

**Gulf of Maine Seabird Working Group
30th Annual Summer Meeting**



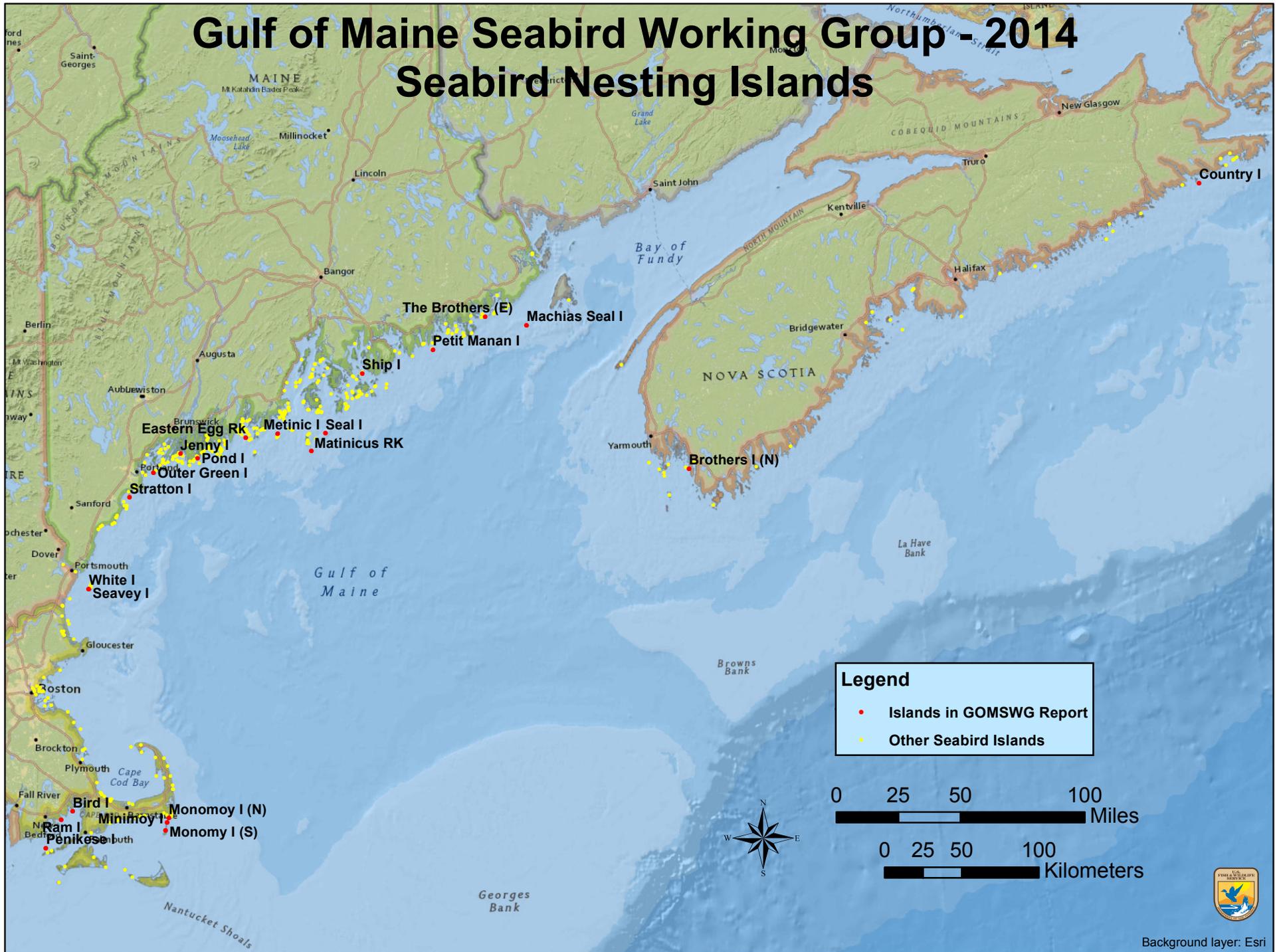
**Hog Island, Bremen, Maine
August 11, 2014**

[Visit the website gomswg.org](http://gomswg.org)

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Gulf of Maine Seabird Working Group - 2014 Seabird Nesting Islands



Background layer: Esri

Introduction

The Gulf of Maine Seabird Working Group (GOMSWG) is a collaborative effort among state and federal agencies, national and state Audubon agencies, universities, non-governmental organizations, and private citizens that have been working to monitor, manage, and restore populations of colonial nesting seabirds in the Gulf of Maine for 30 years. Despite this combined effort, many seabird populations still face significant threats and challenges from predators, declining availability of prey species, climate change, sea level rise, human disturbance, invasive species, and threats during migration. Many of the management agencies are also facing declining budgets that challenge our ability to manage the colonies. It is through our combined effort and sharing of knowledge that seabirds stand the best chance of overcoming the challenges they now face.

Meeting activities involved island reports from Canada to Massachusetts, followed by five afternoon presentations. Also included in these minutes (in Appendix A) are brief details of radio tag projects. A table with 2014 GOMSWG census results will be distributed when it is complete.

Announcement – Waterbird Society Meeting 2015

The 2015 Waterbird Society meeting will be held August 12-15th at the College of the Atlantic in Bar Harbor, Maine. This will be the first time in three years the meeting will be held in the United States. John Anderson (COA) is the local chair of the planning committee.

We are also planning to hold the first Northwest Atlantic Seabird meeting in conjunction with the Waterbird Society meeting. We would like to try and gather seabird biologists working in this region to discuss issues such as at-sea surveys, tracking technologies, colony management, and ecosystem changes influencing seabirds. Please contact Linda Welch (Linda_Welch@fws.gov) if you would like to help organize this meeting.

Island and Site Reports

Canada

Country Island

Megan Boucher, Island Coordinator

Caroline Lecourtois and Doug Smith, Island Assistants

Contact – Jen Rock, Canadian Wildlife Service, Jen.Rock@ec.gc.ca

Country Island is a managed island and each season contractors carry out seabird monitoring with support from the Canadian Wildlife Service.

Tern Census

A first census on June 17-19 resulted in 1270 terns counted. To account for late nesters, 50% of the colony was re-sampled on July 11-12 and counts were adjusted using a Lincoln index of 1.13 resulting in a corrected colony size of 1435 tern nests, including 15 Roseate Tern nests* (Fig. 1). Colony size appears to be relatively stable, reporting > 1000 pairs since 2003. Species composition[†] of Arctic and Common Tern was consistent with the previous years with 59% Arctic and 39% Common Tern. Consistent with other locations, there are fewer ROST nesting in recent years.

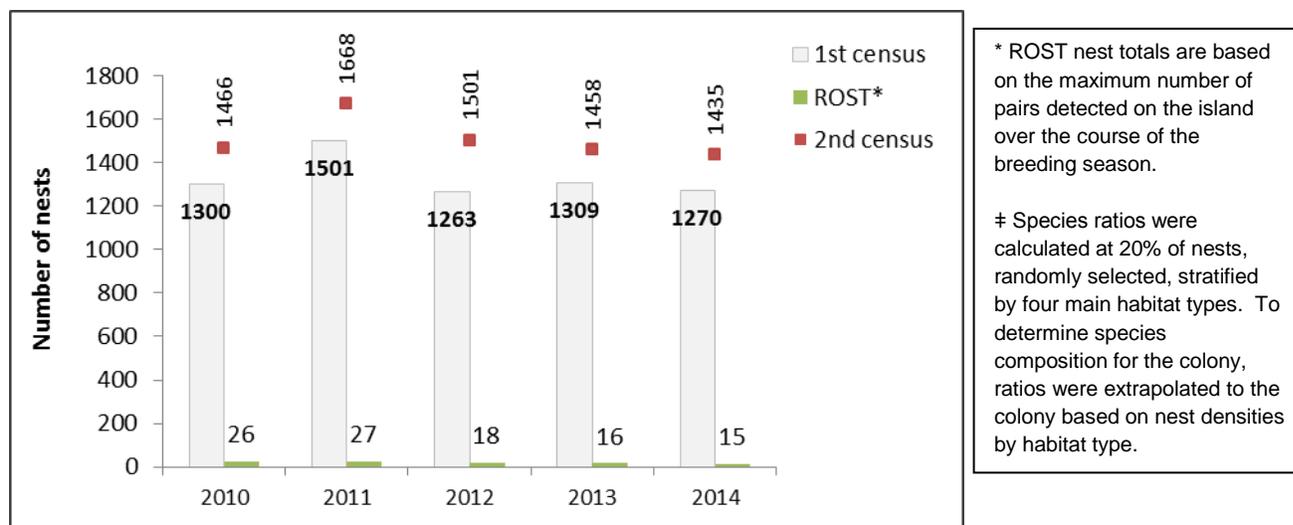


Figure 1. Number of terns on Country Island from 2010 to 2014.

Productivity

Clutch size & hatch success were similar to the annual average (1997-2014) for all tern species. The number of chicks fledged per pair (productivity) was relatively high for Arctic and Common Terns, and the highest on record for Roseate Terns at this colony (Table 1).

Table 1. Reproductive success of Arctic, Common and Roseate Terns at Country Island, N.S. in 2014.

Species	Clutch size \pm SD	Hatching success \pm SD	Productivity \pm SD
ARTE	1.8 \pm 0.4 (60)	0.9 \pm 0.3 (60)	1.5 \pm 0.6 (43)
COTE	2.2 \pm 0.6 (60)	0.9 \pm 0.2 (60)	1.8 \pm 0.7 (42)
ROST	1.7 \pm 0.5 (15)	0.8 \pm 0.4 (15)	1.3 \pm 0.5 (12)

Tern Provisioning

Feeding rates (prey items delivered/hour/chick) were determined for Arctic and Common Terns (Table 2). Feeding rates for Arctic and Common Tern were below average but within the standard deviation (average \pm SD rate 1998 to 2013: 1.0 \pm 0.4 and 0.8 \pm 0.3 prey items delivered/hour/chick for ARTE and COTE respectively).

Table 2. Feeding rates for Arctic and Common Terns at Country Island, Nova Scotia, 2014.

	Arctic Tern	Common Tern
Average number of prey items delivered/hour/chick	0.7	0.7
\pm SD	0.3	0.2
Number of nests watched	31	31
Total hours watched	326	324

At Arctic and Common Tern nests, prey deliveries were dominated by White hake (*Urophycis tenuis*) followed by smaller proportions of other prey species (Table 3).

Table 3. Principle prey items (percent)* delivered to tern chicks at Country Island in 2014.

Prey item	Arctic Tern	Common Tern
White hake	65.5	55.5
Sand lance	3.3	2.4
Atlantic herring	1.3	1.9
Invertebrates	1.6	2.1
Other fish species	24.7	34.6
Not identified	3.6	3.5
Number of nests followed	31	31
Number of prey items delivered	304	373

Predator Activities and Control Efforts

A single Great Black-backed Gull nest was destroyed. There were no major predator management issues in 2014.

Common Eiders

In 2014 at least 223 Common Eiders nested on Country Island (based on a single census conducted 10-June). For the past three years over 200 Common Eider nests have been counted each year.

Black Guillemots

Since tern colony restoration was initiated in 1998 the number of Black Guillemots detected during daily surveys has continued to increase from a maximum of 19 individuals in 2001 to 426 in 2014. Black Guillemots have been confirmed breeding at the colony however the number of nesting pairs is unknown.

Roseate Tern Banding

As part of a collaborative effort to gain a better understanding of ROST movement and survival, Canadian Wildlife Service continued to band Roseate Tern adults and chicks with plastic field readable bands; this initiative has been ongoing since 2011.

The Brothers

Ted D'Eon – Volunteer Steward

Contact – Julie McKnight, Canadian Wildlife Service, Julie.McKnight@ec.gc.ca

North Brother Island is supervised by local steward, Ted D'Eon with support from the CWS and the Nova Scotia Department of Natural Resources. The island was visited by Ted several times between April – July 2013.

Details about this project can be found on Ted's website <http://teddeon.com/tern14.html>

Tern Census

On June 9th, 731 tern nests (including 38 ROST) were counted at North Brother Island; terns did not nest on South Brother Island and have not since 2003 (Table 1). Colony size and species composition are similar to that observed over the past five years; with the colony comprised of approximately 6% Arctic, 89% Common and 5% Roseate Tern (Table 1). Similar to other colonies in the northwest Atlantic, the number of Roseate Terns nesting at this site is relatively low compared to ten years ago (~50% fewer ROST nesting compared to 2003).

Table 1. Number of tern pairs at North Brother, Nova Scotia

	Colony size*	Arctic Tern	Common Tern	Roseate Tern
2010	714			38
2011	725	60		38
2012	658	50	574	34
2013	684	50	596	38
2014	731	44	651	38

* based on single census conducted in early June, i.e. not applying Lincoln Index to incorporate late nesters

LAGU and LETE do not nest on N. Brother Island

Productivity and chick diet are not monitored at this site

Predator Activities and Control Efforts

Contents of three Great Black-backed Gull nests were destroyed. There were no major predator management issues in 2014.

Habitat Restoration

A restoration specialist was contracted to develop a habitat plan for N. Brother Island. Please contact Julie McKnight if you would like any information concerning the report.

Roseate Tern Banding

As part of a collaborative effort to gain a better understanding of ROST movement and survival, Canadian Wildlife Service continued to band Roseate Tern adults and chicks with plastic field readable bands; this initiative has been ongoing since 2011.

Machias Seal Island

Linda Takahashi - island supervisor, University of New Brunswick

Katherine Shlepr and Stephanie Symons - field technicians, University of New Brunswick

Despite a visit by a hurricane, this year was a good year compared to last for the seabirds. The most exciting news: terns nested successfully on the island for the first time since 2005. Also, for the first time since 2006, a full tern census was completed, resulting in 187 nesting pairs of terns. Four terns fledged this year, resulting in 0.11 chicks fledged/nest. Alcids had an average season with ATPU and RAZO reproductive success rates comparable to previous years.

Two incoming Masters students also began their own research. Katherine Shlepr began a study investigating predatory gull behavior on MSI through structured observations and necropsy. Stephanie Symons is investigating foraging patterns of breeding alcids. Finally, 31 geolocator tags were deployed in July and August to determine alcid wintering distribution (5 on RAZO and 26 on ATPU).

Terns

This was our first year of successful breeding since colony abandonment in 2006. We monitored 42 ARTE nests. COTE were present but did not nest in our productivity plots. During our tern census, we found 138 nests with eggs and 49 scrapes, totaling 187 total nesting pairs. The species ratio is 96% ARTE and 4% COTE, totaling 179 ARTE and 8 COTE pairs. Terns were first observed circling the island on May 11. Our first egg was found on June 1 and mean lay date was June 13. The first chick hatched on

June 28 and peak hatch was July 4. Throughout the season, attendance was consistent, unlike recent seasons. In total, within the monitored nests, 21 chicks hatched and 4 survived to fledging age. Two (10%) chicks died from exposure, two from wing injuries (10%), two disappeared (10%) and the rest died of unknown causes (70%). The details of identified ARTE diet (data are % by number, not biomass) and ARTE breeding success (mean \pm SD) are described below for 2014 and two previous years.

Estimated Tern Nests (no formal census from 2007-2013, formal census in 2014) on MSI

2009	2010	2011	2012	2013	2014
150	175	75	50	90	187

Diet (% by number, not biomass) for ARTE on MSI

N	Hake	Haddock	Sandlance	Earthworm	Euphausiid	Amphipod	Other
54	59.3	11.1	7.4	3.7	3.7	3.7	11.1

Breeding Success of ARTE on MSI in 2004, 2005 and 2014

Year	n	Clutch Size	Hatching Success	Chicks/nest alive at Day 15	Chicks/nest alive at Day 20	Fledglings/nest
2004	170	1.42 (0.50)	0.84	0.38	0.30	0.05
2005	183	1.42 (0.50)	0.57	0.03	0.02	0.01
2014	69	1.68 (0.53)	0.57	0.11	0.08	0.08

Predator Control

Non-lethal gull control was conducted again this year with two new, more efficient paintball guns. No other methods of non-lethal control were used. Lethal gull control was conducted by a contracted predator control specialist to remove problem gulls over 2 sessions (June 7-8 and June 20-22). In total, 10 HERG and 1 GBBG were removed. Following lethal control, hunting levels dropped for a shorter period of time following the second cull compared to the first, and subsequently returned to nearly pre-cull levels. Gulls continued to scavenge dead chicks and steal fish from breeding adult ATPU. One HERG was removed due to injury. The combination of lethal and non-lethal control should continue indefinitely.

On nearby Gull Rock (0.25 km from MSI), we found 18 nests and poked 52 eggs. We found 2 nests on MSI and poked 3 eggs. All nests were HERG. This pattern of nesting distribution shows a marked change from 2012 and 2013, where more nests were found on MSI than on Gull Rock.

Alcids

No formal census was conducted for ATPU or RAZO this year. We counted 69 COMU eggs and 121 chicks in July, but since this was conducted so late in the season, it is likely an underestimate. Also, we identified 7 new caves, bringing the total number to 24. The details of alcid productivity, growth and (identified) diet are described below. Diet data are % by number, not biomass. This is the second year we have conducted systematic observations of COMU.

	Monitored Burrows	Mean Lay	Mean Hatch	Burrow Occupancy	Hatching Success (hatch/ active nest)	Nesting Success (fledge/ active nest)	Linear Growth Rate (mass)
ATPU	124	15 May	24 June	0.78	0.61	N/A	6.7 grams/day
RAZO	89	18 May	22 June	0.79	0.75	0.54	6.3 grams/day

	N	Hake	Larval Fish	Euphausiid	Sandlance	Herring	Butterfish	Other
ATPU	1353	59.9	9.8	4.5	4.1	10.7	0.6	10.4
RAZO	562	30.0	18.9	0	15.8	24.8	0	10.5
	N	Herring	Butterfish	Haddock	Unknown Gadoid	Pollock	Rock Gunnel	Other
COMU	169	27.8	0	8.3	33.1	6.5	0	24.3

Other Species

We found 53 COEI nests, the second lowest count on MSI since 1995. Ducklings were first seen in late June, and 19 were still present around the island in early August. LHSP were also breeding on the island and we banded 14 in June, but we did not monitor occupancy or productivity. NOGA were seen flying over MSI throughout the season and several were found loafing periodically on nearby Gull Rock from early July. A TUPU was first observed on June 17 and last seen on July 18. This is the first recorded sighting in eastern North America since the 1830s, and the first ever on MSI.

Maine

Eastern Brothers

Baxter Seguin – Island Supervisor, USFWS Maine Coastal Islands NWR

Jason Tome and Jena Rose Zoller – Island Technicians, USFWS Maine Coastal Islands NWR

This was the 8th year of efforts to establish a new tern and alcid breeding colony on Eastern Brothers Island in Jonesport, Maine. The 17 acre island is currently utilized by black guillemots, common eiders, common terns, Leach's storm-petrels, and razorbills.

Black Guillemots

We observed a season high count of 280 guillemots on the island and in the surrounding waters on Aug 3rd with an average of 166 guillemots during our morning counts. Predation was relatively high compared to previous years due to the presence of 2 mink (one was captured). A total of 13 BLGU adults and chicks and many eggs were predated by mink. Peregrine falcons and/or ravens predated a minimum of 6 adult guillemots. Many burrows are out of reach, but the crew confirmed 76 burrows and regularly checked 43 burrows. Hatch success was slightly higher than last year but still low at 39.2% (total eggs hatched/total eggs, see Table 3). At the end of the season only 30.4% of the burrows monitored had chicks. Many of the chicks do not fledge before the crew leaves so a true productivity estimate cannot be calculated. However, based on chicks over ten days old our productivity rate was 0.43 chicks fledged per pair.

Table 1. The Brothers Islands black guillemot survey results, 2007-2014.

Year	Daily Count Avg.	High Count and Date	Active Burrows E. Brothers	Active Burrows W. Brothers	Estimated # Breeding Pairs (both islands)
2007	500	725 May 31	88	10	160
2008	482	733 Jun 6	95	12	250-300
2009	410	658 May 21	111	14	200-225
2010	480	625 May 16	61	11	240*
2011	244	380 Jun 1	70	1	122*
2012	234	340 Jul 14	65	6	117*
2013	202	380 May 28	82	5	101*
2014	166	280 Aug 3	69	7	83*

*Estimated by calculating half of daily average. Other estimates represent island supervisor's best judgment

Table 2. Black guillemot nesting chronology, The Brothers Islands 2007-2014

Year	First BLGU Egg	First BLGU Hatch	Avg. Lay Date*	Avg. Hatch Date	Avg. Fledge Date*
2007	8-Jun	5-Jul	13-Jun	11-Jul	13-Aug
2008	9-Jun	5-Jul	20-Jun	18-Jul	20-Aug
2009	8-Jun	5-Jul	18-Jun	16-Jul	18-Aug
2010	8-Jun	7-Jul	15-Jun	13-Jul	15-Aug
2011	25-May	16-Jul	17-Jun	14-Jul	13-Aug
2012	26-May	23-Jun	7-Jun	5-Jul	6-Aug
2013	25-May	24-Jun	19-Jun	12-Jul	14-Aug
2014	31-May	30-Jun	12-Jun	10-Jul	12-Aug
Average	2-Jun	3-Jul	15-Jun	12-Jul	13-Aug

*used date found or hatched to calculate avg. lay (-28 days from hatch) and fledge dates (+33days)

Table 3. Black guillemot nest fate, The Brothers Islands 2007-2014.

Year	# Nests	Hatch Success	Nest Fate (at the end of the season)					
			Chicks Alive	Nests with surviving chicks (N)	Abandoned Nests	Predated Nests	Failed due to Weather	Unknown or Active
2007	88	25%	93.3% (24 of 26)	-	-	-	-	-
2008	82?	28%	90.0% (36 of 40)	30.5% (25)	42.7% (35)	2.4% (2)	6.1% (5)	18.3% (15)
2009	82	39%	85.9% (49 of 88)	-	-	-	-	-
2010	19	26%	100% (9 of 9)	-	-	-	-	-
2011	68	34.2%	94.5% (35 of 37)	30.9% (22)	11.8% (8)	27.9% (14)	0%	29.4% (20)
2012	60	54.1%	85.0% (51 of 60)	48.3% (29)	21.7% (13)	25.0% (15)	1.7% (1)	5.0% (3)
2013	63	32.1%	82.3% (28 of 34)	30.2% (19)	22.2% (14)	22.2% (14)	12.7% (8)	17.5% (11)
2014	46	39.2%	64.5% (20 of 31)	30.4% (14)	28.2% (13)	41.3% (19)	0%	0%

Predator Control

The first mink traps were set on the Brothers Islands on March 19 (30 traps) and a raven nest was destroyed on May 2nd. A juvenile male mink was trapped on June 11th on Eastern Brothers Island after predating 9 adult BLGU. Though proactive predator control efforts (tube traps and 40 Conibear traps) were maintained throughout the season mink predation, predated guillemots, an adult common tern, and multiple mink sign were found in mid-July. The second mink was not captured before the crew left on August 7. Common ravens, merlin, and peregrine falcons frequented the island. To deter gulls, we destroyed 14 nests on Eastern Brothers (1 HERG, 1GBBG, 12 species unknown) and poked 7 nests on “Little Brothers” (3 HERG and 4 GBBG). Two gulls were shot and displayed in the alcid/tern restoration area to discourage gulls from loafing (GBBG on May 23rd and HERG on June 10th).

Terns

A tern sound system and 40 tern decoys were deployed on May 2nd. Although 5 COTE were residents of the island throughout the breeding season their numbers increased to an average of 9 in mid-July with a high count of 21 on July 11th. Two pairs of COTE nested on Eastern Brothers Island and each had a successfully hatched clutch of 2. The chicks from the first nest both fledged and were seen in flight. One of the chicks from the second nest was killed before fledging. The remaining chick from the second nest did not fledge before the crew left the island but it was in a healthy state upon our departure. The dominate fish species in the four chicks diet was Herring (35.9%) with Pollock (28.2%) as a close second.

Atlantic Puffins and Razorbills

One hundred and fifteen alcid decoys (60 RAZO and 55 ATPU) were placed along the Southern cliffs of Eastern Brothers Island along with an alcid sound system on March 19th. A second alcid sound system was added to the Island on June 11th. Between 2 and 4 RAZO were regular visitors to the island over the course of the breeding season. 17 RAZO were seen perched or walking along the cliffs of Eastern Brothers while 54 were observed foraging in the waters around the island. Over the course of the season only 11 ATPU were observed, although every time they were foraging in the waters around the island or perched on the rocks.

Petit Manan Island

Wayne MacCabe and Julia Gillis– Island Supervisors, USFWS Maine Coastal Islands NWR
Anna Stunkel and Brittany Morey – Field Technicians, USFWS Maine Coastal Islands NWR

Census

The GOMSWG census was conducted on June 19 and 20, 2014 and 1,103 tern nests were counted and corrected with a 1.09% Lincoln Index to 1,203 tern nests. Tern census results in 2014 were 16.1% lower than 2013 (1,370 nests). To calculate species ratio, we identified 625 tern nests to species, 52% of all tern nests on the island. In 2014, the colony consisted of 56% Common Terns (348 marked nests) and 44% Arctic Terns (277 marked nests), yielding total colony estimates of 670 Common Tern nests and 533 Arctic Tern nests. No Roseate pairs nested this year. Additionally, 54 Common Eider nests were counted during the census.

Petit Manan Island								
	2007	2008	2009	2010	2011	2012	2013	2014
COTE								
# of Nests	1343	1307	1374	912	1138	1186	817	670
Mean Clutch Size	1.70	1.83	1.93	1.7	1.72	1.90	1.77	1.94
Mean Hatch Success	64.8%	85.3%	85%	47.9%	72.3%	78.8%	62%	61.4%
Mean Fledge Success	76.7%	71.6%	56%	31.0%	36.1%	65.1%	48%	45.2%
Mean Chicks Fledged/Nest	0.76	1.12	0.90	0.43	0.40	0.98	0.51	0.54
ARTE								
# of Nests	1038	1255	1268	688	558	758	616	533
Mean Clutch Size	1.53	1.55	1.68	1.6	1.46	1.73	1.49	1.70
Mean Hatch Success	51.9%	75.3%	78%	21.6%	56.8%	73.7%	66%	30.9%
Mean Fledge Success	62.8%	81.3%	54%	20%	24.5%	70%	30%	63.3%
Mean Chicks Fledged/Nest	0.45	0.95	0.70	0.21	0.22	0.89	0.35	0.33
ROST								
# of Nests	5	4	4	2	0	2	2	0
Mean Chicks Fledged/Nest	0.20	1.00	0.20	0.00	0	0.25	0	0
LAGU nests*	1350	1363	1171	270	735	811	750	560
ATPU nests	53	93	104	88	46	63	47	73
COEI nests	49	105	101	56	35	67	55	54
*7.5 % correction factor applied to LAGU nest counts								

Tern Productivity

Reproductive success for both tern species was comparable in 2014 to the previous season; however, numbers were much lower than 2012. A mean of 0.54 chicks fledged per nest for Common Terns and 0.33 for Arctic Terns (these calculations include chicks that died after the 15-day GOMSWG fledge date). Actual productivity was lower at 0.46 chicks fledged per nest for common terns and 0.30 for Arctic Terns. While there seemed to be adequate prey availability, several storms and continued fog contributed to the stresses on the tern colony this year. Great Black-Back gulls moved into the colony and predated some fledgling tern chicks later in the season. Peregrine falcons maintained a presence throughout the breeding season. Bald Eagles frequented the island and predated the laughing gull colony; however, they did not impact the terns.

Tern Provisioning

We conducted provisioning observations for 17 Common Tern nests and 14 Arctic Tern nests for a total of 856 hours and observed 803 prey deliveries. Hake was the primary prey delivered to both Common (30.2%) and Arctic Tern (55.2%) chicks. On average, tern adults delivered 0.94 prey items per nest per hour.

Arctic Tern Metapopulation Project

As part of the Arctic Tern metapopulation project we re-sighted 124 adult Arctic Terns. Additionally, we trapped and banded 43 adult Arctic Terns and banded 64 Arctic Tern chicks.

Diet Item	%	%
	COTE diet	ARTE diet
Atlantic Herring	19.0	10.5
Bluefish	1.0	0.3
Butterfish	2.4	1.1
Invertebrates	2.4	3.9
Hake	30.2	55.2
Sand lance	24.2	3.7
Other	7.7	4.9
Unknown fish	13.1	20.4

Predator Control

Our predator control efforts began as soon as we arrived on the island. A Snowy Owl was seen preying on the alcid colony in early May. After using pyrotechnics with no success we set foothold traps using an Atlantic Puffin decoy as a lure. The owl was nearly caught and not seen again. Peregrine Falcons were the most frequent visitors to the colony throughout the season. During the month of May we discouraged the Peregrine Falcons and other avian predators from perching on the island using bird deterrents. We took a less active role once terns began establishing nests in late May and early June. In late July the Peregrine Falcon became a recurring predator preying mostly on tern fledglings. Bald Eagles were a regular visitor to the island but mainly preyed on the Laughing gull colony. During the census, we oiled the eggs of 429 Laughing Gull nests and destroyed 77 Laughing Gull nests. Lethal removal of avian predators thought to be tern specialists also occurred and included: 12 adult Laughing Gulls, 3 Herring Gulls and 1 Great Black-back Gull.

Alcids

The highest alcid counts for the season were 205 Atlantic Puffins (14 May), 30 Razorbills (9 June), 20 Common Murres (29 July) and 416 Black Guillemots (11 May). We estimated the breeding population of Atlantic Puffins was at least 73 pairs based on the number of active burrows (i.e. burrows with either an adult, egg or a chick). This estimate is higher than previous years, with higher productivity as well. Puffin hatch success was 68.5%, fledge success was 94% and number of fledged birds/nest was 0.65. We documented 5 active Razorbill burrows in 2014 with one possible fledged chick. Although Common Murres were observed loafing on the island, there was no evidence of any breeding attempts. Lastly, we estimated that the Black Guillemot breeding population was 73 pairs. We monitored a subset of the Black Guillemot population (32 nests) for productivity—weighing and measuring wing cord of chicks every 3 days. For these birds, average clutch size was 1.97, average hatch success was 0.51, and average number of chicks per pair was 0.81. This is substantially lower than the 2013 estimate where hatch success was 1.39 and chicks per pair was 1.13.

In addition to daily counts and productivity monitoring, a large portion of our time was spent reading Alcid bands. We re-sighted 111 individual Atlantic Puffins this field season. As well as resighting, we recaptured adult puffins by grubbing burrows and setting box and noose traps. One band was read using the burrow-cam. We banded 37 puffins this summer (16 adults and 21 chicks), replaced 3 bands, and recaptured 15 adults. Finally, we banded 60 Black Guillemots (20 adults and 40 chicks).

Other Research

We satellite tagged one Razorbill as part of a multi-island effort to document foraging behavior and the location of foraging habitat, and determine migration pathways, habitat use, and wintering areas for razorbills in the North Atlantic. In addition, Stantec maintained a solar-powered Anabat detector on the lighthouse to track migratory movement of bats through the Gulf of Maine.

Ship Island

Mary Raikes – Island Supervisor, USFWS Maine Coastal Islands NWR

Jena Rose Zoller – Island Technician, USFWS Maine Coastal Islands NWR

Census

Ship Island was monitored by a two-person crew from May 8–July 25, 2014. During the GOMSWG census on June 16, we counted 393 common tern nests and a total of 405 after applying a Lincoln Index of 1.03. Twenty-two eggs were counted as abandoned, washed up, or predated, but were not counted in the nest total.

	Ship Island				
Common Terns	2010	2011	2012	2013	2014
# of Active Nests	41	105	251	436	405
Mean Clutch Size	1.83	2.16	2.20	2.44	2.26
Mean Hatch Success	22.2%	55.6%	57.1%	72.5%	81%
Mean Fledge Success	56.7%	24.9%	63.9%	46.4%	72.8%
Chicks Fledged/Nest	0.33	0.53	0.82	.80	1.44

Nesting and Productivity

The first nest was observed on May 29 and terns were continuing to copulate as of July 23. High monthly tides coincided with a large storm on June 13 and washed away a small portion of the southern shoreline (25 or more nests); however, these terns relayed and additional nests were found throughout the season. The colonies' overall numbers remained stable with morning count numbers averaging between 400-500 present birds once established. Fair weather coincided with the majority of the hatching and critical rearing stages, which led to a comparatively high hatching and fledging success this year.

Tern Provisioning

We observed an average of 12 total common tern nests for a total of 93 hours and 411 feedings. Average feeding rate was .85 feedings per hour. Atlantic Herring composed 61% of observed feedings, unknown fish 18%, Pollock 10%, Hake 6%, and all others less than 1%, including sand lance and shrimp. A total of 7 definitive prey item species were observed in addition to unknowns and several other species observed in the colony but not in the provisioning plots. It is suspected that because of 6 times more peregrine falcon visits observed this year, especially during provisioning studies in the morning, that deliveries were less frequent and harder to identify due to the flightiness of the colony after a these visits.

Diet Item	% of COTE Diet				
	2010	2011	2012	2013	2014
Atlantic Herring	23.3	24.4	79.4	45.6	60.8
Sand Lance	13.4	17.3	0.9	20.9	.97
Crustaceans	--	--	--	10.5	--
Pollock	1.4	18.1	--	4.3	10
Invertebrates	31.2	1.7	1.6	5.7	.7
Butterfish	2.6	0.4	--	1.7	--
Stickleback	4.9	10.7	0.2	1.5	--
Hake	2.2	0	--	1.1	6.6
Unknown	7.7	20.5	7.2		.97

Predator Control

The most significant predators observed during the 2014 season were merlins, peregrine falcons, and bald eagles. While Bald Eagles were seen nearly daily no attempts were seen made at terns. Peregrines and merlins, though, successfully preyed at least 24 common tern adults and chicks. This year the peregrine falcons visited six times more than last year, however, their presence did not seem to disrupt the overall stability of the colony.

Species	Minimum # of Visits	Minimum # Terns Taken
Peregrine Falcon	43	21
Merlin	16	3
Bald Eagle	48	0

Mink traps were set early in the season with an average of 16.75 traps maintained throughout the season, but no definitive signs of mink were observed. No great-horned owls were observed this year. Gulls did not present a significant predation risk this season and were deterred from loafing on any part of the island. Two herring gulls were lethally dispatched.

Foraging Directions

Foraging directions were observed from three locations on the island from June 4th to July 17 for a total of 35.5 hours. Terns were seen foraging in all directions, but the greatest number of foraging terns was recorded either departing to or arriving from 120-210°.

Metinic Island

Amy Beich – Crew Leader, USFWS Maine Coastal Islands NWR

Syd Cheney – Technician, USFWS Maine Coastal Islands NWR

Tern Census and Productivity

The GOMSWG census of Metinic’s tern colony was performed on June 19, 2014. A total of 417 tern nests were counted in the Northeast Point and South Cove Point. A correction factor of 1.116 was applied to this count, along with a species ratio of 52.9% Arctic Terns and 47.1% Common Terns (n=189). An additional 9 Arctic Tern nests were found in the South Cove for an uncorrected total of 428 nests.

Both Arctic and Common Terns experienced the highest reproductive success for more than 10 years. This success can be attributed to low predation and high quality chick food (see provisioning). Although nest numbers were higher than the past two years, the nest distribution was less dense, spread out over more of the Northeast Point of the island than before.

Metinic Island					
	2010	2011	2012	2013	2014
COTE					
# of Nests	406	300	0	209	220
Mean Clutch Size	2.32	2.19	0	2.8	2.67
Mean Hatch Success*	84%	89% (81%)	0	78.6%	82.1%
Mean Fledge Success*	44% (35)	68% (66%)	0	27.1%	84.1%
Chicks fledged/Pair*	0.85 (0.70)	1.23 (1.08)	0	0.76	1.84

ARTE					
# of Nests	352	198	0	142	257
Mean Clutch Size	2.32	1.45	0	2.1	1.90
Mean Hatch Success*	84%	36% (35%)	0	89.5%	89.3%
Mean Fledge Success*	37% (35)	43% (37)	0	52.4%	84.9%
Chicks fledged/Pair*	0.32 (0.29)	.23 (.22)	0	1.1	1.45

ROST					
# of Nests	1	0	0	0	0
Chicks fledged/Pair	0	-	-	-	-

South End					
ARTE and COTE nests	2	2**			
*when available, data in parenthesis includes fledglings later dead after the GOMSWG fledge date of 15 days					
**Unconfirmed					

Provisioning

We followed 5 COTE nests and 6 ARTE nests this season for a total of 159 nest hours and 186 feedings. Both species fed at a rate of 1.17 feedings per hour. Diet for both species was composed largely of herring and hake – 71.6% for Common Terns and 64.7% for Arctic Terns. Invertebrates made up only a small percentage of either species' diets (1.9% for ARTE and 1.2% for COTE), and no nests were invertebrate specialists. There was no documented feeding of butterfish, sticklebacks or other inedible fish, although a few were found in the colony.

	Total Nests	Feedings/ Hour	Herring	Hake	Hake or Herring	Sand Lance	Pollock	Euphausid	Other & Unknown
COTE	5	1.17	45.7%	7.4%	18.5%	2.5%	1.2%	1.2%	23.5%
ARTE	6	1.17	51.4%	9.5%	3.8%	1.0%	1.9%	1.0%	31.4%

Predators

- Merlin were seen multiple times throughout the season, making several attempts to prey on birds in the colony. No successful attempts were observed, and the terns did not seem overly disturbed.
- A Great Horned Owl was heard calling on May 24th, and several pellets were found in the colony. Two possible owl kills were also observed, both Arctic Terns in the colony. The terns continued to spend the night and did not seem to be otherwise adversely affected. Four leg hold traps were deployed throughout the colony. The owl was not captured or heard again.
- Gulls nests on the north half of the island were oiled to prevent hatching. 145 Herring Gull and 11 Great Black-backed Gulls nests (417 eggs) were oiled over a period of two days.
- Gulls were not observed to be preying heavily on chicks, but five Herring Gulls were taken (three due to injury, one as by-catch in the owl traps and one other) and carcasses displayed in the colony.
- 20 garter snakes were removed from the island throughout the season.
- Metinic's pair of Bald Eagles were also present, and appeared to focus on eiders and gulls for prey. Several juvenile eagles were seen as well.

Black Guillemots

We monitored 42 guillemot nests and recorded a hatch success of 62.1%. Fledge rate is estimated as 38.0% based on the number of chicks that were over 300g at the time of the crew's departure. Overall productivity is estimated to be 0.42. A total of 36 chicks were found, and 20 were banded.

Leach's Storm Petrels

We marked 25 Leach's Storm-petrel burrows early in the season based on calls. However, we were only able to find 7 active burrows (containing an adult, egg or chick) during our June productivity checks. As of July 25th, two of those burrows contained a chick, two contained a predated egg, one contained two adult petrels, and two were empty.

Common Eider

Eiders appeared to do better this year than previous years. A number of large crèches were observed on 113 separate occasions. By the time the crew left, there were several crèches with ducklings mostly covered in flight feathers. Eider numbers appeared to be slightly higher than last year, averaging over 50 for a morning high count. No Common Eiders were banded this year.

Incidental Sightings

101 species of birds were sighted on Metinic this year, including Great Cormorants, Horned Lark, Blue-grey Gnatcatchers, and 18 species of warbler. Northern Flickers were seen breeding on the island for the first time this year.

Seal Island National Wildlife Refuge

Edward Jenkins and Julia Gulka, Island Supervisors – National Audubon Society Seabird Restoration Program

Tern Census

A partial tern census was conducted on June 15 where 14 of the 30 grid squares were surveyed, similar to 2009-2013 censuses, due to safety concerns on the island. This area has been determined to represent, on average, 57% of the total nest number of the colony over the last eleven years in which a complete census was performed (1996-2006). It is recommended that additional grid squares be added at the southern periphery of the colony to account for Arctic Tern nest expansion that has occurred in the past few years. There are an estimated 2,237 total nests on Seal Island (after a Lincoln Index of 1.0396 was applied). On June 15 the species ratio of the colony was determined by marking a 16 meter radius around nine blinds and identifying as many nests to species as possible within each circle. With this, in addition to the composition of four productivity plots on the island, the species ratio is estimated at 38.2% Arctic Terns and 61.8% Common Terns (n=657). Overall, it appears that the population is down about 250 breeding pairs from last year, a majority of which were Arctic Terns.

Table 1. Adjusted number of tern nests found on Seal Island from 2010-2014.

Year	COTE	ARTE
2010	1,788	1,238
2011	1,836	1,201
2012	1,837	959
2013	1,448	1,039
2014	1,383	855

Tern Productivity

For Common Terns, clutch size was slightly down from last year, and very few three-egg clutches were observed in productivity plots. However, productivity increased from last year, and was higher than it has been since 2009. Arctic Terns also fared better this year than last. Productivity was the highest it has been since 2008 on the island. Though a majority of tern chick mortality for both species was due to either starvation or exposure, this mortality largely consisted of B and C chicks. There were few incidents of severe weather this season and provisioning overall was good (see below). Although Roseate Terns were seen on the island on multiple occasions, there were no confirmed nests on the island this year.

Table 2. Tern productivity on Seal Island in 2014. Data for 2013 shown in parentheses.

Species	Mean clutch size	Mean hatch	Productivity	Nests monitored
COTE	1.89 (1.99)	1.70 (1.35)	1.03 (0.28)	65 (92)
ARTE	1.84 (1.78)	1.43 (1.50)	0.86 (0.65)	37 (46)

Tern Provisioning

Thirteen Arctic Tern nests were observed for 420 cumulative hours. The average feeding rate was 1.87 feedings per hour. 16 Common Tern nests were observed for 596 cumulative hours and the average feeding rate was 1.21 feedings per hour. A large amount of both Arctic and Common Tern chick provisioning was made up of hake, euphausiids, and herring (see Table 3). In mid-June, schools of euphausiids were observed close offshore, and represented a large percentage of feedings, as well as hake. Later in the season, the main diet item switched to herring.

Table 3. Principal prey items (percent of diet) in tern chick diet on Seal Island in 2014. Total number of prey items observed n=785 for ARTE and n=724 for COTE.

Prey item	COTE	ARTE
Hake	27.76	33.50
Euphausiid	16.71	11.21
Unknown Fish	20.17	11.21
Herring	16.57	5.48
Amphipod	4.14	3.44

Predator Activities and Control Efforts

Great Black-backed Gulls were the largest threat to the tern colony this season. In June, gulls would enter the colony almost daily, often taking eggs or chicks. Efforts were made throughout the season to remove problem gulls but this proved difficult (see Table 4). In July and August, Herring Gulls were also observed preying on eggs and chicks in the colony. Gull census showed a decrease in Herring Gull nests but an increase in Great Black-backed Gull nests. This, in conjunction with observations throughout the season suggests a larger population of Great Black-backed Gulls on the island than in previous years. Other predators included Peregrine Falcons, Merlins, and Bald Eagles, which were largely observed in the colony towards the end of the season. Laughing Gulls were observed daily and some pairs prospected and displayed in the tern meadow but no nests were made. Laughing Gulls were observed kleptoparasitizing terns throughout the season, and terns were also observed kleptoparasitizing Atlantic Puffins in July and August.

Table 4. Gull control measures by species on Seal Island in 2014.

Species	# Nests destroyed	# Shot
Herring Gull	208	4
Great Black-backed Gull	83	12
Laughing Gull	0	7

Atlantic Puffin

There are a total of 732 known burrows on Seal Island, including 16 discovered this season. Puffin census was performed by determining the activity of 15 circular plots within the colony, each six meters in diameter and each spaced 25 meters apart. The activity of all burrows outside of the main colony was also determined. From observations of incubating adults, eggs, chicks, and feedings, it is estimated that there are 492 active burrows this year. This number is up from last year's estimates, and slightly lower than 2012 numbers, suggesting that last year was a particularly bad year for the puffins, and many, as a result, may have taken a year off from breeding.

Overall, the colony seems to have done better this year than last. The high count of puffins in the colony was 464 this year, up from last year, and puffins were observed loafing throughout the season, suggesting better food resources available and less stress on adults. Puffin productivity this year was 0.75 chicks fledged per pair and hatch success was 0.83 (see Table 5). Unlike last year, it seemed that eggs were laid and chicks were hatching at a normal time, if not a bit early. 76 pufflings were banded during July and August and by the time the crew left, most chicks were large and many had fledged. Five of seven geolocators deployed in 2013 were retrieved throughout the season. Six geolocators were deployed on adult Atlantic Puffins this year in late July.

Table 5. Atlantic Puffin hatch success and productivity on Seal Island from 2010-2014.

	# Burrows monitored	Hatch Success	Productivity
2010	61	0.91	0.77
2011	66	0.80	0.73
2012	78	0.74	0.31
2013	69	0.55	0.09
2014	71	0.83	0.75

Puffin chick diet was monitored over 75 hours throughout July and August. There was an early trend of small hake and bill-loads of sand lance. Later in the season the diet shifted towards herring. Overall hake, herring, and sand lance made up 88.9 percent of observed diet (Table 6); other species included haddock and euphausiids. There were remarkably few butterfish observed during feeding studies, and a large percentage of high nutrient species.

Table 6. Principal prey items in Atlantic Puffin chick diet on Seal Island in 2014. Total prey items n=2,680

Prey item	% of diet
Hake	47.84
Herring	22.01
Sand lance	19.07

Black Guillemot

Black Guillemot productivity was monitored throughout the season. Average hatch was 1.25 hatched per pair and productivity was determined to be 0.61 chicks fledged per pair (n=41). Productivity noticeably increased from 2013 (0.17 chicks per pair) and 2012 (0.47 chicks per pair).

Razorbill

A small and likely expanding colony of Razorbills is present on Seal Island. A high count of 75 individuals was observed this season. A total of 19 active Razorbill burrows were monitored throughout the season. Based on feedings, there are at least three other burrows and likely more around the island. Hatch success was 0.68 and productivity was 0.56, comparable to last year's productivity of 0.57.

Common Eider

Common Eider nest across the island and a large portion nest in high grasses where there is potential unexploded ordinance. In Mid-June, 73 nests were censused, though there are likely many more. There were many large crèches observed throughout the season with a high count of 125 eider chicks, although only a handful were still being seen by the end of the season.

Cormorants

Both Great and Double-crested Cormorants nest on the western end of Seal Island. Added to protocol this season, daily walks were made down to the western side of the island to deter eagles from landing near the cormorant colony. On August 9, around 30 large Great Cormorant chicks were observed in the colony.

Bird Sightings

A record-breaking 142 bird species were observed on Seal Island from the beginning of May to the beginning of August. Highlights included White-winged Dove, Western Kingbird, Oregon Junco, Stilt Sandpiper, and Long-tailed Jaeger. Additionally, the resident Red-billed Tropicbird was seen again this year, its tenth year in a row.

Matinicus Rock

Frank Mayer, Island Supervisor – National Audubon Society Seabird Restoration Program

Tern and Laughing Gull Census

The GOMSWG census was completed June 17-19. There were 564 Arctic Tern nests and 223 Common Tern nests for a species ratio of 72% Arctic and 28% Common Terns. The Lincoln Index correction factor was 1.007. We counted 689 Laughing Gull nests this year which is an increase of 19.4% from last year. We destroyed 144 Laughing Gull nests prior to census in areas where they nested close to terns.

Table 1. GOMSWG census results on Matinicus Rock, 2009-2014.

Year	ARTE	COTE	LAGU
2009	1,278	359	1,161
2010	674	253	958
2011	859	258	778
2012	711	268	557
2013	519	171	579
2014	564	223	689

Tern Productivity

Arctic Terns fledged 0.96 young per nest. Mean clutch was 1.73 for 49 nests. This is higher than in past years and represents the highest productivity on MR since 2002. Common Terns fledged 1.38 young per nest. Mean clutch was 1.96 for 26 nests. While mean clutch was lower than in past years, productivity was the highest since 2002, when the COTE productivity study began.

Table 2. Tern productivity on Matinicus Rock in 2014. Data for 2013 shown in parentheses.

Species	Mean clutch size	Mean hatch	Productivity	Nests monitored
ARTE	1.73 (1.78)	1.20 (1.35)	0.96 (0.76)	49 (51)
COTE	1.96 (2.50)	1.69 (2.3)	1.38 (1.13)	26 (30)

Tern Provisioning

The most common food item in the Arctic Tern chick diet was hake at 63% of the total diet, followed by unknown fish which were 9% of the total diet. The average feeding rate per nest was 2.26 deliveries per hour which was much higher than last year's 1.76. The most common food item in the Common Tern chick diet was hake which constituted 61% of the diet followed by unknown fish at 18% and herring at 6%. Euphausiids were the most common invertebrate and comprised 2% of the total diet. The average feeding rate was 1.5 deliveries per hour which was much higher than last year's 0.81.

Predator Activities and Control Efforts

Predation by gulls was not as major a factor this year as it was in years past, however, we found that productivity was lowest in plots where Laughing Gulls and terns nested in close proximity (0.61) and highest where terns were in Laughing Gull-free areas (1.33). Predation by Herring and Great Black-backed Gulls was almost non-existent this year with the exception of a single Herring Gull which would often come to eat eggs and chicks in foggy weather. A Merlin was observed from mid to late July but was never seen catching a tern.

During census, all eggs in 689 Laughing Gull nests were poked or destroyed to prevent hatching. An additional 144 nests were destroyed before the census. 151 adult Laughing Gulls were shot on 9 June by USFWS, with effort concentrated on parts of the island where LAGUs and terns nested in close proximity to each other. In addition we shot 88 LAGUs that were in close proximity to nesting terns and were predated eggs or chicks. No Herring or Great Black-backed Gull nests were found this year. 13 Herring Gulls and 2 Great Black Backed Gulls were shot.

Atlantic Puffins

Puffin hatch success was 0.79 (n= 77) and productivity was 0.65 chicks fledged per nest (n=74), which is much higher than the last two years. Puffin bill loads delivered to chicks in 2014 consisted mostly of hake (73%), sand lance (13%), and unknown fish (6%). Very few butterfish were seen this year and they only comprised 0.4% of the recorded diet. However, piles of uneaten butterfish were observed in puffin burrows late in the chick-rearing period after feeding studies ended, although no decline in chick weights was observed.

Razorbills

Razorbill hatch success was 0.79 (n = 57), and productivity was 0.54 chicks fledged per nest (n = 48). The first Razorbill chick was heard on 1 June, earlier than in most years. Razorbill chick diet consisted of herring (42%), hake (29%), and unknown fish (10%) with lesser amounts of sand lance (6%) and euphausiid (3%).

Black Guillemots

Mean clutch size was 1.61(n=44), mean hatch was 0.91 hatched per nest (n=44), and productivity was 0.55 chicks fledged per nest (n=40).

Common Murres

The high count for Common Murres in 2014 was 57 on 29 May. The decoys and sound system were moved back to the old location on the loafing ledge after last year's location failed to attract murres.

Leach's Storm Petrels

Hatch success was not able to be calculated this year due to a data collection error.

Manx Shearwaters

Manx Shearwaters were seen on the water regularly throughout the season in groups of as many as 10, and were heard calling from the northwest, west-central, and southwest areas of the island. We banded two large, fat, and happy chicks from the original burrow near the cannon wheel on the Sunset Strip and from the area below Texas blind.

Unusual Birds

A White-winged Dove was observed on 6 July and won some votes for best bird of the year but a beautiful male Prothonotary Warbler that was first seen on 31 July won more votes and was deemed the Official Best Bird of the Year.

Eastern Egg Rock

Maggie Lee Post, Island Supervisor – National Audubon Society Seabird Restoration Program

Census

Arctic and Roseate Tern nests were identified between June 12 and June 20, with Roseate Terns decreasing from 83 to a historic low of 65 nests and Arctic Terns also decreasing from 68 to 62 nests. Five B-wave Roseate Tern nests were also identified opportunistically, bringing the season total to 70 Roseate Tern pairs. An island-wide Common Tern and Laughing Gull nest count was conducted from June 15 to June 17. Common Tern numbers decreased greatly, with a raw total of 625 nests that was corrected with a Lincoln index of 1.025 to 698 nests, including the productivity plots, feeding studies, and carpet plots. The number of Laughing Gull nests remained high, at 1934 nests, despite increased control measures over the past several years.

Table 1. GOMSWG census results on Eastern Egg Rock, 2010-2014.

Year	COTE	ARTE	ROST	LAGU
2010	714	83	82	1553
2011	829	77	90	2051
2012	817	57	71	2065
2013	831	68	83	2083
2014	698	62	65	1934

Larid Productivity

Tern productivity was conducted using both fenced and unfenced plots. The fenced plots and feeding studies for Common Terns comprised 66 total nests which hatched at a rate of 1.91 chicks per nest and fledged at a rate of 1.32 chicks per nest. An unfenced plot of 31 Common Tern nests, located on grey carpets suppressing vegetation growth, was also followed, yielding 1.71 chicks fledged per nest. Roseate Terns hatched 1.36 chicks per nest and fledged at a rate of 1.19 chicks per nest. Arctic Tern productivity was affected most by predatory gulls, including Laughing Gulls, and flooding. The 56 study nests fledged only 0.89 chicks per nest of the 1.48 chicks hatched per nest. For the seventh season productivity was conducted on Laughing Gulls in a fenced plot of 19 nests which hatched 1.84 chicks per nest and fledged 1.32 chicks per nest.

Table 2. Tern and Laughing Gull productivity on Eastern Egg Rock in 2014. Data for 2013 shown in parentheses.

Species	Mean clutch size	Mean hatch	Productivity	Nests monitored
COTE	2.33 (2.53)	1.91 (1.97)	1.32 (0.71)	66 (58)
ARTE	1.84 (1.85)	1.48 (1.20)	0.89 (0.53)	56 (37)
ROST	1.81 (1.90)	1.36 (1.42)	1.19 (0.93)	63 (77)
LAGU	2.42 (2.26)	1.84 (1.68)	1.26 (0.94)	19 (19)

Tern Provisioning

Fourteen Common Tern nests were observed over a total of 451 hours with an average feed rate of 1.87 feedings per hour. Herring was the most frequently fed prey item, comprising 38% of feedings, with hake at 31% and pollock at 7%. Six Arctic Tern nests were observed for a total of 245 hours with an average feed rate of 3.35; hake were the most frequently fed item comprising 45% of diet followed by amphipods at 18% and euphausiids at 6.5%. Seven Roseate Tern nests were observed over 239 hours, averaging 2.14 feedings per hour; hake was the most frequently fed item at 44%, followed by sand lance at 18%, herring at 13%, and pollock at 6%.

Table 3. Principal prey items (percent) in tern chick diet on Eastern Egg Rock in 2014.

n is the total number of prey items observed.

Prey item	COTE	ARTE	ROST
Herring	38	4	13
Hake	31	45	44
Pollock	7	0.5	6
Sand lance	1	0.2	18
Haddock	1	0.4	0.2
Butterfish	0.5	0.4	0.2
Invertebrates	0.7	33	0
<i>n</i>	831	820	511

Atlantic Puffins

This year there were 148 active puffin burrows on the island, the highest recorded for the island and a large increase over the 112 burrows in 2013. The fledging success rate of 0.94 chicks per nest was high for the island. Hake comprised the majority of puffin diet at 69% followed by *Sebastes*, sp. at 9% and herring at 6%. Hake averaged 0.90 bill lengths and became the predominant food source in early July. Herring, averaging 1.91 bill lengths, was more prevalent in June, and *Sebastes*, sp. were first observed in mid-July and averaged 1.06 bill lengths. Butterfish was not a significant source of food for the puffins this year, though the few butterfish observed were large, averaging 1.4 bill lengths.

Table 4. Active burrow count and fledge success for Atlantic Puffins on Eastern Egg Rock, 2010-2014.

ATPU	2010	2011	2012	2013	2014
Active Burrows	123	123	104	112	148
Fledge success	0.86	0.92	0.74	0.91	0.94

Predator Activities and Control Efforts

Herring and Great Black-backed Gulls were the predominant tern predators, though neither species attempted to nest. Five Herring Gulls and four Great Black-backed Gulls were shot over the course of the season. All Laughing Gull eggs, with the exclusion of nests within a fenced productivity plot, were oiled during census and about 537 adults were shot. In addition, a buffer zone was maintained within 10 meters of tern habitat in which all Laughing Gull nests were destroyed periodically throughout laying. Laughing Gulls still appeared to be a source of predation on Arctic and Common Tern eggs and young chicks.

Table 5. Gull control measures at Eastern Egg Rock in 2014. Data for 2013 shown in parentheses.

	GBBG	HERG	LAGU
Gulls Shot	4 (1)	5 (9)	537 (201)
Nests Destroyed	0 (2)	0 (1)	1918 (2064)

Other Notes

Productivity was monitored for Black Guillemots for the second year. Thirty-three nests were followed and had a mean clutch of 1.79, an average hatch rate of 1.48 and fledged 1.11 chicks per nest, a higher fledge rate than 2013's 0.75 chicks per nest. Eighty-five Common Eider nests were identified opportunistically during the tern census. This summer, Egg Rock welcomed 119 visitors, primarily media personnel, donors, and teen campers.

Pond Island National Wildlife Refuge

Halley Walsh, Island Supervisor – National Audubon Society Seabird Restoration Program

Tern Census

Tern census was conducted on June 16. The unadjusted nest count for Common Terns was 558 (not including study nests). The Lincoln Index was 1.0. The adjusted count, including study nests, was 612. This is slightly lower than 2013 (see Table 1).

There were four confirmed Arctic Tern nests on Pond Island in 2014. Although Roseate Terns had a daily presence on Pond Island in 2014, no pairs laid eggs.

Table 1. GOMSWG census results on Pond Island, 2009-2014.

Year	COTE	ROST	ARTE
2009	438	0	3
2010	590	0	3
2011	586	2	0
2012	596	0	0
2013	692	0	0
2014	612	0	4

Tern Productivity

Common Tern productivity was measured by following 60 nests in both fenced productivity plots and unfenced feeding study plots. All nests were monitored from hatch until fail/fledge. Mean clutch size was 2.35 with 1.27 chicks produced per pair (see Table 2). All four Arctic Tern nests were monitored; mean clutch size was 1.75 and productivity was 1.25 chicks produced per pair.

Table 2. Tern productivity on Pond Island in 2014. Data for 2013 shown in parentheses.

Species	Mean clutch size	Mean hatch	Productivity	Nests monitored
COTE	2.37 (2.55)	1.78 (2.04)	1.27 (1.25)	60 (53)
ARTE	1.75	1.25	1.25	4

Tern Provisioning

A Common Tern chick provisioning study was conducted by observing 27 nests. There were a total of 1340 feedings observed in 447 nest hours of observation, for an average feeding rate 3.00 feedings per nest per hour. The primary prey items were sand lance (60.75%) and herring (20.15%) (Table 3). Though not seen in the feeding studies, researchers also observed silversides, bluefish, cunner, and the occasional butterfish delivered to chicks in the colony.

Table 3. Principal prey items in Common Tern chick diet on Pond Island in 2014.

Prey item	Number of items	% of diet
Sand lance	814	60.8
Herring	270	20.2
Hake	16	1.2

Predator Activities and Control Efforts

American Crows were a serious problem for Common Eiders and were observed on several occasions preying on eggs. Great Black-backed and Herring Gulls were also seen preying on both Common Eider and Common Tern eggs and chicks. Three Great Black-backed and one Herring Gull were removed, as well as one Laughing Gull.

A Great Horned Owl (GHOW) was preying on the island at the onset of the field season, and was trapped on the night of May 29. Evidence of a second GHOW was found on June 12 and a second owl was trapped on the night of June 14.

Signs of mammal predation characterized by clusters of adult terns silently hovering across the island and bounding tracks in the sand along the beach were seen on July 12. The predator was identified as a mink and was shot on July 16.

Jenny Island

Kaitlyn Nafziger, Island Supervisor – National Audubon Society Seabird Restoration Program

Tern Census

The annual Gulf of Maine Seabird Working Group (GOMSWG) census was conducted on June 14. A total of 989 Common Tern (*Sterna hirundo*, COTE) nests were counted, with clutches ranging between 1 and 4 eggs. A Lincoln index mark/recapture correction of 1.05 was applied to the uncorrected count. The addition of 82 productivity plot, feeding study, and carpet study nests brought the total to 1,120 nests (Table 1).

Twelve Roseate Tern (*Sterna dougallii*, ROST) nests were found during the GOMSWG census window, and an additional 4 nests were found later, for a total of 16 nests. This is a little over double the number of ROST nests found on the island in 2013.

Table 1. GOMSWG census results on Jenny Island, 2009-2014.

Year	COTE	ROST
2009	578	3
2010	854	32
2011	753	8
2012	948	11
2013	946	7
2014	1,120	12

Tern Productivity

For Common Terns, four productivity plots containing 37 nests and 3 feeding study plots with 21 nests were used to determine productivity, a summary of which follows in Table 2.

Table 2. Tern productivity on Jenny Island in 2014. Data for 2013 shown in parentheses.

Species	Mean clutch size	Mean hatch	Productivity	Nests monitored
COTE	2.24 (2.45)	1.98 (2.09)	1.69 (1.05)	58 (56)
ROST	1.47 (1.57)	0.93 (0.71)	0.80 (0.73)	15 (7)

Tern Provisioning

Seventeen COTE nests in three feeding study plots were monitored in 2014. A total of 1,287 feedings were observed during 679 nest-observation hours, producing an average feeding rate of 1.90 deliveries per hour (compared with 0.64 deliveries per hour in 2013). Average prey size was 53.53mm. Atlantic herring (*Clupea harengus*) made up over half of observed feedings. Hake (including white hake, *Urophycis tenuis*, and four-bearded rockling, *Enchelyopus cimbrius*) made up about 8% of the feedings. Butterfish (*Peprilus triacanthus*) contributed less than 1% to total feedings, as compared to about 2% in 2013.

Table 3. Principal prey items in COTE chick diet on Jenny Island in 2014.

Prey item	Number of Items	% of Diet
Herring	893	69.39
Hake	98	7.61
Amphipod	57	4.43
Pollock	34	2.64
Sand Lance	28	2.18

Predator Activities and Control Efforts

Four Laughing Gulls (*Larus atricilla*, LAGU) were observed entering the colony regularly and actively kleptoparasitized adult terns, though no nests were found. One LAGU was removed.

Large numbers of Great Black-Backed Gulls (*L. marinus*, GBBG) and Herring Gulls (*L. argentatus*, HERG) were observed landing on the north and south ends of the island and silently landing on the carpets (vegetation barriers) during heavy fog. They were observed predated tern chicks and eggs as well as Common Eider chicks. 3 HERG were removed.

Common Eiders

6 Common Eider (*Somateria mollissima*, COEI) nests were found during the GOMSWG census. Several areas of the island containing dense patches of cow parsnip (*Heracleum maximum*) were avoided during census due to the poisonous sap produced by the plant, so some COEI nests were missed. COEI chicks were heavily predated by GBBGs, HERGs, and Bald Eagles (*Haliaeetus leucocephalus*, BAEA).

Outer Green Island

A. Catherine Pham, Island Supervisor – National Audubon Society Seabird Restoration Program

Tern Census

The Gulf of Maine Seabird Working Group (GOMSWG) tern census was conducted on Outer Green Island on June 12. A total of 1083 Common Tern (*Sterna hirundo*) nests were counted. The inclusion of 36 productivity study nests, 20 feeding study nests, and a Lincoln correction index of 1.00 resulted in a corrected total of 1139 nests. This is essentially identical to the 2013 total of 1143 nests and is similar to the totals from 2010-2012 as well. It appears that the Common Tern has reached its carrying capacity on Outer Green Island. There were no known Roseate or Arctic Tern (*S. dougallii* and *paradisaea*, respectively) nests on the island this year, though a number of Roseate Terns were observed loafing around the island throughout the season and several were observed performing their fish flight. At least two pairs of Roseate Terns were observed prospecting for nesting sites in June and July, but no known nesting ensued. A single Arctic Tern was observed flying with a fish in mid-July, possibly in attempt to find a mate.

Table 1. GOMSWG annual census on Outer Green Island, 2009-2014.

Year	COTE	ROST	ARTE
2009	837	0	2
2010	1151	15	0
2011	1067	0	0
2012	1034	0	0
2013	1143	0	0
2014	1139	0	0

Tern Productivity

The first Common Tern egg was laid on May 23. The average number of eggs per nest was 2.13 (n=53), which is the lowest clutch size ever recorded on this island. The first hatch occurred on June 16, and peak hatch lasted approximately from June 21-25. The average number of eggs hatched per nest was 1.92, which is the lowest recorded since 2006 and is to be expected as a result of low average clutch size. The average number of chicks fledged per nest (productivity) was 1.42, which is higher than the average of 1.37 for 2002-2013 and is quite high compared to the average clutch size. This is probably a result of excellent chick diet this year (see *Provisioning*).

Table 2. Outer Green Island annual Common Tern productivity, 2009-2014.

Year	Mean Clutch	Mean Hatch	Productivity
2009	2.87	2.70	1.68
2010	2.81	2.63	2.09
2011	2.43	1.98	1.77
2012	2.81	2.19	1.42
2013	2.60	2.27	1.15
2014	2.13	1.92	1.42

Tern Provisioning

Chick provisioning was observed at 20 Common Tern nests this season over 807 observer hours. A total of 1394 feedings were recorded for an average feeding rate of 1.73 items/hour, which is much higher than the 2013 feeding rate of 1.10 items/hour. The average prey size was 62.55mm, much larger than the 2013 average size of 55.87 mm. The most frequently observed prey item was herring species (*Clupeidae* sp.), which made up 70.95% of the observed chicks' diet. This is a significant change compared to 2013 when hake species and herring species made up 41.80% and 26.60% of the chicks' diet, respectively. Of particular note was the high frequency of bill-loads of herring, where adult terns brought back more than one fish at a time. These changes are likely related to this year's cool sea surface temperatures (see *Weather*), as herring are cold water fishes.

Predation

Gull predation on tern eggs and chicks was a problem this season. Early in the season, Laughing Gulls (*Leucophaeus atricilla*) were opportunistically preying on eggs. Later in the season, Great Black-Backed Gulls (*Larus marinus*) entered the colony multiple times, generally at dawn and dusk, to take tern chicks. Deterrence methods included gull walks, blind stunts in attempt to destroy the gulls, and the use of a Screamer Siren gun. A total of three Great Black-Backed Gull nests were found on neighboring Junk of Pork Island and were destroyed. A Herring Gull (*Larus argentatus*) nest was found on Outer Green Island and was destroyed as well.

Weather

The weather this season was characterized by cool, dry days punctuated with occasional heavy rain events. Air temperatures ranged from 49°F to 78°F, with an average temperature of 53.51°F in May, 60.36°F in June, and 63.33°F in July. The sea surface temperatures (SST) were quite cool this year, ranging from 47°F to 66°F, with an average SST of 49.87°F in May, 54.81°F in June, and 56.80°F in July. Precipitation was recorded on 25 days this season for a season total of 9.45 inches. Several of the heavy rain events resulted in many Common Tern nests being flooded or abandoned.

Black Guillemots

This year, four new Black Guillemot (*Cepphus grylle*) burrows were found, raising the island total to 20. Of those, fifteen were active this year with an average clutch size of 1.67 eggs per nest; this data does not consider the first clutch if it failed and relaying ensued. Of the fifteen active burrows, eight hatched, six failed for various reasons, and at least one was still incubating at the close of the season on July 24. The average number of eggs hatched per nest was 1.08. As of the close of the season, no guillemot chick had yet fledged, making it impossible to calculate productivity.

Common Eiders

This year, Common Eider (*Somateria mollissima*) nests were systematically searched for and monitored for phenology and hatch success. A total of twenty-three nests were found, of which fourteen hatched. The average clutch size was 4.68 eggs and the average hatch was 2.68 eggs hatched/nest. Based on a

combination of flotation data, incomplete clutches, and observed hatches, the average date of nest initiation was May 19, the average date of start of incubation was May 23, and the average hatch date was June 24 (first hatch May 30).

Spotted Sandpipers

For the first time this year, Spotted Sandpipers (*Actitis macularius*) were systematically searched for and monitored for phenology and hatch success. A total of nine nests were found, of which six hatched. At least two more nests were suspected based on chick locations early in the chick-rearing period. The average clutch size was 4 eggs and the average hatch was 2.44 eggs hatched/nest. Based on a combination of flotation data, incomplete clutches, and observed hatches, the average date of nest initiation was May 29 (first egg May 25), the average date of start of incubation was June 1, and the average hatch date was June 21 (first hatch June 18).

Stratton Island

Kristina McOmber, Island Supervisor – National Audubon Society Seabird Restoration Program

Tern Census

Roseate Terns increased from 2013 levels to 103 nests for the GOMSWG census and 110 total nests for the season. Arctic Terns nests increased from 3 in 2013 to 8 in 2014. An island-wide Common Tern nest count was conducted on 12 June. The Common Tern nest count of 1226 nests was corrected with a Lincoln index of 1.025, to 1255 nests, and the addition of productivity and feeding study nests brought the total count to 1314 nests. This is an increase from 1284 nests in 2013. Least Terns on Stratton Island increased from 92 pairs in 2013 to 97 in 2014. An additional 2 nests laid after the census brought the season total to 99 Least Tern nests.

Table 1. GOMSWG census results on Stratton Island, 2010-2014.

Year	COTE	ARTE	ROST	LETE
2010	854	12	35	76
2011	960	11	51	59
2012	1033	0	71	86
2013	1284	3	93	92
2014	1314	8	103	97

Tern Productivity

Tern productivity was conducted using both fenced and unfenced plots. The 59 nests in the Common Tern plots hatched at a rate of 1.69 chicks per nest and fledged at a rate of 1.29 chicks per nest. Roseate Terns hatched 1.10 chicks per nest and fledged at a rate of 0.99 chicks per nest for the 82 nests followed. Least Terns hatched 1.52 chicks per nest from 99 nests, but our estimate of 0.38 chicks fledged per nest is considered extremely conservative. However, Least Tern productivity was certainly negatively impacted by the Common Terns nesting on the beach, as we observed several Least Tern chicks carried off by territorial Commons Terns. Eight Arctic Tern pairs nested low in the intertidal and experienced near total nest failure in their first nesting attempt, with only 1 nest escaping the tide and fledging one chick. Most re-nesting attempts were also taken by a high tide. Weather was also a factor in tern productivity. Three major rain events occurred, which caused multiple deaths by a combination of exposure and starvation.

Table 2. Tern productivity on Stratton Island, 2010-2014.

	2010	2011	2012	2013	2014
COTE					
Mean clutch	2.64	2.50	2.60	2.02	1.95
Mean hatch	1.85	2.23	2.40	1.83	1.69
Productivity	1.73	1.70	2.04	1.41	1.29
ROST					
Mean clutch	2.06	1.94	1.80	1.88	1.49
Mean hatch	0.88	1.82	1.45	1.52	1.10
Productivity	0.98	1.24	1.32	1.27	0.99
ARTE					
Mean clutch	2.00	1.91	-	2.00	2.00
Mean hatch	1.50	1.45	0	0	1.22
Productivity	0.67	0.36	0	0	0.22
LETE					
Mean clutch	1.97	1.88	1.96	1.97	1.86
Mean hatch	1.24	1.50	1.48	1.65	1.52
Productivity	--	0.38	0.65	0.72	0.38

Tern chick provisioning

Thirteen Common Tern nests were observed for a total of 355 nest hours. This year sand lance was the identified fish species most offered to chicks, comprising 36% of the diet, with hake and herring making up a total of 22%. Unknown fish made up 38% of items offered. Eleven Roseate Tern nests were observed for 221 nest hours. Sand lance made up 55% of their diet, with herring being the second most common item at 6% and hake at 3%. The remainder was made of up unknown fish, and pollock. A subset of Least Tern nests were observed. Hake were the most commonly fed item at 43%, with sand lance at 30%, herring at 15%, and killifish at 5%.

Predation

Herring and Great Black-backed Gulls were the predominant tern predators and also continue to have a devastating impact of Common Eider chick success. Five Herring and 11 Great Black-backed Gulls were shot over the course of the season. As part of an effort to reduce Herring and Great Black-backed Gull populations on Stratton and Bluff Islands, eggs in all gull nests found on Bluff Island were poked, and all gull nests found on Stratton Island were destroyed. Five Great Black-backed Gull nests were found on Stratton and destroyed, and 34 Herring Gull and 68 Great Black-backed Gull nests were poked on Bluff Island.

Wading Birds

A census of the wading bird colony on Stratton Island was conducted on May 19-20. A total of 54 Glossy Ibis, 9 Black-crowned Night Heron, 32 Great Egret, and 74 Snowy Egret nests were found.

American Oystercatchers

Three pairs of American Oystercatchers nested on Bluff and Stratton Islands in 2014. Two nests hatched chicks and 1 washed out in mid-June. No fledglings were seen.

Double-crested Cormorants

On June 9, 133 Double-crested Cormorant nests were counted on Bluff Island by visual estimate from a boat.

Visitors

In 2014, Stratton Island had 212 documented visitors. Visitors included USFWS and National Audubon personnel for research purposes, Maine Audubon Society field trips, a Prout's Neck Audubon Society field trip, and visiting kayakers and boaters.

Notable Birds

Stratton Island crew searched wide and far for mesmerizing, notable and rare bird species, aiming binoculars in the bushes, reeds, grass, water, trees, and air. Our merry band of green birders managed to snag 115 separate bird species, including the unmistakable and elegant Black Skimmer, the enigmatic and breath-taking Tricolored Heron, and the Yellow-crowned Night Heron.

Least Terns - Maine

From June 10-12th, a coordinated statewide least tern census documented a minimum of 245 least tern pairs within the State of Maine. During the window count 164 of those least tern pairs nested at Crescent Surf while 79 nested on Stratton Island, 4 nested at Higgins Beach, and 2 nested at Popham Beach. Later in the season there were 99 nesting pairs recorded at Stratton, 7 pairs at Popham, 11 pairs at Higgins Beach, and 4 pairs at Laudholm Beach in Wells. Crescent Surf produced a minimum of 29 fledgers, Stratton Island produced at least 36, a minimum of 6 fledged from Popham, and there were 4 fledgers from Laudholm. The small colony at Higgins Beach was not successful due to predation issues. State productivity was estimated to be > 0.30 fledgers per pair. Overall, productivity was significantly lower than the previous few years.

Estimate of Least Tern Pairs

	WELLS	LAUDHOLM FARM	CRESCENT SURF	GOOSE ROCKS	WESTERN BEACH	STRATTON ISLAND	HIGGINS	RAM ISLAND	SEAWALL	POPHAM	REID STATE PARK	TOTAL
2003	0	20 (0)	57 (8)	8 (0)	0	-	38 (53)	0	0	0	33 (5)	156 (66)
2004	15 (10)	1 (0)	[50] (3)	0	0	-	45 (54)	0	0	0	50 (2)	146 (69)
2005	0	4 (1)	[52] (7)	0	[40] (3)	18 (9)	[22] (0)	0	[17] (0)	0	0	114 (20)
2006	[1] (0)	0	30 (10)	[25] (1)	0	103 (15)		0	0	0	[1] (0)	134 (26)
2007	1 (1)	0	[37] (1)	[45] (2)	0	113 (10)8	0	0	0	0	0	150* (112)
2008	0	0	92 (52)	2 (0)	[2]	72 (33)	0	0	0	0	0	166* (89)
2009	0	0	102** (62)	[6]** (0)	0	72 (16)	[16] (0)	0	0	0	0	170 (78)
2010	0	[1]**	136** (45)	[18]**	0	76** (5)	0	0	0	0	0	211* (50)
2011	0	0	123* (73)	23* (12)	0	59* (28)	0	0	0	0	0	205* (113)
2012	0	0	99* (78)	0	0	86-92* (72)	0	5 (1)	0	2	0	185- 191* (155)
2013	0	0	129* (93)	0	0	92* (79)	0	0	0	3* (0)	0	224* (172)
2014	0	4** (4)	164* (29)	0	0	79* (36)	4* (0)	0	0	2* (?)	0	249* (72)

[] colony deserted

() number of fledgers

* simultaneous count at all occupied nesting sites during window count, not a site specific high nest count

** nesting outside of the window count and not included in state total

Laudholm Farm Beach, Wells

Ashley Gorr and Kate O'Brien, Rachel Carson NWR

Population Estimate: There were no active nests during the statewide census period. Following heavy predation on Crescent Surf Beach, just across the Little River, 4 pairs nested on Laudholm. One 2-egg nest was predated just before or just following hatching by an unknown predator. One 1-egg nest was abandoned. Two 2-egg nests hatched and fledged 4 chicks.

Comparison: This was the first year that least terns nested on Laudholm Beach since 2005 when 4 nests were recorded, 1 nest hatched, and 1 fledgling was produced.

Predator Control: No predator control was conducted though USDA Wildlife Services removed predators at nearby Crescent Surf Beach. An unpowered net fence was put around the nests for a portion of the nesting period, mostly for protection from humans, though it may have helped keep mammalian predators away as well.

Crescent Surf Beach, Kennebunk

Ashley Gorr and Kate O'Brien, Rachel Carson NWR

Population Estimate: There were 164 active nests during the statewide least tern census on June 10th. Crescent Surf Beach had a challenging season. Our final estimate is > 29 fledglings produced, or 0.18 fledglers per pair. Two simultaneous daytime beach counts were conducted and the numbers of fledglers counted on July 21st and August 1st were 14 and 10, respectively. Two early fledglers were believed to be unaccounted for by the July 21st count, and 3 additional fledglings were produced late in the season. A couple of big weather events posed challenges to the colony this year. Mid-June storm tides wiped out almost all of the early season nests. Though Hurricane Arthur didn't actually cause much damage, however, the threat imposed by the storm caused us to pre-emptively remove the net fence energizing system from the beach. A red fox took advantage of this opportunity and devastated the majority of eggs and chicks. The net fence had been arranged as only one loop this year as compared to two separate loops in the past, due to the disturbance it would have caused to nesting piping plovers to do so. We plan to make it a higher priority to divide the fence into two loops again in the future, so as not to leave the entire colony vulnerable if and when predators do breach the fence.

Comparison: In 2013, the high count of nests was 224, with a minimum fledgling count of 172, yielding an estimated productivity of 0.78. In 2012, the high count of nests was 191, with a minimum fledgling count of 151, or an overall productivity of 0.79. In 2011, the high count of nests was 123. The high fledgling count was 73, yielding an estimated productivity of 0.59. Productivity was poor from 2003-2007. The steady growth of the tern population is likely due to the intensive wildlife management actions at these productive beaches on the mainland and at Stratton.

Predator Control: USDA Wildlife Services removed specialist predators from the Crescent Surf beach area throughout the breeding season.

Goose Rocks Beach, Kennebunk

Laura Minich Zitske, Maine Audubon Society

Population Estimate: No least terns nested on Goose Rocks in 2014.

Comparison: In 2013 and 2012 no terns nested. In 2011 a high of 23 pairs we observed, however due to predation only 9 pairs nested, and produced at least 12 fledglings.

Predator control: USDA Wildlife Services removed numerous predators from Goose Rocks Beach area.

Ram Island

Maine Audubon Society

Population Estimate: No least terns nested on Ram Island in 2014.

Stratton Island

Kristina McOmber, National Audubon Society

Population Estimate: There were 79 nests recorded during the statewide census on June 10th. A high count of 99 nests was recorded later in the season. There was a high count of 36 fledglings, though this is thought to be an underestimate of total number of fledglings.

Comparison: In 2013, the minimum number of pairs was 92, with a minimum of 72 fledglings.

Predator Control: gull control on island

Higgins Beach, Scarborough

Laura Minich Zitske, Maine Audubon Society

Population Estimate: There were 4 nests recorded during the census window between June 10th and June 12th, with a high count of 11 nests later in the season. At least 5 eggs survived to hatch, however, no chicks survived to fledge. Lack of productivity was attributed to heavy fox predation.

Comparison: 2014 marked the first year that least terns had nested on Higgins Beach since 2009 when there were a minimum of 16 nesting pairs; this colony was abandoned due to predation.

Predator Control: No predator control.

Popham Beach, Phippsburg

Laura Minich Zitske, Maine Audubon Society

Population Estimate: Approximately 2 pairs were documented nesting during the window count between June 10th and June 12th, with a later high count of 7 nesting at any one time, and 6 chicks surviving to fledge. The increase in productivity was attributed to predator removal by USDA.

Comparison: In 2013, 3 pairs were documented nesting during the census window, with a high count of 4 nesting at any one time. No chicks survived to fledge due to heavy fox predation. In 2012, 2 least tern pairs fledged 3 chicks. Prior to 2012, no nesting had occurred since 1997.

Predator Control: USDA Wildlife Services removed specialist predators from the Popham Beach area throughout the breeding season.

New Hampshire

White and Seavey Islands

*Dan and Melissa Hayward – Project Coordinators, Shoals Marine Lab
Virginia Winkler and Nora Papian - Field Biologists*

Census

The A-Wave Common Tern census occurred on June 16, 2014. The census recorded 2080 Common Tern nests on Seavey Island, which was corrected with a Lincoln Index to 2117. At the time of the census, there were 200 nests within productivity plots on Seavey that led to a total of 2317 nests. The White Island census found 231 nests. The A-Wave census, therefore, totaled 2548 Common Tern nests, almost 300 more than in 2013. However, the average number of eggs per nest decreased this year compared to previous years. The average number of eggs per nest was 2.15 eggs per nest, 0.25 eggs per nest lower than in 2013.

The census of Roseate and Arctic Tern nests was conducted on June 20th. On June 20th there were 69 Roseate Tern nests, an increase of 35% from the 51 Roseate nests observed in 2013. The Arctic Tern nests increased by 1 nest from 2013, to 3 nests that included 5 eggs.

The B-Wave Common Tern census was conducted on July 13th. The census of Seavey was based upon the nests within the monitored productivity plots that were initiated after the A-Wave census. On July 13th there were 23 new nests that included 44 eggs. This was extrapolated to determine a total of 266 nests on Seavey, for a B-Wave total of 289 nests. The B-Wave census of White Island yielded 36 new nests. The estimated B-Wave for 2014 is 267 nests. The season total for Common Tern nests is 2873, the highest count since the beginning of the restoration effort in 1997.

The B-Wave census of Roseate and Arctic Terns was conducted in the same manner as the A-Wave census. There were 7 B-Wave Roseate Tern nests, for a season total of 76 nests. This is an increase of 17 nests from 2013. There were no B-Wave Arctic Tern nests, as in 2013.

Census

Species	COTE	ROST	ARTE
Date	6/16/2014	6/20/2014	6/20/2014
A-Wave (Seavey)= + Plots(200)+	2317	69	3
White Is(231) =Total	2548	After 6/20/14	After 6/20/14
B-Wave (July 13)	325	7	0
Season Total Nests	2873	76	3

Five Year Population Comparison (at A-Wave Census)

Species/Year	2009	2010	2011	2012	2013	2014
COTE (prs)	1993	2251	2447	2044	2269	2548
ROST	34	48	42	51	51	69
ARTE	6	6	3	4	2	3

Five Year Population Comparison (Season Totals)

Species/Year	2009	2010	2011	2012	2013	2014
COTE (prs)	2377	2615	2811	2577	2619	2873
ROST	40	53	50	63	59	76
ARTE	7	6	5	5	2	3

Tern Productivity: A-Wave

Despite the increase in the total Common Tern nests from 2013 to 2014, the clutch size and success decreased from 2013 to 2014. The 2013 productivity was 1.30 chicks per nest, whereas it dropped to 0.81 this year. The clutch size similarly decreased from 2.40 eggs per nest to 2.15 eggs per nest in 2014. Although there was a 10% increase in the number of eggs from 2013 to 2014, the number of abandoned nests, failed nests, and unhatched eggs doubled from 2013 to 2014.

The Roseate Terns had a successful year on Seavey Island. The A-Wave productivity was 0.94, which decreased from 1.14 in 2013. The average clutch size decreased from 1.69 eggs per nest in 2013 to 1.49 eggs per nest in 2014. The number of banded ROST chicks increased from 24 in 2013 to 61 in 2014.

The Arctic Terns had a relatively successful season, although there are so few nests it is difficult to compare year to year trends. There were 3 active nests this year, up from 2 in 2013. All 5 eggs hatched, but 1 chick died prior to fledging. In 2013, all 4 chicks fledged.

Tern Productivity: B-Wave

The B-Wave census of the productivity plots resulted in 23 nests with 44 eggs. The success of these nests was significantly lower, primarily due to nest abandonment. The average clutch size was 1.91 eggs per nest, with the hatch rate of 1.0 per nest, and a fledge rate of 0.61.

There were 7 B-Wave ROST nests. Of these 7 nests, 4 of the eggs hatched and all the chicks fledged. In 2013, 5 B-Wave ROST chicks fledged. There were no B-Wave Arctic Tern nests.

White Island Productivity Plot

A productivity plot was set up on White Island in order to compare the Common Tern success rate with that in the main colony on Seavey Island. There were 17 nests that had an average clutch size of 1.94, a hatch rate of 1.24 and a fledge rate of 0.59.

Season Description

The presence of a dog on White throughout the breeding season discouraged the terns from nesting in the area around the house. An electric dog fence was set up upon arrival and the dog was encouraged to roam within the boundaries. There were nests initiated within the fenced in area and they were slowly moved to the perimeter.

Rainfall was below average in May and June of 2014. However, a number of storms did contribute to egg and chick mortality. In particular, a series of strong storms from July 3rd-July 5th caused high mortality within the productivity plots. The number of dead chicks found within the plots on July 5th and 6th was 33.

Predation pressure caused significant impacts in the 2014 season. Egg predation seemed to be primarily by sandpipers, based upon the visible punctures of the eggs. The peak egg predation of this nature coincided with a presence of Ruddy Turnstones in late May and early June. The predator that caused the most disruption was a juvenile Peregrine Falcon. The falcon was first seen on the morning of May 20th, and returned to the colony May 27th through June 5th, and hunted throughout the summer. The colony was stressed by the falcon during peak incubation and nearly abandoned. Extended dread flights at sunrise and sunset were observed during incubation and prior to the hatching period.

Gull predation was relatively light throughout the season. Constant biologist presence likely contributed to the decrease in problem gulls. The late season presence of the peregrine falcon could have also led to a decrease in gull presence.

The nest density within the productivity plots increased from 2013 to 2014. The average nest density during the A-Wave was 3.33 nests per m², an increase of 15.23% from 2013. The average nest density for the entire 2014 season was 3.72 nests per m², an increase of 9.54% over 2013. The increase in nest density was likely due to an increase in vegetative cover, which rendered much of the island unsuitable for Common Tern nesting.

As mentioned above, the vegetation was quite successful this year, but rendered much of Seavey inaccessible to Common Terns for nesting. The vegetation forced the terns to nest densely in available locations. This likely contributed to the observed adult aggression towards chicks that resulted in higher chick mortality. On June 20, 2014, an employee of New Hampshire Fish and Game sprayed Round-Up Pro (Concentrate) on vegetation towards the center of the island in preparation for a prescribed burn that is scheduled for this fall. Fish and Game will return in mid- to late August to treat areas avoided previously due to nesting activities.

The following table represents the Peak COTE hatch information for the A-Wave.

Year	2009	2010	2011	2012	2013	2014
Peak Hatch Period	6/26-6/29	6/19-6/23	6/23-6/28	6/15-6/21	6/22-6/28	6/19-6/24
Peak Day	6/29	6/20	6/25	6/18	6/25	6/20
Standard Deviation	3.64	4.10	3.25	3.83	5.25	4.62

Tern Productivity

COTE A-Wave Totals [Season Totals]

Year	2009	2010	2011	2012	2013	2014
Nests Monitored	122[140]	184[189]	184[212]	163[235]	162[190]	200[223]
Mean Clutch	2.53[2.45]	2.68[2.62]	2.29[2.22]	2.70[2.43]	2.40[2.32]	2.15[2.12]
Mean Hatch	2.15[2.00]	2.37[2.26]	2.05[1.91]	2.02[1.40]	2.06[1.86]	1.65[1.57]
Fledglings/Nest	1.23[1.11]	1.81[1.67]	1.36[1.22]	0.94[0.80]	1.30[1.22]	0.81[0.78]
Total Fledglings	2541[2638]	4074[4393]	3328[3429]	1921[1649]	2950[3195]	2064[2241]

ROST A-Wave Totals [Season Totals]

Year	2009	2010	2011	2012	2013	2014
Nests Monitored	34[40]	48[53]	42[50]	51[63]	51[58]	69[76]
Mean Clutch Size	1.88[1.75]	1.90[1.87]	1.98[1.86]	2.0[1.89]	1.69[1.64]	1.49[1.45]
Mean Hatch	1.26[1.10]	1.44[1.38]	1.38[1.22]	1.25[1.06]	1.22[1.21]	1.01[0.97]
Fledglings/Nest	1.06[.93]	1.31[1.27]	1.21[1.16]	0.98[0.86]	1.14[1.12]	0.94[0.91]
Total Fledglings	36[37]	64[66]	51[58]	50[54]	58[64]	65[69]

ARTE A-Wave Totals [Season Totals]

Year	2009	2010	2011	2012	2013	2014
Nests Monitored	6[7]	6	3[5]	4[5]	2	3
Mean Clutch Size	2.00[2.00]	2.00	2.00[2.00]	2.00[1.80]	2	1.67
Mean Hatch	0.43[0.71]	1.83	1.00[0.60]	1.5[1.20]	2	1.67
Fledglings/Nest	.33[0.29]	1.5	0.33[0.20]	0.50[0.44]	2	1.3
Total Fledglings	2[2]	9	1[1]	2[2]	4	4

Tern Feeding Study

Nest Hours	Feeding Rate/hr
642hrs 11min	0.72

Species	Hake	Herring	Sand Lance	Unknown Fish	Butterfish
% of Diet	33.12	27.08	16.15	6.04	5.22

Predator Control

The biologists arrived on White and Seavey Islands on May 19 to initiate gull control. There were no gull nests initiated on either island. The gull predation was low enough to be considered insignificant throughout the season. There was no take of either Herring or Great black-backed Gulls during the 2014 season.

Unfortunately, there was a high level of predation on adult, chick and fledgling terns from two unusual predators. A juvenile Peregrine Falcon was first observed on the morning of May 20. The peak predation pressure by the falcon was from May 27 until June 3. During this period, a new kill site would be found at least once a day, and the falcon was observed in the colony multiple times a day. The level of predation by the falcon declined after the 3rd, but it returned periodically throughout the season and began hunting regularly at Seavey at the end of July. As of July 29, it was confirmed that the falcon killed at least 17 adults and fledgling Common Terns, but the number taken is likely higher.

The second potential predator was a muskrat. The first instance of predation thought to be by the muskrat was July 1. It is believed that the muskrat killed at least 32 chicks just prior to their fledging. An attempt to trap the predatory muskrat was unsuccessful.

On August 14 an adult Snowy Owl was seen in the colony. It was flushed and re-sighted on the 15th and 16th. It was still present on September 3rd.

Predator Control (as of 8/16/2014)

Species	Nests Destroyed	Eggs Destroyed	Adults Taken
GBBG	0	0	0
HERG	0	0	0

Gull Control (May 19-Aug 5)

Control Method	Average/Day
Human Control	1.31
Screamer	1.17
Banger	0.18
Cap	0.06

Other Nesting Species

There was no evidence of breeding Black Guillemots this breeding season. Common Eiders nested on Seavey Island and White Island and several Spotted Sandpiper nests were found on both islands as well.

Species	COEI	SPSA
# Of Nests	32	12

Interesting Observations from the Season

July 24- 250 Sooty Shearwater, 200 Great Shearwater, 150 Cory's Shearwater, 2 Manx Shearwater, 60 Northern Gannets, 30 Wilson's Storm-Petrels, a juvenile South Polar Skua, and a single Bonaparte's Gull.

July 21-Black-legged Kittiwake in breeding plumage.

May 23, 29, 30, July 4-Atlantic Puffin-single individual sightings

July 20-5 Razorbills

June 20-3 American Oystercatchers

July 11-Black Skimmer

Funding for this project comes from the USFWS State Wildlife Grants, New Hampshire Fish and Game Nongame and Endangered Wildlife Program, NH Moose Conservation License Plate Program, the 908 Group, and private donors.

Massachusetts

Monomoy Islands – Monomoy National Wildlife Refuge

Kaiti Titherington – Biological Science Technician, U.S. Fish & Wildlife Service

Kate Iaquinto – Wildlife Biologist, U.S. Fish & Wildlife Service

North Monomoy Island

Common Tern:

Census: The North Monomoy Island tern census was conducted on 8 June when 22 nests were counted.

Productivity: Productivity was not monitored throughout the season but general observations suggested that productivity was poor, likely due to gull predation.

South Monomoy Island

Common Tern:

Census: The South Monomoy Island tern and gull census was conducted on 6 and 7 June. The nesting area has been delineated into 60m² grids, and all nests were tallied by grid number. The total number of common tern nests counted was 7,998. To compensate for an early census date we calculated additional numbers based on the productivity plots as well as the Lincoln Index for a final estimate of 8,526 nest for South Monomoy Island.

A B-census was not conducted, however based on the number of nests initiated in productivity plots after June 20th, we estimated there to be an additional 899 nests in the colony during the B period.

Productivity: The reproductive success of common terns on South Monomoy Island was excellent based on 313 A count-nests in 33 fenced productivity plots. The reproductive success for the plots monitored was 1.58 chicks fledged per nest. The following calculations are based on A-nests only and reproductive success is measured by chicks fledged per nest attempt.

Table 1. Comparison of Productivity Information for A-Period Nesting Common Terns on South Monomoy Island: 2012 to 2014

	2012	2013	2014	Standard Deviation	Standard Error	Sample Size
Average Clutch Size	2.55 eggs/nest	2.42 eggs/nest	2.38	0.65	+/- 0.04	313
Average Eggs Hatched Per Nest	2.18 eggs hatched/nest	2.20 eggs hatched/nest	2.17	0.85	+/- 0.05	313
Hatching Success	85.8%	90.9%	91.0%			
Fledging Success	57.6%	67.3%	73.0%			
Reproductive Success	1.26 chicks/nest	1.65 chicks/nest	1.58	0.92	+/- 0.05	313

Table 2. Number of Pairs and Reproductive Success of Common Terns on South Monomoy Island 2012 to 2014

	2012	2013	2014
Number of Pairs	7762	7526	8526
Reproductive Success	1.26	1.65	1.58

Feeding Stints: Staff conducted 15 1-hour long common tern feeding stints from 27 June - 12 July. Seven nests with small to medium chicks were marked by the observer. Prey item and prey length were recorded during each stint. Observers recorded 64 total feedings during 15 hours of stints. Sand lance was the most common prey item (79.7%). Other delivered prey items included herring (4.7%), hake (1.6%), bluefish (6.3%), and unknown fish (7.8%). The average prey length was 1.92 culmen-lengths. Prey species observed within the colony but not during feeding stints included butterfish, squid, killifish and flounder.

Adult Trapping and Banding: Sixty-six adult common terns were captured this season during refuge banding efforts. Of the terns captured, 55 were previously banded and 11 were affixed with new bands. Of the 55 banded adults captured, 40 were originally banded at Monomoy NWR, 1 has not been reported, 5 were from Pam Loring's nano-tag research in 2013 and the remaining were as follows; Great Gull

Island, NY (8), Wareham, MA (5), Punta Rasa, Argentina (3), Brazil (1), Cuttyhunk Island, MA (1), Mattapoissett, MA (1), Plymouth Long Beach, Plymouth, MA (1).

Roseate Tern:

Census: Eight roseate tern nests were counted during the census window on South Monomoy Island. A total of 11 chicks hatched and all chicks were considered fledged based on GOMSWG standards. Day stints were continued until 1 July and no B-Period nests were observed.

Productivity: The reproductive success of roseate terns on South Monomoy Island was excellent with a 100% fledging success rate. The following calculations are based on the total number of A-nests and reproductive success is measured by chicks fledged per nest attempt.

Table 3. Comparison of Productivity Information for A-Period Nesting Roseate Terns on South Monomoy Island: 2012 to 2014

	2012	2013	2014	Standard Deviation	Standard Error	Sample Size (n)
Average Clutch Size	2.00 <i>eggs/nest</i>	1.63 <i>eggs/nest</i>	2.13	0.35	+/- 0.13	8
Average Eggs Hatched Per Nest	2.00 <i>eggs hatched/nest</i>	1.50 <i>eggs hatched/nest</i>	1.38	0.92	+/- 0.11	8
Hatching Success	100%	92%	64.71%			
Fledging Success	100%	100%	100%			
Reproductive Success	2.00 <i>chicks/nest</i>	1.50 <i>chicks/nest</i>	1.38	0.92	+/- 0.11	8

Table 4. Number of Pairs and Reproductive Success of Roseate Terns on South Monomoy Island 2012 to 2013

	2012	2013	2014
Number of Pairs	1	8	8
Productivity (chicks fledged/nest)	0.29	1.5	1.38

2014 Attraction Project: A roseate tern attraction project began in 2009 in an effort to attract roseate terns to South Monomoy Island due to the severe loss of habitat on Minimoy Island. This project was continued annually and in 2014 two sound systems were placed near the main nesting colony along with artificial nesting structures, which consisted of six artificial nest boxes covered by a piece of plywood, and a new type of chick shelter shaped like a teepee. The teepee chick shelters used were modeled after those used by the Massachusetts Natural Heritage and Endangered Species Program on Ram Island. Four pairs of roseate terns nested inside the artificial nesting structures and three of those pairs nested within 30 feet of a sound system. This is the second year that roseate terns have nested in nesting structures on South Monomoy Island and this is considered by staff to be a small but important success of this effort thus far.

Restoration Project: A CRI grant funded roseate tern habitat restoration project was initiated on South Monomoy Island to increase roseate nesting area in and around the colony. A total of 2,175 seaside goldenrod seedlings were planted during two planting events in 2014, 725 in the spring and 1450 in the

fall. The plantings were focused on three 180 by 60 m² study areas, each containing a different density of nesting common terns. Five pairs of roseates nested within the study areas in 2014.

Adult Trapping and Banding: Seven roseate tern adults were captured using Potter traps, all of which had been previously banded. Color bands were removed from three birds and blue plastic field readables with white lettering were added to all birds. The bands were reported to Bird Banding Lab and Jeff Spendelow of USGS.

Roseate Staging and Re-sighting: In conjunction with Mass Audubon and USGS, Refuge staff has been conducting counts of staging roseate and common terns on the refuge and South Beach, Chatham, in addition to re-sighting color banded adult roseate terns. Staging counts began on 4 August and will continue as staff availability allows and the terns are present. This year staff is also distributing materials to educate beach users about staging and roosting birds and documenting human caused disturbances as they occur.

Least Tern:

Census: Least terns nested in two main areas on South Monomoy Island as they have historically. The A-period census was conducted on 16 and 18 June. A total of 376 nests were counted during the A-period census window. There was no B-period census conducted this year because the number of terns present at the Refuge nesting areas remained relatively consistent throughout the nesting season.

Productivity: Productivity was not quantitatively monitored, but was estimated to be poor. Many fledglings were present on the island prior to Hurricane Arthur but very few remained after the storm passed through.

Black Skimmer:

Census: Two pairs of skimmers were spotted on North Monomoy, South Monomoy and Minimoy Islands throughout the season, however neither pair nested on refuge.

Laughing Gull:

Census: During the tern census, which took place June 6th and 7th, 983 active laughing gull nests were counted, compared with 972 in 2013, and 441 in 2012. Numbers were likely higher since the census was held early this year, though no additional counts were made to estimate the peak number of nesting laughing gulls.

Productivity: Productivity was not monitored, however it was estimated to be qualitatively good based on the number of chicks and fledglings seen throughout the season.

Kleptoparasitism: Stints were continued this year to monitor the number of kleptoparasitism attempts by laughing gulls on common terns. Sixty-nine one-hour long stints were conducted in the tern colony throughout the field season. During stints a total of 1351 kleptoparasitism attempts were recorded, with an average of 19.58 per hour. Laughing gulls were successful 52% of the time, common terns were successful 21% of the time, the outcome was unknown 17% of the time, and prey items were dropped during 10% of the attempts. The number of laughing gulls involved in a kleptoparasitism may affect the outcome of each attempt. When laughing gulls were most successful at kleptoparasitizing fish from terns, there was on average seven laughing gulls involved. When common terns were successful, the average number of laughing gulls was five.

Minimoy Island

Common Tern:

Census: No common tern nests were found or monitored on Minimoy Island this field season.

Productivity: Productivity on Minimoy Island was zero.

Roseate Tern:

Census: No roseate tern nests were found on Minimoy this field season.

Productivity: Productivity on Minimoy Island was zero.

Black Skimmer:

Census: No black skimmer nesting activity occurred on Minimoy this year. No nests were found in 2014, 2013 or 2012 and five nests were counted each year in 2011, 2010, 2009, and 2008.

Laughing Gull:

No laughing gull nesting activity occurred on Minimoy this year.

Predators (Refuge-wide)

Great Black-backed Gull and Herring Gull: Five herring gulls and 11 great black-backed gulls were removed from South Monomoy Island during 2014. Great black-backed gulls were observed in the colony a total of 20 times while only one herring gull seen in the colony during the season.

Northern Harrier: Nesting northern harriers were not documented on the refuge, but based on their presence on South Monomoy Island, in addition to the abundance of suitable northern harrier habitat, it is likely that at least one pair was actively nesting. Northern harriers were observed at the South Monomoy Island tern colony eight times throughout the season. In late-July harrier predation was observed to have been the cause of death to at least three fledged terns.

Coyote: A total of five coyotes were removed from South Monomoy Island in 2014. Scat, tracks and sightings of coyotes were seen near the tern colony and throughout the island. Overall predation by coyote was thought to be minimal.

American Crow: American crows were observed on South Monomoy Island throughout the season however none were seen within the colony.

Common Grackle: Evidence of common grackle predation on piping plover nests was also observed in 2014. Thirty-four common grackle were removed to reduce predation stress on nests in areas of high predation. Common grackle likely have little to no impact on nesting terns. However, they may consume least tern eggs, although no evidence of this was observed. Common grackle are primarily a problem for nesting piping plover on the island.

Wading Birds: A wading bird census on North Monomoy Island was conducted on 16 May. Observers counted 157 black-crowned night heron nests, 48 snowy egret nests, and 25 great egret nests. No census was conducted on South Monomoy Island this year, because wading birds have not been found nesting on the island since 2007. Staff sighted 4 black-crowned night-herons on South Monomoy Island and a small amount of depredation was observed in the tern colony.

Owl (Unidentified Species): Snowy owls were seen early in the season however no evidence of predation was observed.

Peregrine Falcon: One peregrine falcon was documented flying over the colony on 22 May.

Unknown Predator Events: On 23 May, 24 adult common terns were found dead in the main colony, 16 of which were decapitated and the heads were left with the bodies. The remaining 8 with heads intact had no obvious signs of trauma.

Massachusetts Summary

Dr. Ian Nisbet - I.C.T. Nisbet & Co., North Falmouth, MA

This report is based on preliminary numbers reported at the MA tern meeting in October.

MA totals	ROST	COTE	ARTE	LETE	BLSK	LAGU
Total 2014	1,832	16,812.5	1.5	3,259	4	2,089
Total 2013	1,330	16,336.5	0.5	3,478	3	1,863
% change	38%	3%	200%	-6%	33%	12%

Total numbers of Roseate Terns increased markedly this year after several years of near-constant numbers and are now nearly as high as at the peak in 2000. Common Terns have been stable at around 16,000 pairs for several years. One new pair of Arctic Terns appeared at Penikese Island and bred successfully, while the mixed pair of Arctic x Common Terns bred together for the eighth year and raised one hybrid chick. Least Terns were at similar numbers to recent years. One new pair of Black Skimmers appeared. Laughing Gull numbers increased again by about 12%.

Within the Massachusetts sites in the Gulf of Maine (mainly at Monomoy NWR and Plymouth Beach except for Least Terns), changes were similar:

MA sites in Gulf of Maine, 2014

	ROST	COTE	ARTE	LETE	BLSK	LAGU
MA GOM total 2014	8	9,636	0	1,713	1	2,089
MA GOM total 2013	8	9,104	0	1,872	0	1,863
% change	0	6%	0	-9%	++	12%

At the main sites in Buzzards Bay, numbers of all three species increased markedly in 2014 over those in 2013. However, productivity was lower than usual (0.58-1.04 fledged chicks per pair for Common Terns, and 0.85-1.08 fledged chicks per pair for Roseate Terns).

Snowy Owls were present at all three islands in winter and early spring, and the owl at Ram Island remained until after the terns arrived and killed several individuals of both Common and Roseate Terns.

Primary Buzzards Bay sites, 2014

	ROST	COTE	ARTE
Bird Island	1,121	2,391	0
Ram Island	682	3,790	0
Penikese Island	20	915.5*	1.5*

*Includes one COTE x ARTE hybrid.

Afternoon Session/Research Abstracts

Forage Fish, Seabirds and Ocean Ecosystems

John Crawford, Science and Policy Manager, U.S. Fisheries NE, Pew Charitable Trust

The Pew Charitable Trusts is working to advance strong science-based fisheries management in the Northeast. We are focused on promoting the transition to Ecosystem-Based Fisheries Management (EBFM), including protecting habitat and adopting new approaches to restoring and conserving key species that are vital as food in the ecosystem – *forage fish*. Our work on forage fish rests on a strong scientific foundation provided by the *Lenfest Forage Fish Task Force*, and that of other scientists, showing that forage fish must be managed for higher abundance than other fish in order to support dependent predators in marine ecosystems. This has been slow to find its way into policies that govern the harvest of Atlantic herring, menhaden, and other important forage species. In 2013, the New England fishery removed 1.5 billion Atlantic herring, offering stiff competition for puffins and other wildlife users of this important resource. We are working to promote the use of good science to ensure abundant forage, and to avoid localized depletion that can adversely affect seabirds, whales and other marine predators. Federal fisheries law requires managers to protect Essential Fish Habitat and this includes essential prey species like herring. We are urging NOAA Fisheries to consider the spawning areas for Atlantic herring as it develops new plans for habitat protection this fall – a matter of direct relevance to those interested in the future of seabird colonies in the Gulf of Maine. Historically, river herring were also a major component of the forage assemblage in the Gulf of Maine but the numbers are a mere shadow of what they once were due to dams, pollution and bycatch in at sea fisheries. We are supporting the fisheries managers in developing new policies to reduce the at-sea capture of these important forage fish.

For more information:

Pew's U.S. Oceans Northeast campaign page: <http://www.pewtrusts.org/en/projects/new-england-ocean-conservation>

EBFM: <http://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2014/03/20/ecosystembased-fisheries-management>

Lenfest Forage Fish Task Force: <http://www.oceanconservationsscience.org/foragefish/>

Herring Alliance: <http://www.herringalliance.org/>

The Effects of Warm Water on Nesting Success of Atlantic Puffins in the Gulf of Maine

Stephen Kress, Seabird Restoration Program, National Audubon Society

In 2012 record high sea surface temperatures and the earliest known plankton bloom in the Gulf of Maine may have given a head start to the growth of pelagic-juvenile butterfish (*Peprilus triacanthus*) in the coastal waters of mid-coast, Maine. This became a problem for puffins nesting at Maine's two largest colonies, Seal Island NWR and Matinicus Rock. Butterfish have usually been an uncommon fish in the diet of Maine puffins which typically feed on white hake (*Urophycis tenuis*) and Atlantic herring (*Clupea harengis*), both slender bodied fish that puffin chicks can easily swallow. In contrast, butterfish have a round shape which may exceed the gape of the puffin chick. This became problematic in 2012, when butterfish comprised 8.5% of the puffin's diet and were the largest recorded in the previous eight years. In the absence of herring, puffins attempted to feed their chicks butterfish, but many chicks starved after attempting to swallow these broad-bodied prey. In the previous five years, Seal Island puffins fledged an average of 0.77 chicks per pair, but in 2012, they fledged only 0.31 chicks/pair. In many nesting burrows, dead puffin chicks were found surrounded by large butterfish. The mortality would have been worse without the appearance of late season pelagic juvenile bluefish in the final weeks prior to fledgling. In the winter of 2013, the second warmest SST (after 2012) and several severe storms coincided with an exceptional mortality event affecting at least 264 razorbills and 40 puffins, found dead in February and March along the coast of Massachusetts. Subsequently, puffins at Matinicus Rock and Seal Island nested two weeks later than usual and the number of nesting pairs declined by a third, suggesting that many puffins died and/or were in poor condition following the stressful winter of 2012-2013. Even the pairs that nested were largely unsuccessful, with productivity declining to a new record low of less than 0.13 at Seal Island and Matinicus Rock. Butterfish were uncommon in the puffin's diet in 2013, but other forage fish were insufficient for most puffins to successfully raise young. Future research is necessary to learn where puffins spend the non-breeding season and where they forage for food during the nesting season.

Where are Atlantic Puffins and Razorbills foraging? The use of GPS tracking devices to reveal movements and habitat use in the Gulf of Maine

Stephanie Symons, M.Sc. Candidate, University of New Brunswick, Department of Biology

I am studying the foraging movements of breeding Atlantic Puffins *Fratercula arctica*, and Razorbills *Alca torda*, using Global Positioning System (GPS) loggers (EcoTone®, ~5g). These download to a base station aerial on the lighthouse when within 300m of the base station. I attached loggers to feathers in the middle of the back using TESA® tape and cable ties. GPS positions were recorded every 30 minutes for approximately 4 days. I found that chick-rearing adult puffins' foraging trips (N=7) averaged 21% longer than incubating (N=4) puffins (91.5±20.0 km vs. 75.1±18.5 km). Chick-rearing adults also traveled 44% farther from MSI (43.6±8.8 km) than incubating adults (30.2±5.7 km). The opposite is seen with razorbills: incubating adults' (N=4) foraging trips (67.8±18.3 km) averaged 82% longer than chick-rearing adults (37.1±13.8 km; N=7). Chick-rearing adults also traveled about half as far from MSI (15.4±5.0 km) as incubating adults (29.9±7.9 km). Generally, Puffins remained on the water south of MSI whereas Razorbills frequented Grand Manan and the mainland between Machias, ME and St George, NB. I will look at daily time budgets as well as diving and foraging patterns. This study will allow mapping and modeling with the goal of delineating marine protected areas for our seabirds.

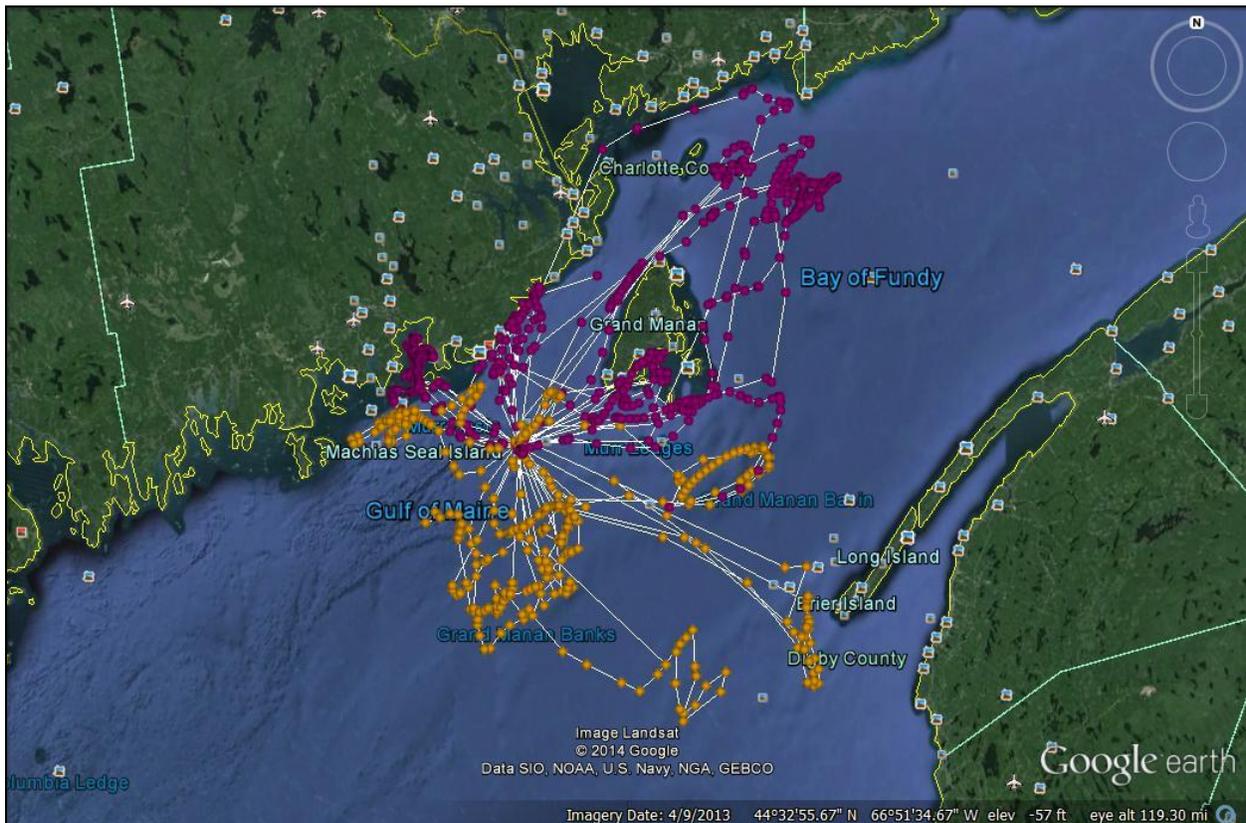


Figure 1. Foraging movements for Atlantic Puffins (orange, N=11) and Razorbills (purple, N=11) from Machias Seal Island, May 21st to July 24th 2014.

The Gulf of Maine Coastal Ecosystem Survey. Preliminary results and advice solicitation

Andrew Allyn¹, Aly McKnight² and others³

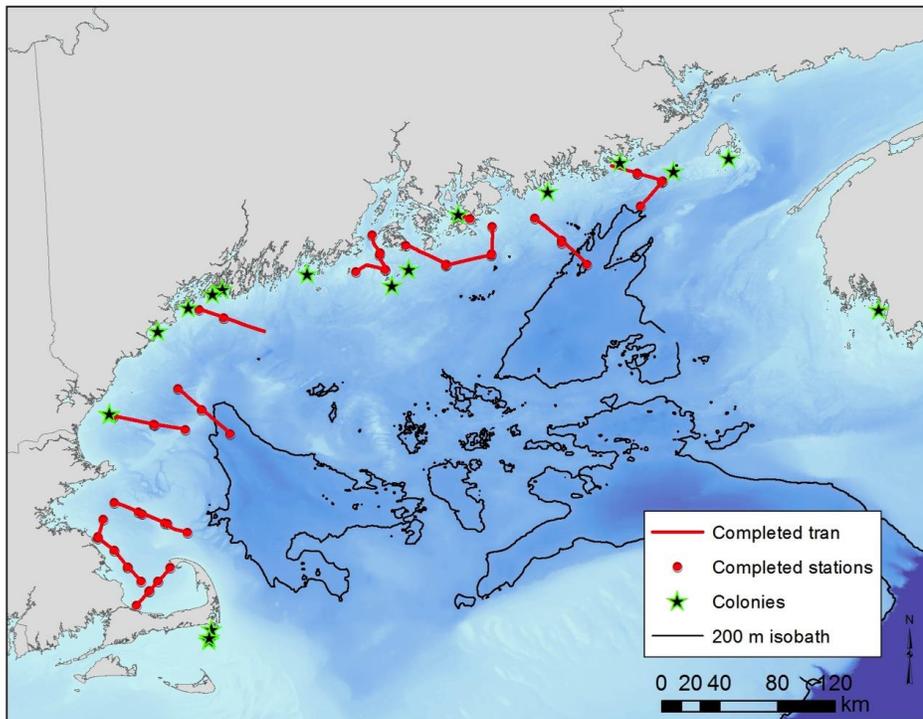
¹University of Massachusetts Amherst School of Marine Sciences, Amherst, MA

²University of Maine Dept. of Ecology and Environmental Sciences and Maine Cooperative Fish and Wildlife Research Unit, Orono, ME

³Other project partners include: Maine Dept. of Inland Fisheries and Wildlife (Project lead), New Hampshire Dept. of Fish and Game, Massachusetts Dept. of Fisheries and Wildlife, U.S. Fish and Wildlife Service, Gulf of Maine Research Institute, Biodiversity Research Institute, and the University of New Hampshire

Many questions remain concerning the structure and function of the ecologically and economically important Gulf of Maine coastal marine ecosystem. These questions include those surrounding the at-sea ecology of marine birds, such as their distribution, abundance and habitat selection patterns. We sought to quantify and investigate these patterns this summer during the first Gulf of Maine ecosystem survey. From June 30th to July 17th, a multidisciplinary team of researchers completed integrated, ecosystem surveys from Cape Cod Bay to Jonesport. Within this area, 12 transects were distributed in an attempt to capture waters that spanned significant depth gradients and that were near seabird colonies, major basins and other areas of interest. Along these transects, the team collected a plethora of data across many different trophic levels, including the distribution and abundance of marine birds and mammals. Here, we present preliminary findings and highlight some of the advantages of an integrated, ecosystem-based survey. Additionally, we discuss a few of the survey challenges and our plans for the next survey with the goal of soliciting advice from the Gulf of Maine seabird research community to improve the survey design and maximize our efforts.

July 2014 Gulf of Maine Coastal Ecosystem Survey
Transects and Cast Stations



A tale of two species: how predator management led to the fall and rise of Machias Seal Island's tern colony

Lauren Scopel, University of New Brunswick

Machias Seal Island (MSI), NB, was once the largest Arctic Tern colony in North America. MSI accounted for at least 50% of the regional Arctic Tern population in the Gulf of Maine (GOM) in the 1990s and early 2000s, when the regional population was increasing. In 2006, however, the MSI tern colony abandoned breeding mid-season, following two consecutive years of low breeding success; in spite of annual attempts at nesting, breeding failure continued through the 2013 season. Since 2006, the regional population has experienced rapid declines, leading to concern over its sustainability. In 2014, the first major positive sign of colony recovery at MSI manifested when tern chicks fledged for the first time since 2005, in clear response to the resumption of lethal gull control.

Although food, weather, and predation were all proposed factors in the continued failure of the MSI tern colony, we were not able to identify the relative proportion of these influences until recently. It is now clear that predation by gulls is the major inhibitor of colony recovery on MSI; predation and inclement weather have the biggest negative impacts on nesting success. I will describe models showing the relative influence of food, weather, and predation on MSI tern nesting success from the years 1995-2005, and explain how changes in our gull control methods changed gull and tern behavior. We determined that the tern colony cannot succeed if egg predation rises above 25%; identification of this threshold will improve the precision of our predator management objectives. While this year's success is encouraging, there is still a long way to go before pre-abandonment levels of productivity and breeding numbers are reached; future success will depend upon our ability to conduct lethal gull control.

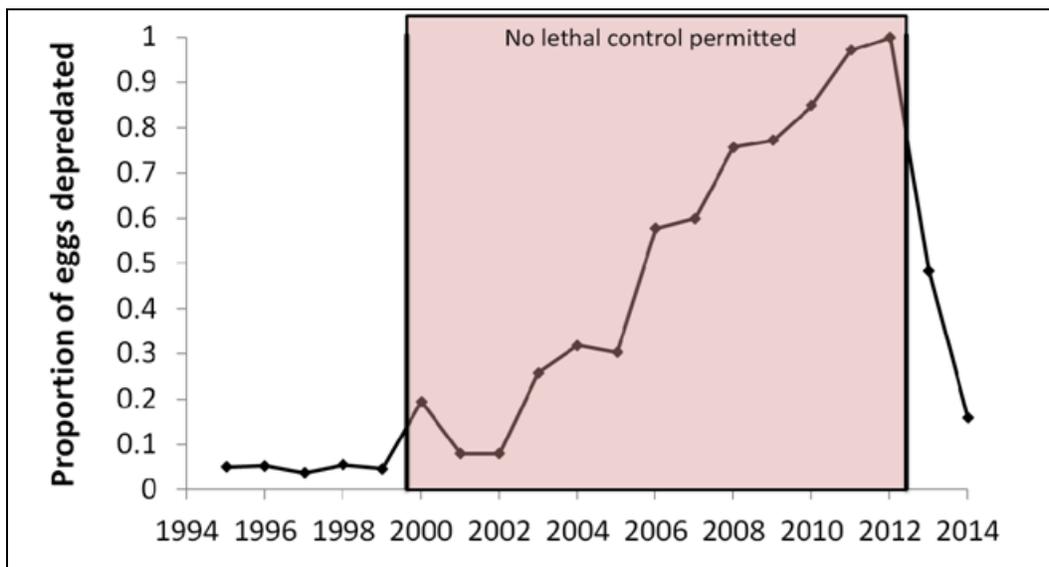


Figure 1. Proportion of depredated eggs in tern productivity plots on MSI, 1995-2014. Lethal control of gulls was not permitted in 2000-2012.

Appendix A. Radio Tag Reports

Although not reported in detail at GOMSWG, investigators using radio tags were encouraged to submit a brief project report in the form of a table. These reports are presented here in Appendix A.

Roseate Terns, The Brothers, Nova Scotia

Project Title	Where do Roseate Terns nesting at the Brothers forage?
Species	Roseate Tern
Location of project (island, state/province)	The Brothers, Nova Scotia
Time frame; when is project taking place	June, 2014
Sample size	Seven
Type of tag and manufacturer	Lotek PinPoint: PP10
Purpose of tagging; What type of data is collected (behavior, migratory, feeding, geographic?)	Foraging locations
Geographic accuracy of data collected	accuracy of ± 10 m
Timing of collection (how often is data collected; i.e. transmitter is turned on every other day for 4 hours)	Tags were programmed to collect ten locations
Life of transmitter/battery	PP10 are capable of collecting 10 locations with a user-programmable schedule
How data is collected (recapture of individual, remote, satellite?)	Recapture of individual
Attachment method	TESA tape and Loctite glue; attached to middle of back
Cost of receiving stations (if applicable) and tags	
Principle investigator & contact info	Julie McKnight Canadian Wildlife Service Julie.Mcknight@ec.gc.ca
Data outcome	Only one tag was recovered, 5 days after deployment, and all ten gps fixes were located on the colony. Two birds lost tags and the remaining four birds could not be re-trapped: • a tagged pair abandoned

	<ul style="list-style-type: none"> • two birds were ‘trap shy’.
<p>General information on project results (what worked/challenges)</p>	<ul style="list-style-type: none"> • Tags are easy to use - charge /program/download & export data • Birds became trap-shy • Terns were able to remove tags (2 attachment points using tape and glue) and thus, tags should be retrieved as soon as possible in order to reduce chances of tag loss or removal • 10 readings was limited but PP40s (40 readings) are too heavy for ROST at this time (2.8g +attachment).
<p>Weight of the tag</p>	<p>< 1.5 grams (standard is 1.1g, ours were modified to have a harder shell for waterproofing)</p>

Photos: Ted D'Eon



Atlantic Puffin and Razorbill, Machias Seal Island, New Brunswick, Canada

Project Title	Foraging areas and habitat use of Atlantic Puffins and Razorbills in the GOM through GPS tracking.
Species	Atlantic Puffin Razorbill
Location of project (island, state/province)	Machias Seal Island, NB, Canada
Time frame; when is project taking place	May to August 2014 and 2015
Sample size	11 Razorbills 11 Atlantic Puffins
Type of tag and manufacturer	GPS tag, EcoTone
Purpose of tagging; What type of data is collected (behavior, migratory, feeding, geographic?)	Feeding – longitude, latitude, speed, dive duration, date, time.
Geographic accuracy of data collected	GPS positions are within 10-15 meters
Timing of collection (how often is data collected; i.e. transmitter is turned on every other day for 4 hours)	Tag takes GPS position every 30 minutes, and battery lasts approximately 4 days. Tags are rechargeable and can be redeployed if recovered.
Life of transmitter/battery	Life of transmitter is dependent on settings you choose for the tag (how often tag takes position, how often it tries to contact the base station, sensitivity of dive data, etc.)
How data is collected (recapture of individual, remote, satellite?)	Data are downloaded to the base station (usually set up in the colony) via UHF radio when the tag comes within 300 meters of the base station
Attachment method	Cable ties and TESA tape; They were attached to 3 sets of back feathers with zip-ties & TESA tape. The important thing seems to be to avoid having it flap up & down against the back, it needs to sit down as flat as possible.
Cost of receiving stations (if applicable) and tags	30 tags + 3 base stations, reader & software = \$45 000 CAD
Principle investigator & contact info	Prof. Tony Diamond, UNB, Fredericton NB Canada tonydiamond49@gmail.com or diamond@unb.ca
General information on project results (what worked/challenges)	Deployed 11 tags on ATPU and 11 on RAZO. Received 5 trips for ATPU and 33 for RAZO. Attachment method appeared to work really well.

	<p>There were only 2 RAZOs that had abandoned their tags after deployment (confirmed during resighting). 2 other RAZOs had no recorded trips for unknown reasons. Both of these burrows had cameras set up on them therefore further investigation may be possible. I had the most success grubbing a targeted bird if I grubbed before sunrise. Grubbing early chick-rearing adults (ie. with young chicks) is not recommended. I deployed 3 tags on ATPU with young chicks: two abandoned and one chick could not be located later on during its development. Generally, chicks from tagged burrows grew more slowly (wing chord: ~1mm less per day for both RAZO and ATPU, Mass: ~2.29g less per day for RAZO and ~0.1g less per day for ATPU).</p> <p>Just before the field season, my crew went to a training workshop in Ottawa, organised by Environment Canada & given by folks who had used them on murrelets but led by Lech Iliszko who has used them on dovekies (!); I had met him at the Waterbirds meeting in Germany last fall & had difficulty believing this could work. But it does. Ecotone is a Polish company & their website gets more & more Polish the deeper you dig, but the basic information is there.</p>
<p>Weight of the tag</p>	<p>Weight of tag alone - 5g on puffins, 8g on Razorbills. Hard to weigh the tape & zip-ties but might have added another 3-4g each.</p>

Arctic and Common Terns, Metinic, Matinicus Rock, Seal and Ship Islands, Maine

Project Title	Using Nanotags to document tern foraging and migratory behavior
Species	Arctic and Common Terns
Location of project (island, state/province)	Metinic, Matinicus Rock, Seal, and Ship Islands
Time frame; when is project taking place	Terns tagged in June 2014
Sample size	63 in 2014
Type of tag and manufacturer	LOTEK NTQB 4-2 nanotag
Purpose of tagging; What type of data is collected (behavior, migratory, feeding, geographic?)	Colony attendance, foraging flight direction, and migration patterns
Geographic accuracy of data collected	Depends on number of receiving stations. May be limited to flight direction if you don't have additional receiving stations recording occurrences of terns away from the colony
Timing of collection (how often is data collected; i.e. transmitter is turned on every other day for 4 hours)	Continuous data collection at multiple remote receiving stations
Life of transmitter/battery	154 days
How is data collected (recapture of individual, remote, satellite?)	Receiving stations with multiple antennas continuously record data
Attachment method (including location of tag)	Sewed to back of bird with 2 sutures
Cost of receiving stations (if applicable) and tags	Tags \$199 each , receiving station costs vary with number of antennas, average \$2500
Principle investigator & contact info	Linda_Welch@fws.gov
General information on project results (what worked/challenges)	This is our third year of tagging terns (first two years at PMI). We have been able to document number of foraging flights per day, flight direction, difference between incubation and chick rearing, and migration patterns. Antenna array now stretches from Atlantic Canada to Chesapeake Bay.
Weight of tag	1.6g

Greater Shearwater, Stellwagen Bank National Marine Sanctuary

Project Title	Satellite Tracking of Great Shearwater
Species	Great Shearwater
Location of project (island, state/province)	Stellwagen Bank NMS, MA
Time frame; when is project taking place	Shearwaters were tagged in July 2014
Sample size	13 (Over 90 shearwaters tagged in the Gulf of Maine in recent years)
Type of tag and manufacturer	Satellite tags :Microwave Telemetry and North Star
Purpose of tagging; What type of data is collected (behavior, migratory, feeding, geographic?)	Sanctuary managers want to look at local habitat use, but project contributes to larger efforts on GoM habitat use and by-catch issues
Geographic accuracy of data collected	Varies with number of satellites (250 – 1000 m)
Timing of collection (how often is data collected; i.e. transmitter is turned on every other day for 4 hours)	Tags transmitting continuously
Life of transmitter/battery	Tags could last 3 years, attachment likely to fail after 12 months
How is data collected (recapture of individual, remote, satellite?)	Satellite download
Attachment method (including location of tag)	Tags were sutured to back of bird using 4 sutures
Cost of receiving stations (if applicable) and tags	~\$3,000 per tag
Principle investigator & contact info	David.wiley@noaa.gov (or Linda_Welch@fws.gov for tag attachment info)
General information on project results (what worked/challenges)	We also collected blood, feather, and exhaled gas samples for stable isotope analysis. Additional stable isotope samples were collected from additional shearwaters in September 2014 (birds not tagged).
Weight of tag	17g

Common Terns, Monomoy NWR (MA) and Great Gull Island (NY)

Project Title	Tracking Common Terns Across the Southern New England Shelf Using Nanotags and Automated Radio Telemetry Stations
Species	Common Terns
Location of project (island, state/province)	Monomoy NWR (MA) and Great Gull Island (NY)
Time frame; when is project taking place	2013 & 2014, future work TBD
Sample size	2013: 72 on Monomoy NWR. 2014: 70 Monomoy NWR and 50 on Great Gull Island
Type of tag and manufacturer	Lotek NTQB 4-2 nanotags. Also tested 1-g GPS loggers (Lotek PinPoint10) on 5 COTE from Monomoy NWR in 2014
Purpose of tagging; What type of data is collected (behavior, migratory, feeding, geographic?)	Breeding, post-breeding, pre-migratory staging movements
Geographic accuracy of data collected	Varies
Timing of collection (how often is data collected; i.e. transmitter is turned on every other day for 4 hours)	Nanotags on 5-6 second burst rate interval. GPS tags programmed to collect 1 location every 2 hours for a total of 10 locations
Life of transmitter/battery	163 days (nanotags), 10 locations (gps tags)
How data is collected (recapture of individual, remote, satellite?)	Vhf telemetry (nanotags), recapture individuals (gps tags)
Attachment method	Glue and sutures (see photo following this table)
Cost of receiving stations (if applicable) and tags	Varies
Principle investigator & contact info	Pam Loring (ploring@eco.umass.edu)
General information on project results (what worked/challenges)	Nanotags & radio towers effective for tracking terns within ~6 km range. Challenges: telemetry array labor intensive to set up and maintain, data analysis complex
Weight of the tag	1.0g



Appendix B. 2014 GOMSWG Attendees

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