

Summary of 2016 Field Season

(The first year of the transfer of responsibility for MSI seabird work from Tony Diamond to Heather Major)



Figure 1. The 2016 crew: L to R, Angelika Aleksieva, Marla Koberstein, Lucy Smith, Stefanie Collar

There was a marked difference between the first and second halves of the breeding season this year, reflected in weather, food availability and fledging success of seabirds nesting on Machias Seal Island. Throughout June, there was little rain, and newly hatched chicks were provisioned well with a diet dominated by hake. July brought heavy rain and persistent fog, resulting in chick loss from exposure and flooding both at tern nests and in alcid burrows. In addition to the changing weather, we saw an abrupt transition in prey type and abundance brought to the colony. Chick diet became predominantly euphausiids, supplemented with insects and very small hake and stickleback. A majority of tern, razorbill and common murre chicks were close to fledging age at the time of this prey decline and were marginally affected. Atlantic puffins however have been largely unable to adequately provision their chicks, and there has been very limited chick growth, numerous tick infestations and island-wide puffling mortality; ***overall breeding success was 12%, the worst in 22 years.***

This season there were four dedicated field crew throughout the breeding season, two technicians and two students pursuing Masters degrees through Canadian Universities. Stefanie

Collar returned as island supervisor and Marla Koberstein came on as field technician. Angelika Aleksieva, from McGill University, collected foot web tissue biopsies, as well as blood, from puffin adults and chicks of known ages for a study on molecular methods of age determination. She also took samples from razorbill chicks 5-15 days old. Lucy Smith, from the University of New Brunswick, collected feather samples from breeding adults and will use genetic analysis to look at puffin dispersal between islands in the North Atlantic. Both students were involved in all data collection duties in addition to their Masters projects.

Alcids

The crew arrived on MSI on May 11, concurrent with the start of the alcid breeding season. Date of peak egg-laying for puffins was May 17, and razorbill breeding began slightly earlier, with peak lay date occurring May 14. (** Note that in the study's first year, 1995, puffins laid 18 days earlier than razorbills*). For both species, this is a week earlier than the start of the 2015 breeding season. We conducted a puffin census June 10-11. The extrapolated findings suggest between 5400 and 6100 pairs breeding, a 10% increase from 2015. This increase was apparent in the number of puffins seen loafing on the island during the day, and the increase in resights recorded this season, as compared to 2015. We conducted a razorbill census June 9, and results suggest about 2825 RAZO breeding pairs, 14% less than the 3290 in 2015. The decrease is focused on the most densely-populated area in the southwest part of the island. Early in the season gull predation of eggs was pronounced; we tallied over 100 depredated razorbill eggs this season, and this probably accounts for some of the decline in active nests. Razorbills had a hatch success of 0.55 and nest success of 0.41 this season, down 10% and 8% respectively from the average of the last 5 years and well below the long-term means of 0.71 and 0.54.

Both puffin and razorbill adults were seen loafing on the colony in large numbers this year, and we re-sighted 484 puffin and 238 razorbill. These included a number of razorbills banded as fledglings in 2014 on MSI, return to the colony to prospect. In late June, we re-sighted 3 prospecting puffins, all banded as fledgers on Matinicus Rock between 2011- 2013. It will be exciting to see if they recruit successfully to the MSI breeding population. We also retrieved the majority of geo-logger tags deployed in 2015 on puffins (77% retrieved) and razorbills (88%). One of the puffin tags had been deployed in 2014, so logging 2 years of data!



Figure 2. Geolocator tag attached to colour band on a puffin.

Hake, stickleback, gadoids, euphausiids and squid were abundant during early chick rearing. In 2015 the alcid diet was dominated by sandlance throughout the season, including large amounts of larval sandlance; this year larval sandlance was seen infrequently, and adult sandlance were brought in primarily by razorbills. Hake, 7-10 cm in length, dominated alcid bill-loads during the first part of the season. In July hake began to disappear from alcid diets, and those that were brought in were considerably smaller (~3 cm). As hake became less abundant, razorbill chick feeding frequency dropped precipitously; we completed just 10 fewer hours of feeding watch for razorbill this season (61 hours), but had >750 fewer prey items recorded. We observed attempted kleptoparasitism of puffin bill-loads by razorbills throughout the season, more frequently in July.



Figure 3. Razorbill egg in a former puffin burrow; razorbills are increasingly taking over puffin burrows.

Razorbill chicks require half the time of puffin chicks to reach fledge age, and were less affected by this decline in prey. However, there was increased fledging success for those razorbills who began breeding in the early part of the season, compared to those that began later.

Most puffin chicks were only mid-way through their growth when the diet shift occurred, and development was severely affected. In July, the puffin chick diet was largely euphausiids, and small hake and stickleback. There was also an increase in butterfish and squid being brought to the colony. The majority of puffin chicks grew at an alarmingly slow pace, and most consistently lost weight throughout the month of July. The average growth rate for puffin chicks this season was 1.8 g/day, the lowest ever recorded at MSI (21-yr mean is 6.2g/d). We

witnessed unprecedented levels of puffling mortality

throughout the colony, and few chicks reached adequate weight or size for successful fledging; mean fledging mass was 191g, compared with the 21-yr mean of 280 and a previous lowest of 218 (in 2013). There was also a high instance of tick infestations on puffin chicks this season, and in 15 of our monitored burrows ticks were removed from chicks at least once, many with recurring infestations. ***Overall this was a disastrous breeding season for puffins.***



Figure 4. Chilly banding session: Heather, Angelika and Marla, May.

The common murres nesting on MSI continue to increase in number and area occupied, including 22 large ‘caves’ and many individual burrows within the razorbill colony. We estimate 350-500 breeding pairs present this season, and ~400 chicks hatched. There was intense depredation of murre eggs by gulls and ravens in May and early June, but there was a second wave of nesting, and murre chicks continued fledging through the entire month of July. The murres were not greatly affected by the prey shift that occurred, probably because hake made up a very small portion of their chick provisioning, and they are more adept at catching larger prey. We resighted on 10 banded murres this season; all had been banded on MSI, 4 between 2005-2007, and 6 in 2013. We banded 5 adult and 50 fledgling murres, and were lucky enough to see many of the banded fledgers heading out to sea.

Table 1. Breeding Success of alcids on MSI in 2016

	Monitored Burrows	Mean Lay	Mean Hatch	Burrow Occupancy	Hatching Success (hatch/ active nest)	Nest Success (fledge/ active nest)	Linear Growth Rate (mass)
ATPU	87	May 17	June 26	0.79	0.71	0.12	1.8
RAZO	85	May 14	June 18	0.75	0.55	0.41	4.34

Table 2. Diet (% by number, not biomass) for ATPU and RAZO on MSI

	n	Herring	Hake	Euphausiid	Butterfish	Sandlance	Larval	Other
ATPU	1053	1.2	55.3	15	4.8	12.1	1.1	10.4
RAZO	339	16.5	52.8	2.9	0.3	13.3	9.4	4.7

*Does not include unidentified prey items

Table 3. Diet (% by number, not biomass) for COMU on MSI

	n	Herring	Hake	Gadoid	Butterfish	Squid	Rock Gunnel	Other
COMU	175	30.3	7.4	13	14.3	19.4	13.1	2.4

*Does not include unidentified prey items

Terns

Terns breeding on MSI had a successful season, fledging chicks for the third successive year since the colony collapse in 2006. We monitored 54 Arctic tern nests located throughout the core of the island, including two fenced plots. We estimate that island-wide there were ~175 nests. In addition to our monitored nests, about 50 nests were counted on the rocky island perimeter, many of which produced chicks. This is an encouraging sign that lethal gull control is working, and that in the future the tern colony may once again encompass the whole island.

The first tern egg was encountered May 26, and mean lay date was June 3. There were 6 eggs depredated in early June, but then no other egg predation until mid-July. Mean hatch date was June 24, and hatching success was 0.68 (the highest since 2004 – see Table 2, below). We had a noticeable increase in abandoned eggs this season, making up about ~20 of our monitored nests. In July, wet weather and declining prey availability resulted in the loss of the majority of the ‘B’ chicks in our productivity plots. However, the remaining chicks did well, with 27 monitored nests raising 1 chick to fledge, and 3 monitored nests raising 2 chicks to fledge. The fledge success for monitored productivity nests this season was 0.55 fledge/nest. This is lower than 2015, but still better than any other year since 2003. We estimate ~50 Arctic tern fledgers island-wide. This season we re-sighted 5 prospecting Arctic terns, all banded at EER, PMI, MR or SINWR between 2013 and 2014. (** This signifies that birds from other islands in the metapopulation are prospecting MSI for breeding sites!*) Perhaps most exciting was an observation of one banded as a fledgling at MSI in 2014 - the first successful fledgling at this colony since the colony collapse in 2006.

The proportions of common and Arctic terns was 94% Arctic and 6% common, and common tern presence was more conspicuous than in 2015. We noted at least 7 active common tern nests; five of these were within 10 m of one observation blind, all successfully hatching chicks, and at least 1 raising a chick to fledge. Late in the season, common tern adults were seen prospecting island-wide.

We completed 24 hours of common tern feeding watches on 3 nests (using video cameras), and 63 hours of Arctic tern feeding watches on 7 total nests in two separate plots. Both tern species relied heavily on hake; Arctic tern provisioning included krill (euphausiids) and larval fish, while common tern diets were supplemented with herring and stickleback.

Throughout July, insects, primarily moths and dragonflies, made up much of the chick diet for both species.

Table 4. Estimated Number of Arctic Tern Nests on MSI (formal census in 2014 only)

2010	2011	2012	2013	2014	2015	2016
175	75	50	90	187	150	175

Table 5. Breeding Success of ARTE on MSI in 2004, 2005, 2014, 2015, 2016

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
2015	51	1.69 (0.55)	0.56	0.72	0.66	0.66
2016	54	1.52 (.60)	0.68	0.55	0.46	0.44

Table 6. Diet (% by number, not biomass) for terns on MSI

	n	Herring	Hake	Euphausiid	Insect/Moth	Larval fish	Stickleback	Other
ARTE	277	0.4	42	32	4	9.4	3.2	9
COTE	35	9	51	0	17	0	9	14

*Does not include unidentified prey items; COTE feeds from video footage

Other Projects

Angelika's Masters project required puffins of known age - individuals first captured and banded as fledglers here on MSI. To meet these requirements, we captured many breeding puffins from burrows that are not monitored as part of our seasonal productivity study. This put us in contact with individuals that have not often been encountered since their first capture, which was quite exciting! Many of these puffins had not been recorded in over 10 years, yet they presumably have been breeding here on MSI for almost a decade! It was a great opportunity to increase our understanding of the puffin demographics on MSI.

For Lucy Smith's project we collected feather samples from 50 breeding puffins, both those involved in our annual productivity study and from random burrows across the colony and captured in mist-nets during prey sampling activities. The majority of these individuals were previously unbanded, or banded as adults, and so are of unknown origin. Her results will provide us with a better understanding of the post-natal dispersal of puffins in the North Atlantic.

During the last week of June, Danielle Fife from Acadia University collected blood and feather samples from the primary species breeding on MSI, including Leach's storm-petrels, common eiders, Atlantic puffins, razorbills and common murre.

Predator Control

Non-lethal gull control was continued this year, using paintball guns and hazing of loafing individuals. Lethal gull control was again conducted by a contracted predator control specialist on June 10. A total of 6 adults were removed, 5 herring gull and 1 great black-back gull. All individuals removed were known nest predators, and we did not have to conduct any additional rounds of lethal gull control. Tern nests were not heavily depredated initially, as gulls seemed focused on taking razorbill and murre eggs, but in July we estimate 8 tern chicks were depredated from productivity nests. Tern egg predation rate was 10%, down from 14% in 2014-2015.

Gull Rock, the adjacent island home to a persistent breeding colony of herring and great black-backed gulls, was visited twice during the season, June 11 and July 5. A total of 17 gull nests, 16 herring and 1 great black-backed, were found and destroyed by shaking and poking eggs. No gull nests were found on MSI this year.

Other Species

Northern gannets were present on MSI throughout the season, constructing nests in 2 separate locations. At least 3 pairs were seen nest building, courting and copulating on a ledge at the southwest corner of the island, though none of these nests were active. Another pair constructed a nest within 15 m of an observation blind, within the razorbill colony, and laid an egg on June 15. The pair continued to add nesting material and incubate for the next several days, but both were prone to abandon the nest unprovoked, leaving the egg unattended. Though many steps were taken to avoid disturbing them, the egg disappeared on June 20 presumably depredated by a gull. This nest site was abandoned after June 20, but gannets continued to occupy the SW edge until late July.

The high count of adult common eiders this season was 186 (126 males, 130 females), and 39 ducklings. We banded 5 females and encountered 20 active nests on MSI and 2 on Gull Rock. Ducklings were first seen during the second week of June, and were seen into August; we estimate that at least 5 successfully fledged.

There were many Leach's storm-petrels breeding on MSI this season, and we conducted banding of both adults and chicks. We recaptured some individuals that had been part of the 2015 geo-logger tagging study, including 1 bird with the tag still attached! We successfully removed the tag and collected the data. (**This bird provided the first information ever on where our LHSP go in the winter; in the tropical Atlantic off West Africa, in the Canary Current*). In August, we located storm-petrel burrows throughout the island, recapturing 5 adults, and newly banding 16 adults and 26 chicks.

In June an ancient murrelet, *Synthliboramphus antiquus* was photographed just offshore



of MSI by a passenger on a tourist boat. This is an extremely rare and unusual species in the North Atlantic, and the first record for both New Brunswick and Maine.

Figure 5. Successful puffin wrangling by Heather! Photo by Tony Einfeld.