are the weekly average number of Roseate Terns and Common Terns (combined) with plastic field-readable (PFR) bands identified/day by Jeff Spendelow over a 14-week period starting on 20 June in each year. Note the relatively low values (highlighted in yellow) for periods 10-13 in 2017 compared to the values from 2015, 2016, and 2018. nd = no data.

Week Number and Starting Date (6-20 = 20 June; 9-19 = 19 September)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year	6-20	6-27	7-04	7-11	7-18	7-25	8-01	8-08	8-15	8-22	8-29	9-05	9-12	9-19
2014	3.7	1.4	1.3	1.6	3.3	2.5	41	27	32	59	64	19	10	6
2015	0.3	0	0.4	0.9	1.7	6.9	25	nd	43	36	55	66	49	15
2016	nd	4	4.7	6.1	14	34	58	77	50	40	50	49	38	nd
2017	nd	nd	nd	5.5	20	55	44	44	50	16	15	15	22	8.4
2018	nd	nd	nd	nd	nd	26	41	49	54	61	72	89	36	12

Overall, 738 (48.7%) of all 1514 ROST chicks banded with PFRs at participating colony sites were seen as HYs on CCMA in 2018 (compared to 31.0% of 2012 chicks banded seen as HYs at CCMA in 2017). However, only six (19.4%) of 31 ROST chicks from NS were seen as HYs at CCMA in 2018. All six of these were from LBNS and none were from CYNS; this contrasts greatly with the high rate of encounters of HYs from CYNS in 2009 reported by Jedrey et al. (2010).

In addition to the 114 HYs (42.1% of 271 chicks banded) from ME+NH seen at CCMA, 21 more were seen as HYs at their own or other colony sites in ME+NH so overall 49.9% of the chicks from those states were seen as HYs somewhere; this is considerably lower than the 65.6% of ROST chicks from that area seen as HYs everywhere in 2017. By contrast 614 (51.1%) of 1,201 ROST chicks banded in CT+NY were seen at CCMA and another 394 were seen in CT+NY, so overall 1,008 (83.9%) were seen as HYs in 2018 (compared to the 26.4% seen at CCMA and 71.1% seen at all sites in 2017).

Despite the record high number of ROSTs banded as chicks with PFRs in 2017, only four were seen as “Second Year (SY)” one-year-old birds on CCMA in 2018 (six SYs were seen on CCMA and 20 were seen at all sites in 2017). Other results and comparisons of numbers of known-age adults from prior cohorts banded as chicks seen on CCMA and elsewhere are being delayed until all 2018 encounter data are received and summarized.

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