

Recent Projects by Members of the Atlantic Marine Bird Cooperative December 2018



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At-Sea Surveys

The Northwest Atlantic Seabird Catalog

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With the goal of conducting research and informing coastal and offshore planning activities, collaborators from the Bureau of Ocean Energy Management, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey compiled available information from data sets on seabird observations in the Northwest Atlantic into a single database. The resulting product is the Northwest Atlantic Seabird Catalog (formerly the Atlantic Offshore Seabird Compendium), which characterizes the survey effort and bird observations that have been collected across space and time. While our primary objective is to aggregate seabird data, these data additionally include marine mammal, sea turtle, fish, bat, bug, boat, marine debris, and other observations at sea. The seabird catalog includes over 700,000 observations that were recorded over several decades. If you need data we might have it, and if you have data we might want it! For more information please visit our GitHub repository (<https://github.com/USFWS/AMAPPS/tree/master/NWASC>) or watch our presentation on YouTube (<https://youtu.be/6GWptGkFiWg>).

Pelagic seabird surveys in Atlantic Canada

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The Canadian Wildlife Service (CWS) has been conducting pelagic seabird surveys since 2006 to quantify abundance and distribution of birds at sea in Atlantic Canada. The surveys are conducted from both ships and aircraft, and effort extends from the eastern Canadian Arctic to the Gulf of Maine and east across the North Atlantic. The data are used to help understand the threats faced by birds at sea and help define areas for marine protection. Current projects include quantifying the risks of offshore oil and gas activities, defining conflict areas between birds and fishing activity, defining bird vulnerability to increased levels of shipping through Canada's Arctic, and supporting protected area planning throughout the region.

2018 AMAPPS Shipboard Surveys – Seabirds

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Seven shipboard surveys were completed in 2018 during Ecosystem Monitoring Surveys (EcoMon), a beaked whale survey, and NOAA Ship transits (Table 1). Cruises sampled regions from the Gulf of Maine to the Gulf of Mexico (Figure 1). A total of 10,711 sightings of birds and other marine megafauna were recorded in the survey zone and 18,021 in total. The majority of sea bird species for each cruise varied by survey season and region and was dominated by Storm-Petrels and Shearwaters. Wilson's Storm-Petrels (*Oceanites oceanicus*), Great Shearwaters (*Puffinus gravis*), and Sooty Shearwaters (*Ardenna grisea*) were most frequently sighted birds on the spring (HB1803) and summer (GU1804) EcoMon surveys of the Northeast US Shelf and the transit north from Key West, Florida, to Newport, Rhode Island, (GU18TN). Greater Shearwaters, Wilson's Storm-Petrels, and Leach's Storm-Petrels (*Oceanodroma leucorhoa*) were the most abundant species sighted on the beaked whale survey (GU1803) off the shelf of Georges Bank. Wilson's Storm-Petrel and Sooty Tern (*Onychoprion fuscatus*) were the most abundant birds on the transit from Miami, Florida to Newport, Rhode Island (HB18TN), which included a track into and out of the Tongue of the Ocean off the Bahamas. Observers also counted 117 endangered Black-

capped Petrels (*Pterodroma hasitata*) on the offshore transit between South Carolina to North Carolina. Dominant species shifted on the Northeast US Shelf in the fall. Northern Gannets (*Morus bassanus*) and Bonaparte’s Gulls (*Chroicocephalus Philadelphia*) were the most abundant on the fall EcoMon (S11802). Finally, the transit from Norfolk, Virginia, to Pascagoula, Mississippi, (GU18TS) through the Gulf of Mexico had a different bird community that was dominated by sightings of Black Terns (*Chlidonias niger*), Royal Terns (*Thalasseus maximus*), Cory’s Shearwater (*Calonectris diomedea*), and Sooty Tern.

Table 1. A summary of 2018 NEFSC AMAPPS Shipboard Surveys on which observers sailed with the primary goal of conducting seabird surveys to collect abundance and distribution data and the secondary goal to collect abundance and distribution data for other marine megafauna including marine mammals, sea turtles, sharks, and other large pelagic fishes. Number of sightings (no.) within the 300-m survey zone and total include birds and megafauna.

Cruise	Program	Start Date	End Date	Duration (days)	Sightings (no.)	
					Survey Zone	Total
HB1803	Ecosystem Monitoring	23-May	04-Jun	13	3026	5472
GU18TN	NOAA Ship transit	11-Jul	16-Jul	6	1094	1666
GU1803	Beaked Whale survey	21-Jul	18-Aug	13	1111	1214
HB18TN	NOAA Ship transit	01-Aug	06-Aug	6	665	2651
GU1804	Ecosystem Monitoring	22-Aug	30-Aug	9	1459	2267
GU18TS	NOAA Ship transit	02-Sep	09-Sep	8	838	1246
S11802	Ecosystem Monitoring	01-Nov	12-Nov	10	2518	3505

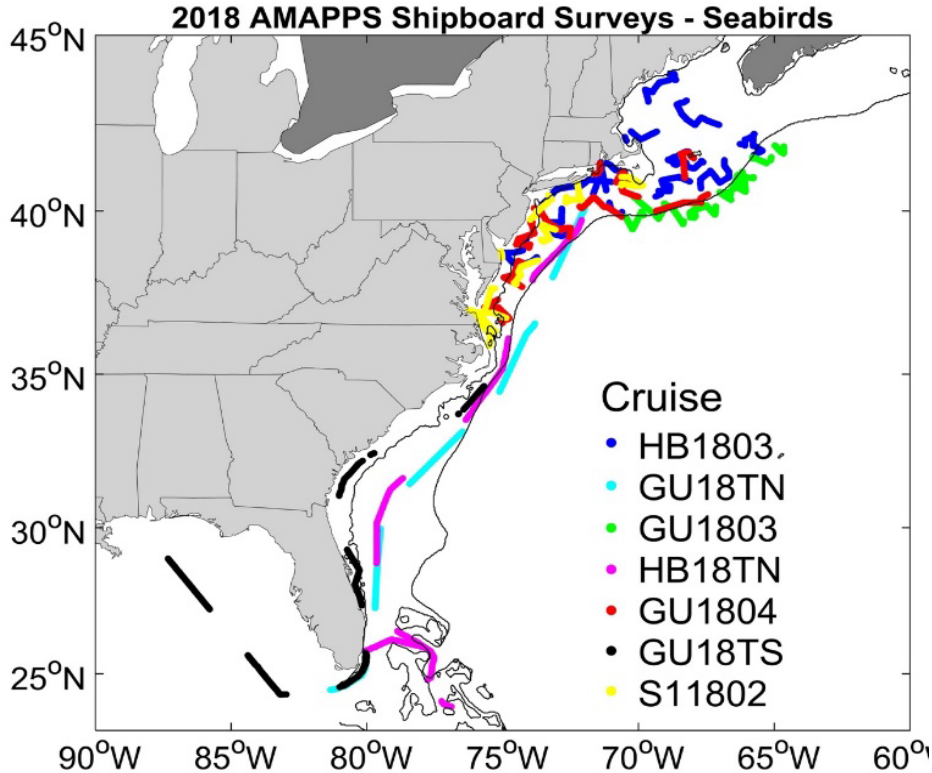


Figure 1. A summary of 2018 NEFSC AMAPPS Shipboard survey tracks.

Stellwagen Bank National Marine Sanctuary Research and Monitoring: Volunteer Contributions

Contact: Anne-Marie Runfola, Stellwagen bank NMS, Anne-Marie.Runfola@noaa.gov

In FY18, volunteers contributed 6,620 hours in support of our science and research mission at the sanctuary.

Stellwagen Sanctuary Seabird Stewards (S4):

Anne-Marie Runfola organized five standardized seabird data collection cruises on the R/V *Auk*, and 32 collection trips on whale watch vessels. 62 volunteers and the Director of Important Bird Areas at Mass Audubon, Wayne Petersen, joined our staff to record 40,000 sightings this year (wildlife, vessels and marine debris), for a program total of more than 250,000 sightings since the 2011 pilot program.

Kevin Powers (volunteer, consultant) worked with Mike Thompson, Dave Wiley, Anne-Marie and the S4 interns to create an effort correction system, and the team has effort corrected 2012-2017 data. Kevin created an annual report template for us to use, and we'll publish a report by Spring 2019. The S4 data has been incorporated into the sanctuary's Condition Report to help determine sanctuary biodiversity, species richness, state of the birds and future trends. The Condition Report will be made available to AMBCC as soon as it's completed.

Last year, Mass Audubon honored SBNMS as Heroes in their 2017 State of the Birds report for the S4 program and other sanctuary work in research, policy, management and education/outreach: Page 33 text attached in email:

https://www.massaudubon.org/content/download/21633/304821/file/mass-audubon_state-of-the-birds-2017-report.pdf

Earth Is Blue magazine just featured the S4 program for the third year in a row, including a tribute to Kevin Powers as the Stellwagen and the National volunteer of the year for the Office of National Marine Sanctuaries. 2016 and 2017 magazines can be found here: <https://sanctuaries.noaa.gov/magazine/> 2018 not uploaded yet.

Other Research Support:

Volunteers helped support 30 other cruises in FY18 (shearwater tagging, whale tagging, sand lance sampling), offering skills such as photography, wildlife observation, and data collection.

Atlantic Marine Assessment Program for Protected Species

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The Atlantic Marine Assessment Program for Protected Species (AMAPPS) is a long-term research and monitoring program designed to improve baseline knowledge regarding the distribution and abundance of seabirds, marine mammals, and sea turtles. BOEM, NOAA, and the U.S. Fish Wildlife Service actively conduct seasonal at-sea surveys, both on-shelf and off-shelf, to examine coastal and pelagic seabird communities. Since 2017, the FWS and BOEM completed three low-level AMAPPS aerial surveys, all of which were conducted from Maine to Florida in summer and fall. NOAA and BOEM collected fine-scale seabird distribution and abundance data from ships-of-opportunity, namely on NOAA's Ecological Monitoring Surveys, and Protected Species Surveys. Four of these were conducted in 2017 (spring and summer) and six in 2018 (spring, summer, fall).

Starting in February 2018, BOEM and Normandeau Associates used high fixed-winged aircraft to conduct three photogrammetry surveys of seabirds in the South Atlantic Bight. Some of the imagery

collected for this project will train computer vision algorithms to automate detection and classification of seabirds at sea.

A final project report that summarizes AMAPPS findings from data collected between 2010-2014 is available

at: <https://www.boem.gov/espis/5/5638.pdf>; <https://www.boem.gov/espis/5/5639.pdf>; <https://www.boem.gov/espis/5/5640.pdf>

High Resolution Aerial Baseline Surveys of Marine Wildlife in the New York Offshore Planning Area

Contact: Julia Willmott, Normandeau Associates, jwillmott@normandeau.com

Normandeau in collaboration with APEM is performing a three-year survey effort is collecting spatial data using high-resolution digital aerial surveys of wildlife (birds, marine mammals, sea turtles, sharks, rays, large bony fish and fish shoals) in the New York Offshore Planning Area (OPA), from the south shore of Long Island to the continental shelf break. The approximate size of this area is 12,650 square nautical miles and includes state and federal waters. With four seasonal surveys per year, these surveys became the world's largest aerial digital survey effort in the offshore environment. The ultra-high resolution aerial digital surveys are designed to capture seasonal variations in wildlife distributions for three consecutive years. Targets within images are identified to the lowest possible taxonomic group and georeferenced. The objectives are to provide information to support the responsible siting of offshore wind projects, and to act as a baseline for monitoring impacts of stressors on wildlife in the OPA. The survey reporting determines the distribution and relative abundance of wildlife and determines the seasonal and inter-annual variability of the distribution.

The <https://remote.normandeau.com> (ReMOTe) data management system is used for this project, which allows input from remote collaborators and facilitates data processing, project monitoring, and visualization for the client through a secured password protected log-in. ReMOTe provides efficient workflow, traceable QA/QC, and provides quality data outputs in a timely manner. As resulting data are to support responsible siting of offshore wind projects, the cloud-based interactive GIS visualization tools on ReMOTe provided for client view, and to a lesser extent public view, includes toggle on and off buttons to view distributions by season, species, flight height, and species associations with bathymetry.

High Resolution Aerial Ecological Baseline Studies of the U.S. Outer Continental Shelf, North Carolina and South Carolina

Contact: Julia Willmott, Normandeau Associates, jwillmott@normandeau.com

Normandeau in collaboration with APEM is collecting information using ultra-high resolution digital imagery along the North Carolina and South Carolina coast line, and includes more detailed survey of four wind energy areas defined by the Bureau of Ocean Energy Management. The area covers approximately 11,000 square nautical miles and the surveys record the presence of marine mammals, turtles, birds, cartilaginous fish, large bony fish, boats and other structures, location of sargassum and weed mats, and fish shoals. The ultra-high aerial digital surveys are designed to capture the seasonal variations in wildlife distributions for two consecutive years. Targets in images are identified to the lowest possible taxonomic group and georeferenced. The objectives are to provide information to support the responsible siting of offshore wind projects, and to act as a baseline for monitoring impacts of stressors on wildlife around the North and South Carolina coastline. The survey reporting determines the distribution and relative abundance of wildlife and determines the seasonal and inter-annual variability of the distribution.

The <https://remote.normandeau.com> (ReMOTe) data management system is used for this project, which allows input from remote collaborators and facilitates data processing, project monitoring, and visualization for the client through a secured password protected log-in. ReMOTe provides efficient workflow, traceable QA/QC,

and provides quality data outputs in a timely manner. As resulting data are to support responsible siting of offshore wind projects, the cloud-based interactive GIS visualization tools on ReMOTe provided for client view, and to a lesser extent public view, includes toggle on and off buttons to view distributions by season, species, flight height, and species associations with bathymetry.

Integrative Statistical Modeling and Predictive Mapping of Seabird Distribution and Abundance on the Atlantic Outer Continental Shelf

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In 2018, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Coastal Ocean Science (NCCOS) completed a project mapping the spatial distributions of marine bird species in U.S. Atlantic Outer Continental Shelf waters that can be used to inform marine spatial planning in the region. The project was funded by the US Department of the Interior, Bureau of Ocean Energy Management (BOEM) through Inter-Agency Agreement Number M13PG00005 with the US Department of Commerce, NOAA, National Ocean Service, NCCOS. The project analyzed sighting data spanning nearly four decades (1978-2016) from the ‘Northwest Atlantic Seabird Catalog’, a database of at-sea visual and photographic sighting data maintained by the U.S. Fish and Wildlife Service, along with sighting data from the Canadian Wildlife Service, Environment and Climate Change Canada. A spatial predictive modeling framework was applied to translate the sighting data into comprehensive seasonal maps of the spatial distributions of birds. In brief, the sighting data were related to a wide range of environmental predictor variables, and comprehensive data on those environmental variables were then used to predict the relative density of birds across the project study area. A ‘climatological’ approach was taken whereby long-term average environmental patterns were used to predict long-term distributions of birds integrated across the range of years of sighting data. A total of 47 marine bird species and 140 species-season combinations were modeled. The final project report is available at https://coastalscience.noaa.gov/data_reports/modeling-at-sea-density-of-marine-birds-to-support-atlantic-marine-renewable-energy-planning-final-report/, and the final maps have been incorporated in the Northeast and Mid-Atlantic regional ocean data portals.

Gulf of Mexico Marine Assessment Program for Protected Species

Contacts:

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Ship-base surveys: Jeff Gleason, USFWS Gulf Restoration Office, jeffrey_gleason@fws.gov

Collaborators: **Aerial surveys:** Randy Wilson, USFWS; Jim Lyons, USGS; Emily Silverman, USFWS; Allison Sussman, USGS; Elise Zipkin, Michigan State University; Kayla Davis, Michigan State University. **Ship-based surveys:** Jeff Gleason, USFWS; Patrick Jodice, USGS - SC CFWRU; Chris Haney, Terra Mar Applied Sciences LLC; Pamela Michael, SC CFWRU– Clemson University; Yvan Satgé, SC CFWRU – Clemson University.

Despite the importance of the Gulf of Mexico for marine species, there is limited information available to quantify species-use in the region. To bridge this gap, the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS), was developed as a federal partnership between the Bureau of Ocean Energy Management, the U.S. Fish and Wildlife Service, the U.S. Geological Survey, and the National Oceanic and Atmospheric Administration. For seabirds, ship-based and aerial surveys are being

used. To date, beginning in April 2017, ~165d of ship-based surveys were conducted on 13 pelagic cruises in the northern Gulf of Mexico. Using standard, transect-based methodology ~5,700 detections of 36 seabird species were amassed, totaling ~25,000 seabirds. Preliminary results indicated high numbers of non-breeding Black Terns (*Chlidonias niger*) in the Mississippi River delta and Western Gulf habitat for up to 8mo of the year; a widespread presence of Brown Booby (*Sula leucogaster*), a tropical species commonly associated with coastal environments, in pelagic waters; an extended presence of European-breeding Band-rumped Storm-petrel (*Oceanodroma castro*) in US waters from March to September; and the regular occurrence of Black-capped Petrel (*Pterodroma hasitata*). Ship-based vessel surveys will continue through calendar year 2019, and possibly into spring of 2020 pending funding availability. Low-level (200' ASL) aerial surveys covering the coastal 50nm were conducted from the USA-Mexico border to Key West, FL including the Dry Tortugas during February 2018 and July 2018. 180 EPA-40km² hexagons were randomly selected by generalized random tessellation stratified sampling. For each hexagon, a random flight direction was selected, thus defining two additional, adjacent hexagons and creating a three-hexagon sampling unit. Using a double-observer protocol and three observers collected data along 3 parallel 10nm transects spaced 1nm apart or 30nm of transect were flown per sample unit. Preliminary results indicated no apparent detection bias based on observer or seat location, though flock size estimation differed between observers in the front and rear seats. In winter, detections were dominated by gulls and Northern Gannets (*Morus bassanus*) offshore and waterfowl (e.g., mergansers) and Common Loons (*Gavia immer*) nearshore, whereas in summer several true pelagic species were observed near the outer continental shelf (e.g., shearwaters and storm-petrels) while gulls, terns, and Brown Pelicans (*Pelecanus occidentalis*) dominated the nearshore environment.

Colony Management and Monitoring

Seabird Monitoring Efforts at White and Seavey Islands, NH

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In 2018 Shoals Marine Lab piloted a small-scale study to evaluate habitat management options on the White and Seavey Island tern colony in the Gulf of Maine. We evaluated effects of the pre-breeding application of seawater, extra-saline seawater, and artificial turf on habitat quality/heterogeneity and tern occupancy. Analysis of data is currently underway, and will inform expanded 2019 habitat management plans.

Seabird Colony Registry and Atlas for the Southeastern United States

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The most recent atlas of seabird nesting colonies for the eastern U.S. was published in 1978 (Osborn and Custer, 1978) and up-to-date information was required by state and federal biologists to efficiently manage seabird species in the region. We created a *Seabird Colony Registry and Atlas of the Southeastern United States* to compile the locations and attributes of seabird colonies along the coasts of South Carolina, Georgia, and northeast Florida for 2003-2017. Primarily intended for use by local, state, and federal resource manager, the purpose of the Registry and Atlas is to provide an updated and integrated regional repository for seabird data, including a spatial inventory. The Registry and Atlas will aid in the development of regional conservation and management plans, and can be used to evaluate important bird use areas. Following the occurrence of a natural or anthropogenic stressor, such as a pollution event or

hurricane, this product may serve as a reference for response teams. The Registry and Atlas also may support the selection of study sites for research or the development of long-term monitoring plans.

Reference: Ferguson, L.M., Y.G. Satgé, J. Tavano, and P.G.R. Jodice. 2018. Seabird colony registry and atlas for the Southeastern United States. Final Report for U.S. Fish and Wildlife Service. South Carolina Cooperative Fish and Wildlife Research Unit, Clemson, South Carolina.

Seabird Colony Monitoring and Management in the Gulf of Maine

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The National Audubon Society's Seabird Restoration Program (NAS-SRP) continued long-term monitoring of breeding seabird populations in the Gulf of Maine, focusing on diet studies, productivity, growth, and populations of Common, Arctic, and Roseate Terns (*Sterna hirundo*, *S. paradisaea*, *S. dougallii*), Atlantic Puffins (*Fratercula arctica*), Razorbills (*Alca torda*), Black Guillemots (*Cepphus grylle*), and Leach's Storm-petrels (*Oceanodroma leucorhoa*). NAS-SRP's long-term work is supported by partners including the U.S. Fish and Wildlife Service's Maine Coastal Islands National Wildlife Refuge (Brian Benedict and Linda Welch) and Maine Department of Inland Fisheries and Wildlife (Brad Allen). Don Lyons joined the NAS-SRP team as Director of Conservation Science in August 2018. In 2018, a 'marine heat wave' occurred in the Gulf of Maine during the latter half of July and first half of August, with daily mean sea surface temperatures sometimes exceeding the long term average by >4°C. This thermal event apparently had significant impacts on the distribution and potentially the abundance of forage fish in the Gulf, as indicated by dramatic declines in seabird chick feeding rates and chick growth. Tern nesting was heavily impacted. Puffin chick growth slowed considerably during the thermal event and many chicks died, but those that survived received ample feedings during a return to more moderate conditions in later August and many ultimately fledged.

Seabird Monitoring Efforts at Machias Seal Island, New Brunswick

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At Machias Seal Island (MSI), 2018 marked the 24th consecutive year of research and monitoring of the seabird community. Graduate students, Mark Dodds and Mark Baran, continued their MSc thesis related research on alcid movements by retrieving 15 (Razorbill) and 19 (Atlantic Puffin) GLS tags deployed in 2017. Breeding success of puffins was down considerably from 2017 and below our long-term average. Razorbill breeding success remained similar to previous years. Arctic terns had another successful season and fledged chicks for the fifth consecutive year since the colony collapse in 2006. We completed our second year of monitoring leach's storm-petrels and monitored 48 burrows. We depart MSI before the petrels fledge, thus only have adequate data to calculate hatching success, which was 71% in 2018. Stephanie Symons defended her MSc thesis on GPS-tracking of razorbills and puffins and is now working for the New Brunswick government; one paper from her thesis is currently in revision. Lauren Scopel is completing her PhD thesis and has submitted a paper with Tony, Steve Kress and Paula Shannon on differing responses of seabirds (throughout the Gulf of Maine) to the changing prey community.

Common Eider Duckling Survival Study

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Dan McAuley, USGS, Dmcauley@usgs.gov

In 2016, we conducted a common eider duckling survival pilot study at a breeding colony in Casco Bay, Maine. We assessed methodologies used to mark female eiders with nasal disks and VHF radio transmitters (n=50) and began to collect baseline data on the extent of brooding areas, detection of marked hens, and duckling survival. Due to funding limitations in 2017, we only performed a capture effort to mark hens with nasal discs designed for long-term retention in order increase our sample size (n=33) of marking locally breeding hens for future identification and brood tracking. In 2018, we continued to nasal mark (n=34) and track hens with VHF radios (n=23) to collect baseline duckling survival data. Each week from capture through mid-August, we performed boat-based surveys to locate marked hens, determine weekly status (i.e., nesting, loafing, brooding), count ducklings from marked and un-marked broods, and estimate the number of fledged ducklings. Duckling survival rates appear low, 22% in 2016 and 14% in 2018. In 2019, we hope to continue the study in order to collect three years of duckling survival data and assess overall duckling survival. Project investigators: U.S. Fish and Wildlife Service, Biodiversity Research Institute, Maine Department of Inland Fisheries and Wildlife, USGS Patuxent Wildlife Research Center.

Colonial Waterbird Management and Monitoring in North Carolina

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In North Carolina, the NC Wildlife Resources Commission leads a multi-partner effort to manage and monitor colonial waterbirds (as well as nesting shorebirds) in the state. Approximately 84-94 sites are posted annually against trespass by 13-15 partner agencies and organizations.

At most sites, little or no productivity monitoring is conducted, with exceptions being at the south end of Wrightsville Beach and Lea-Hutaff Island where Audubon North Carolina tracks productivity for Common Terns, Least Terns, and Black Skimmers (as well as plovers and oystercatchers). Audubon North Carolina also bands Black Skimmer chicks. Vegetation management to benefit Royal and Sandwich Terns, among others, takes place at two dredge islands on the Cape Fear River with a combination of fire and herbicide treatments as needed. Audubon North Carolina conducts ISS-type surveys at four inlets in southeastern North Carolina and includes in these surveys counts of all bird species, including AMBC focal species.

Two student research projects from the Ray Danner Lab in UNC-Wilmington's Department of Biology and Marine Biology were also conducted this year at Lea-Hutaff Island. Laura Schaale used a drone to map the thermal landscape of a beach colony site and investigated how temperature affects Least Tern nest site selection and success. *Rebekkah Leigh LaBlue investigated how differential egg patterning in Least Terns contributes to individual heat gain and hatching success and the color-mediated tradeoff between heat gain and camouflage.*

Through the partnership of site managers, independent researcher John Weske bands most Royal Tern and Sandwich Tern chicks fledged in the state, as well as a smaller proportion of Brown Pelicans. His banding work in North Carolina has been ongoing since the 1970s.

An evaluation of long-term tern productivity trends on the Maine Coastal Island National Wildlife Refuge in the Gulf of Maine

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USFWS, Maine Coastal Islands NWR, and National Audubon Society, Project Puffin, have been monitoring Common and Arctic tern productivity rates on 10 islands in the Gulf of Maine (GOM) since 1988. Data are available for three annual productivity metrics (productivity, mean clutch size and fledge success) although timelines vary by location and species, with an average of 21 years of data across all island-species combinations. There is growing concern that tern productivity is declining across the region due to changing environmental and ecological conditions. Rapid warming, shifts in the timing of seasonal transitions, and other environmental conditions have been documented for in Northeast coastal habitats, with a distinct intensification since the early 2000s. These changes have potential ramifications for the timing and availability of forage resources that nesting seabirds rely on during the summer breeding season. This project seeks to investigate if and how trends in productivity for two seabird species of high conservation concern, Common terns (*Sterna hirundo*) and Arctic terns (*S. paradisaea*), have changed over time, whether a regime shift in productivity has occurred, and to evaluate potential underlying mechanisms influencing especially poor or good productivity years.

Seabird Colony Management at Maine Coastal Islands NWR

Contact: Linda Welch, USFWS, Linda_Welch@fws.gov

Maine Coastal Islands NWR has been working for the past 35 years to restore, manage, and monitor colonial nesting seabirds along the coast of Maine. The Refuge owns over 60 seabird nesting islands, and actively manages six islands for nesting common, Arctic, and roseate terns, Atlantic puffins, razorbills, common murrelets, black guillemots, Leach's storm-petrels, common eider, and laughing gulls. We have a long history of cooperatively managing several of the islands with National Audubon Society. We monitor productivity and chick growth rates, diet composition and feeding rates, conduct metapopulation research on puffins and Arctic terns. Management efforts focus on predator control and habitat enhancement. Recently our research efforts have focused on trying to understand how the climate change driven changes in the Gulf of Maine are influencing seabird fitness and productivity.

Seabird Tracking Studies

Tracking Great Black-backed Gulls with GPS Loggers on Appledore Island, NH

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Long term sub-colony census data show marked declines in the breeding populations of herring and great black-backed gulls on Appledore Island in the southern Gulf of Maine. The past few years, however, both census data and whole island counts of all nests indicate an apparent stabilization of the populations, despite inter-year variation. This year, we placed GPS data loggers on five Great Black-backed Gulls. The birds chosen already had bands, but had not been sighted anywhere but at the breeding colony, so we had no data on their travels beyond Appledore. Preliminary data collected from the loggers indicate that some of these rarely seen birds are foraging primarily at sea, but others are visiting terrestrial sites like landfills or mudflats. We look forward to next year when the birds return to Appledore and we find out if their

foraging behavior is similarly consistent for these individuals over the winter. We also plan to look at AIS data to try and determine whether at-sea foraging birds are mainly fishing for themselves, or are following vessels for scraps.

We also are at work on analyzing the social interactions in the colony, specifically the question of pair bonding and divorce, as well as extended parental care of fledglings--something our banding resight data has given us an intriguing glimpse into.

Spatial and Reproductive Ecology of Brown Pelicans in the Gulf of Mexico

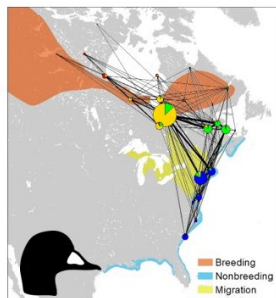
Contact: Patrick Jodice, USGS - South Carolina Cooperative Fish & Wildlife Research Unit, pjodice@clermson.edu

Brown Pelicans (*Pelecanus occidentalis*) in the southeastern United States constitute a valuable study population for investigating coastal ecological systems. To resolve information gaps for the species in the Atlantic Bight, PhD student Bradley Wilkinson is tracking 45 adult pelicans with satellite transmitters breeding at four colonies in South Carolina. In addition to habitat use patterns, both natural and anthropogenic disturbances will also be investigated to provide baseline risk assessments. These include the impacts of large-scale meteorological events such as hurricanes, potential interactions with offshore energy development, oil spill risk assessment modeling, and the magnitude of influence on pelican nestlings posed by the local shrimp trawling fleet. We expect to also deploy transmitters at locations in Georgia and northern Florida.

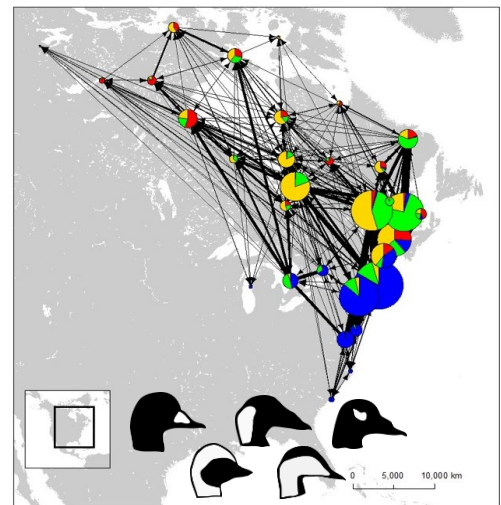
Constructing a migratory network for eastern North American sea ducks

Contact: Dr. Juliet Lamb, University of Rhode Island and Rhode Island DEM; jslamb@uri.edu

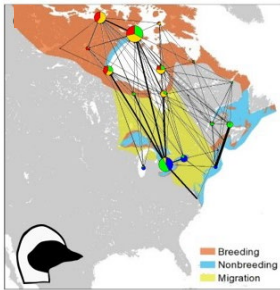
Since 2010, the Atlantic and Great Lake Sea Duck Migration Study (AGLDSMS) has brought together partners from a multi-national group of agencies throughout eastern North America to simultaneously track high-priority sea duck species using satellite transmitters. The data from this study, as well as other tracking efforts, have resulted in over a decade of individual telemetry data on five species—common eider *Somateria mollissima*, black scoter *Melanitta americana*, surf scoter *M. perspicillata*, white-winged scoter *M. deglandi*, and long-tailed duck *Clangula hyemalis*—including over 200,000 locations from 672 individuals. To date, analyses of these tracking data have focused on species-specific and within-season movements; however, the dataset also provides a unique opportunity to examine and compare year-round



movement patterns across multiple sympatric species, and to identify sites with broad conservation importance. We used a network analysis approach to summarize multi-species movement patterns and highlight areas of high conservation value.



Migratory network for five species of sea ducks in the Atlantic and Great Lakes. Colors represent proportional habitat use by season (blue = winter; red = breeding; green = spring staging; yellow = fall migration and molt)



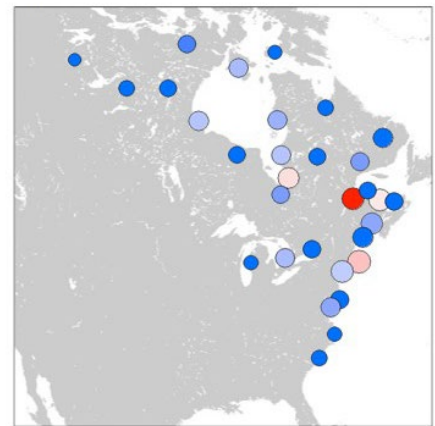
Black scoter (L) and long-tailed duck (R) ranges and migratory networks

Our analyses showed that sea duck populations in eastern North America are highly connected throughout their range. During non-breeding, individuals move widely between sites, with no geographic segregation. The Atlantic and Mississippi flyways function as one large population for all sea duck species except the geographically limited common eider. This suggests the importance of coordinated management across the region, rather than managing species on a flyway-specific basis.

Long-tailed ducks, which migrated further north than other species but not as far west, were the best single-species

representative of overall network connectivity. This suggests that long-tailed ducks could be a good “umbrella species” for monitoring and conservation, since protecting their key habitats is likely to benefit not only this species but a wide range of other sea duck species.

The most important sites for population mixing and habitat connectivity for the full suite of sea duck species were primarily sites used for migration (fall molt and spring staging). These included southeast James Bay, the St. Lawrence River estuary, the Northumberland Strait of New Brunswick, and Nantucket Shoals (which is also a key wintering area for many species).



important, some less important

In the future, we plan to use these telemetry data to analyze how individual species share resources in common habitat areas and identify important landscape features selected by sea ducks during different seasons, to further guide strategies for conserving sea duck habitats and populations in eastern North America.

Tracking Common Terns with Satellite Tags (Petit Manan Island, Maine)

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In June 2017, Maine Coastal Islands NWR, in collaboration with USFWS R5 Migratory Bird Program, BOEM, and the Avian Research and Conservation Institute equipped five incubating common terns with 2 gram solar satellite tags. We used Teflon tape harnesses to attach the tags, and monitored each nest with GoPro cameras to document potential tagging effects. Two of the tagged birds (both females) departed the nesting colony in early August, staged on Cape Cod for several days, and then flew directly to the north shore of Venezuela in six days. The remaining three birds (all males) eventually made their way to Cape Cod where they staged for 4-6 weeks. Two of the terns had close encounters with multiple hurricanes, apparently flying straight through (or over??) Hurricane Maria. These birds also flew to Venezuela, taking 7-10 days to complete the trip. The average distance of the fall migration was 4,430 km. Three transmitters documented wintering areas in Suriname, French Guiana, and the long-term use of Marajo Bay in Brazil. The remaining tagged male continued along the shore of Brazil until it reached Argentina. Unfortunately that transmitter stopped working in late February 2018. The two remaining tagged females left Brazil in early May and took an average of 10 days to return to the breeding colony in Maine. One transmitter remains active as of November 2018 and has documented a second fall migration and continued use of the Marajo Bay region.

Assessing Movements of Nanotagged Birds Near the Block Island Wind Farm: A Validation Study

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James Miller and Gopu Potty, Department of Ocean Engineering, University of Rhode Island, 215 South Ferry Rd. Narragansett, RI 02882

Ramakrishna Janaswamy, Department of Electrical & Computer Engineering, 100 Natural Resources Road, 215-D Marcus Hall, University of Massachusetts, Amherst, MA 0100

From July 2017 - Sept 2019, we will test the ability of digital VHF transmitters to assess fine-scale movements of birds at the 5-turbine Block Island Wind Farm, which is the only active offshore wind energy facility in North America. This BOEM funded study will model macro- and micro-exposure behavior of birds near a wind farm. We have constructed two land-based tracking towers on Block Island, and another tracking array on the eastern-most turbine platform on the wind farm. This will allow us track targets from multiple angles to maximize tracking efficacy. In addition, we will conduct detailed calibration surveys by towing a transmitter at different altitudes along fixed transects near the wind farm to assess model accuracy. Results from this research will provide the first detailed information available on behaviors of terns, plovers, and other birds in North America near an active wind farm. In addition, we will provide the first critical assessment of using land-based and turbine-based tracking arrays to monitor fine-scale movements of birds near offshore wind energy facilities.

Roseate Tern Metapopulation Project

Contact: Dr. Jeff Spendelow, Research Wildlife Biologist, USGS-Patuxent Wildlife Research Center JSpendelow@usgs.gov ; 301-497-5665

For the past 30+ years I've been coordinating cooperative research on the metapopulation dynamics and ecology of the endangered NW Atlantic breeding population of Roseate Terns (ROSTs, *Sterna dougallii*). There have been – and continue to be – many facets to this cooperative research, but the overarching goal of the Cooperative Roseate Tern Metapopulation Project (CRTMP) is to determine what are the major factors that are limiting the recovery and growth of this population. Many cooperators continue to work at breeding sites, but I basically stopped working at colony sites after 2010 and since 2011 have been focused on pursuing Staging Site Studies (SSS), mainly in the “Greater Cape Cod & Islands” area of southeastern Massachusetts (MA). I had a new multi-year PWRC Study Plan entitled “Evaluation of Potential Impacts of Offshore Wind Energy Projects in the Northeastern U.S. on Endangered Roseate Terns: Who is at Risk and When” approved in 2016. This work has involved a rather “low tech” approach, based on resighting colorbanded individuals with 3-character plastic field-readable (PFR) bands to examine temporal and geographic variation in the use of staging sites by ROSTs of different ages and breeding status (e.g., Hatch Year (HY) birds; nonbreeding 1-, 2-, and 3-yr-old adults; failed and successful breeders that are not caring for an HY; and successful breeders that are giving postfledging care to HY ROSTs) now coming from 12 colony sites spanning the entire breeding range. Preliminary results from prior years have been presented at several AMBC meetings. The 2017 SSS results differed considerably in several ways from those from past years. For example, there was a major decline in the use of Outer Cape Cod (CCMA) staging sites in late August 2017 as terns shifted westwards and we were able to document that even ROSTs originally banded as chicks in Maine and Nova Scotia were passing

through or nearby two offshore wind-energy permitted areas in Nantucket Sound (MA) and Block Island Sound (RI) to reach staging areas around Great Gull Island, NY (GGNY). I am still waiting for 2018 data from some places, but a preliminary look at what has been received so far indicates that numbers of staging ROSTs on Outer CCMA more or less “returned to normal” for the late summer 2018 staging period. However, it also looks as though there were secondary consequences in the nesting sites used in 2018 by some of the terns that staged in the NY-RI area in 2017, and some that eventually returned back north to nest in Maine & NH in 2018 were seen visiting GGNY in May, again suggesting they may have passed through potential offshore wind-energy areas. Although I will be officially retiring at the end of 2018, I plan to continue to collect and analyze data on staging terns for several more years as an “Emeritus Researcher”.

Tracking Movements and Foraging Habits of Great Shearwater

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Stellwagen Bank National Marine Sanctuary continued its satellite tracking work into 2018 marking the sixth consecutive year of following wintering great shearwaters in the Gulf of Maine. Annual variation in spatial use of the Gulf of Maine from 2013-2017 has now been evaluated and will be described in a future publication. We have documented that sand lance (*Ammodytes* spp.) is being taken by shearwaters and it appears that these forage fish provide an important link to the distribution of the birds. We also collect information on molt and stable isotopes (i.e. feathers, exhaled gases, and blood). Results from the combined shearwater tagging efforts in New Brunswick (R, Ronconi), Maine (USFWS), and the SBNMS effort were recently published: Powers et. al 2017. Movements and Foraging Habits of Great Shearwater (*Puffinus gravis*) in the Gulf of Maine, Marine Ecology Progress Series, 574: 211-226.

Foraging Ecology, Diet, and Prey

Fecal DNA Analysis to Monitor Tern Diets in Gulf of Maine

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In partnership with UNH biologists (Gemma Clucas and Adrienne Kovach), Shoals Marine Lab trialed a fecal DNA method to monitor tern diets at our mixed breeding colony in the Gulf of Maine. Adult Common Terns defecate upon intruders as a defense mechanism, and so, as we conducted normal colony monitoring efforts, we collected the feces that rained down on us. We also collected fecal samples from chicks of both species as they were being banded. We used metabarcoding to identify prey items from the DNA contained in the fecal samples. We used a hierarchical approach, employing universal eukaryotic primers to determine the breadth of the diet and fish-specific primers to identify fish prey items with higher resolution. We are comparing these results with chick-provisioning observations (from observation blinds and SML's remote-view nest camera) and stable isotope analysis of chick feathers to assess the suitability of this technique for long-term and range-scale monitoring of tern diets.

Using Long-term Seabird Datasets to Understand Forage Fish Trends in the Gulf of Maine

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National Audubon Society's Seabird Restoration Program (NAS-SRP) continues to work with several partners to use long-term NAS-SRP datasets on seabird chick diet, growth rates, and productivity to improve understanding of forage fish populations in the Gulf of Maine. Cooperation continued with graduate research fellow Keenan Yakola of the University of Massachusetts and the Northeast Climate Adaptation Science Center (NECASC) in an analysis of NAS-SRP's long-term dataset on tern diets and nesting success in relation to changing environmental conditions. Further collaboration with Michelle Staudinger at NECASC involves using stable isotope analysis of hatched seabird eggshells to infer adult diet during the pre-nesting period. An additional effort with Lauren Scopel and Tony Diamond of the University of New Brunswick examines potential environmental drivers of alcid diet and breeding success in the Gulf of Maine, with support from The Pew Charitable Trusts (Katharine Deuel). This partnership builds on a prior effort to relate seabird diet to Atlantic herring recruitment and stock size (Scopel et al. 2017). Ongoing dialogue with the staff of NOAA Fisheries' Northeast Fisheries Science Center (Scott Large and others) seeks to enhance the use of seabird data in Ecosystem Based Fisheries Management.

Recent efforts to study the foraging ecology of breeding Black-capped Petrel (*Pterodroma hasitata*) in Sierra de Bahoruco, Dominican Republic

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The South Carolina Cooperative Fish & Wildlife Research Unit partnered with the Dominican NGO Grupo Jaragua to gather fine-scale data on the foraging ecology of Black-capped Petrels (*Pterodroma hasitata*) breeding in the Sierra de Bahoruco, Dominican Republic. We recorded the foraging movements of three chick-rearing adults during a provisioning trip for 8-11 days in April 2018. Tracked petrels travelled between 2,000 and 4,000 km and foraged 34.5% of the time. In two instances, at-sea behaviors were consistent with coastal rafting near confirmed and suspected breeding colonies. While our results showed differences in individual choices of foraging areas, they supported earlier findings that petrels nesting in the Dominican Republic utilize the Caribbean basin frequently and the northwest Atlantic uncommonly during the breeding season. For two of the birds, foraging areas appeared to be associated with physical processes, such as the Guajira upwelling or climatological fronts in the outer continental shelf of the South Atlantic Bight. These two areas were also characterized with the highest fishing effort for the commercial longline fishery. Concurrently, we collected fecal samples from 11 chick-rearing adults and are planning to perform a genetic sequencing of prey DNA in the winter of 2018-2019.

Reference:

Satgé, Y.G., E. Rupp, and P.G.R. Jodice. 2018. A preliminary report on efforts to study the spatial ecology of Black-capped Petrel (*Pterodroma hasitata*) in Sierra de Bahoruco, Dominican Republic – I: GPS tracking of breeding adults. Unpublished Report, South Carolina Cooperative Research Unit, Clemson University, Clemson, South Carolina, USA.

Selected East Coast Osprey Colonies as Quantitative Biomonitorers of Regional Menhaden Abundance: Proposed to the ASMFC as “Ecological Reference Points” for Long-term Menhaden Management

Contact: Paul R. Spitzer, PhD, 31672 Old Orchard Rd., Trappe, MD 21673, spitzer_paul@hotmail.com

Spitzer and colleagues have carried out 50 years of osprey field research since 1968. For the first decade, this was assessment of the profound destructive impact of DDT and dieldrin residues on reproduction and population dynamics (Spitzer *et al.* 1978, Spitzer 1980). Recovery followed, to a current state of abundance that enables precise study of food limitation, with no known contaminant effects. We have developed an array of simple, easy study techniques; plus intimate familiarity with the ecology of selected colonies where Atlantic Menhaden are the prime food fish during the eight-week nestling period and subsequent fledgling period. With adequate context, this enables annual quantitative assessment of regional menhaden abundance, using the osprey reproductive parameters “young fledged/active nest” (Y/AN) and “young fledged/successful nest” (Y/SN), or “mean brood size”.

Three East Coast osprey colonies are proposed to serve this scientific function:

1) High Menhaden Abundance: The Connecticut River Estuary, CT, colony has been studied since the 1930's, and was reduced to one active nest at the end of the DDT/dieldrin era (Spitzer 1980). The current active nest count is about 120, which continues to rise when appropriate nest sites are available. A pre-fledging Y/SN check of the predator-proof nest platforms at the Roger Tory Peterson Wildlife Area, Great Island, Old Lyme, CT, yields consistently large broods of young, with many three-young broods. This estuary and adjacent Long Island Sound are a consistent menhaden “hotspot” and sanctuary, with ecological parameters that enable the fishes’ active habitat selection, and no local harvest pressure.

2) Variable Menhaden Abundance: The Gardiners Island, NY, colony has supported 200-300 active nests since the historic visit of Alexander Wilson in 1803 (Wilson 1812). Spitzer first visited this colony in 1969, finding 38 nests near the end of the DDT era (Spitzer 1980). This isolated, predator-free island is surrounded by the open, tidal waters of Gardiners Bay and Block Island Sound (Atlantic Ocean). This is prime menhaden habitat—but the colony is apparently highly sensitive to variable regional abundance of these migratory fish. For much of our 50-year time-series (maintained by Michael Scheibel of TNC and NYSDEC), Y/AN and Y/SN appear to track menhaden abundance (the working hypothesis, supported by ample annual observations). Since the ASMFC limitation of harvest quotas in 2013, both Y/AN and Y/SN have been high, and this food-limited population has recovered from 20 nests to 55 nests. If current trends are maintained, we hope for increase toward historic levels. Thus Gardiners is a bellwether of menhaden management for ecosystem benefits. The owners of this private island are highly supportive of this objective.

3) Mediocre Menhaden Abundance: The Broad Creek colony, off the Choptank River, near St. Michaels, MD, on the eastern shore of Chesapeake Bay. Spitzer (unpublished) studied this breeding cluster in 1983-87 and 2018, finding consistent Y/AN slightly above replacement rate of ~0.8 Y/AN (Spitzer 1980): the 6-year mean is 0.95, and the range 0.72-1.17. Y/SN mean is 1.56, range 1.36-1.80, with dramatic losses due to nestling starvation and resulting brood size reduction. In three years of intense study, 1984-86, this nestling loss was 41%, 57%, and 43%. The 2018 active nest count was 39, compared to 1983-87 mean of 48 (range 46-53). (This is due to reduction of manmade predator-proof offshore nest sites—but the breeding population is considered to be stable. In the five years 1970-74, with less nest site management, Jan Reese found a mean of 36 active nests in Broad Creek.) The almost exclusive prey at Broad Creek are menhaden, mostly smaller 2-year-old fish. High local plankton density and green turbidity (Secchi ~1 m) has shaped this diet in the past, and for the foreseeable future. Menhaden rich in lipid are thought to supply “metabolic water” to nestlings facing heat stress—which can be extreme at this southern site. The between-colony comparison is very important to note: The Gardiners Island, NY, colony held on at a

reduced level of active nests through many years of menhaden limitation, large-scale nestling starvation, and reproduction which averaged near the estimated replacement rate of 0.8 Y/AN.

Research for Possible Regional Extension of This Biomonitor Approach: New York Bight waters are known to be rich in seasonal, migratory menhaden, and currently attract Humpback Whale watchers from the adjacent NYC urban region. Osprey colonies are situated at the “Gateway” public shore preserves on each side of the Bight: Sandy Hook, NJ, and Jamaica Bay, NY. These need study and quantitative assessment as possible “menhaden colonies”.

References:

Spitzer, P.R., Risebrough, R.W., Walker, W., Hernandez, R., Poole, A., Puleston, D., and I.C.T. Nisbet. 1978. Productivity of ospreys in CT-Long Is. increases as DDE residues decline. *Science* 202-333-335.
Spitzer, P.R. 1980. Dynamics of a discrete coastal breeding population of ospreys (NYC to Boston) during a period of decline and post-DDT recovery, 1969-1978. PhD Diss., Cornell U., Ithaca, NY. 90 pp.

Trends in the Diet of Common, Arctic, Roseate, and Least Terns in the Gulf of Maine: Influences of Climate Change

Contact: Michelle D. Staudinger, DOI Northeast Climate Science Center, mstaudinger@usgs.gov

Keenan Yakola, a Masters student at the University of Massachusetts Amherst and a fellow with the DOI Northeast Climate Science Center, digitized historic data on tern chick provisioning collected between 1986 and 2017 on seven different seabird colonies in the Gulf of Maine, USA. These islands are managed by the National Audubon Seabird Restoration Program and the Maine Coastal Islands NWR who are collaborators on this project. To date, this research has summarized and quantified intraspecific and interspecific geographic variation in the chick diets of Common, Arctic, Least and Roseate Terns and is now modeling the impacts of changing environmental conditions on seasonal and annual dietary composition. Results from this project identify forage fish species that support the long-term sustainability of regional tern populations and provide insights on how climate change is altering the availability of forage resources to seabirds nesting in the Gulf of Maine.

Assessing the pre-breeding foraging ecology of seabirds along the Northeast U.S. coast using Stable Isotope Analysis

Contact: Michelle D. Staudinger, DOI Northeast Climate Science Center, mstaudinger@usgs.gov

As part of the Five College Coastal and Marine Sciences summer internship program (<https://www.fivecolleges.edu/marine>), students at the University of Massachusetts Amherst, in collaboration with the DOI Northeast Climate Adaptation Science Center, USFWS, and Project Puffin are evaluating the pre-breeding foraging ecology of seabirds nesting along the Northeast U.S. coast. Stable carbon and nitrogen isotopes from hatched eggshell tissues collected during the 2016, 2017, and 2018 nesting seasons are being tested for: 1) inter-specific differences among a variety of species nesting on shared islands (primarily terns (Arctic, Common, and Roseate terns) and alcids (Atlantic puffin, razorbills, and black guillemots) but a few other species of interest including spotted sandpiper and common eiders); 2) intra-specific differences of populations nesting across different colonies; 3) inter-annual differences among species nesting on shared islands; and 4) within season trends of isotopic signals by hatch date within species. In 2016 and 2017, sampling was limited to the Maine Coastal Islands NWR; in 2018 collections were expanded to include three new islands in the GOM and seven new southern colonies in NH, MA, CT and NY. Over 1,000 samples have been collected of which ~200 have been analyzed to date. Results will provide new insights into the habitat and trophic level at which seabirds species are feeding just prior to nesting across the Northeast.

Using Stable Isotope Analysis and Next Gen- Sequencing to Document Seabird Diet Composition

Contact: Linda Welch, Maine Coastal Islands NWR Complex, Linda_Welch@fws.gov

Maine Coastal Islands NWR is working with Boston University, Long Island University, and the University of New England (UNE) to try and better understand foraging behavior and diet composition in Common and Arctic Terns, Atlantic Puffins, and Great Shearwaters. Samples were collected from several tern and puffin breeding colonies in Maine to document the presence of specific forage fish in the seabirds' diet. Current monitoring efforts on the colonies indicate what species of fish are delivered to chicks, but we don't currently have information on the diet of adult seabirds. Shearwater samples were collected in Massachusetts during satellite tagging efforts with Stellwagen Bank NMS. We are hoping the DNA analysis will help answer that important management question. UNE found up to 12 species of forage fish in the 2017 samples and is currently analyzing the 2018 samples. BU and UNE are conducting the stable isotope analysis of blood and breath samples, as part of a larger effort to understand seabird and forage fish interactions throughout the Gulf of Maine.

Dynamic Ocean Management

Contact: Dave Wiley, Stellwagen Bank National Marine Sanctuary, David.Wiley@noaa.gov

The Stellwagen Bank National Marine Sanctuary and colleagues from the United States Geological Survey, Woods Hole Oceanographic Institution, University of Massachusetts-Dartmouth, University of Connecticut, and Boston University are studying the productivity and ecology of sand habitats, with a focus on sand lance forage fish. The project is funded by a three-year grant from the Bureau of Ocean Energy Management. This study focuses on the collection and analysis of biological and oceanographic data that might indicate the drivers for forage fish distribution and abundance on sand shoals, such as the Stellwagen Bank, and how forage fish distribution and abundance impacts the distribution and relative abundance of protected resources (whales and seabirds) and the relative abundance and catch of commercial fishes.

Bycatch

Updating 2015 and 2016 seabird-fishery interaction estimates for the US Northeast and Mid-Atlantic waters

Contact: Dr. Debi Palka, NOAA Northeast Fisheries Science Center, Debra.Palka@noaa.gov

An in press NOAA Northeast Fisheries Science Lab Reference report (Sigourney et al. in press) provides bycatch estimates for 10 species of seabirds caught in commercial fisheries off the east coast of the United States during 2015 and 2016. This is an update to Hatch (2017) that conducted a comprehensive analysis of bycatch for 10 species of seabirds across six gear types during 1996 to 2014. During 2015 and 2016 a total of 655 birds were recorded as bycatch in commercial fishing gear, with 579 birds from the northeast region and 76 birds in the mid-Atlantic region. The majority of observed bycatch was of great shearwaters (514) followed by red-throated loons (36), herring gulls (24), northern fulmars (20), northern gannets (17), sooty shearwaters (14), common loons (10), thin-billed murrelets (8), great black-backed Gulls

(7) and double-crested cormorants (5). The majority of seabird interactions occurred in gillnets (613) followed by sea scallop dredges (21), bottom otter trawls (16) and paired midwater trawls (5). In 2015, total bycatch estimates among all gear types included 14 (CV=1.02) common loons (*Gavia immer*), 49 (CV=1.01) double-crested cormorants (*Phalacrocorax auritus*), 9 (CV=0.91) great black-backed gulls (*Larus marinus*), 1992 (CV=0.06) great shearwaters (*Puffinus gravis*), 185 (CV=0.52) herring gulls (*Larus smithsonianus*), 51 (CV=0.28) northern fulmars (*Fulmarus glacialis*), 174 (CV=0.41) northern gannets (*Morus bassanus*), 60 (CV=0.92) red-throated loons (*Gavia stellata*), 16 (CV=0.62) sooty shearwaters (*Puffinus griseus*) and 22 (CV=0.51) thin-billed murrelets (*Uria aalge*). In 2016, total bycatch estimates among all gear types included 115 (CV=0.42) common loons, 20 (CV=0.65) double-crested cormorants, 26 (CV=0.68) great black-backed gulls, 1498 (CV=0.10) great shearwaters, 121 (CV=0.34) herring gulls, 9 (CV=0.76) northern fulmars, 89 (CV=0.38) northern gannets, 553 (CV=0.19) red-throated loons, 81 (CV=0.37) sooty shearwaters and 16 (CV=0.80) thin-billed murrelets.

References:

Hatch JM. 2017. Comprehensive estimates of seabird–fishery interactions for the US Northeast and mid-Atlantic. *Aquatic Conserv: Mar Freshw Ecosyst.* 2017:1–12.

Sigourney, DB, Orphanides CD, and Hatch JM. In press. Estimates of seabird bycatch in commercial fisheries off the east coast of the United States from 2015 to 2016. US Dept Commer, Northeast Fish Sci Cent Ref Doc. Xx-xx; xx p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <https://nefsc.noaa.gov/publications/>

Outreach brochure on seabird bycatch in US Atlantic waters

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We are currently in the process of developing a 6.5in x 10 in, 4 booklet type brochure that folds out into 4 sections. Inside 4 sections when completely folded out will have identification photos and simple descriptions of species commonly bycaught. Outside sections briefly describe why NOAA Fisheries care about seabirds, how fishery bycatch is monitored, and what we know about bycatch in the US North Atlantic waters. Hopefully this brochure will be completed by spring 2019.

Multi-Topic & Miscellaneous Updates

Bird-Smart Wind Energy Campaign

Contact: Holly Goyert, American Bird Conservancy, hgoert@abcbirds.org

In 2010, the American Bird Conservancy (ABC) developed a Bird-Smart Wind Energy Program to advance the sustainable development of wind energy while minimizing risk to affected bird life. ABC supports the effort to combat climate change through responsible renewable energy development. However, we have concerns regarding the impacts of offshore wind turbines on seabirds. We are working with partners to implement our Bird Smart Wind Energy Policy, which promotes: compliance with a strong regulatory framework; proper siting of turbines away from high-bird-collision-risk areas; independent, transparent pre-and-post-construction monitoring; effective mitigation by wind energy facilities to minimize bird mortality; and compensation for the loss of protected birds. For more information on ABC's Bird-Smart Wind Energy Campaign, please visit abcbirds.org/program/wind-energy-and-birds/

Spatial and Reproductive Ecology of Brown Pelicans in the Gulf of Mexico

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This study focuses on providing baseline information about populations of Brown Pelicans (*Pelecanus occidentalis*) across the northern Gulf of Mexico. From 2013-2016 we analyzed movement data for 90 satellite-tracked adult pelicans to determine preferred marine habitat characteristics (Lamb 2016), individual and colony-wide variation in home ranges and migratory patterns (Lamb et al 2017a and b). We also studied chick survival from hatch to fledge, chick body condition, and chick stress levels (Lamb et al. 2016), as well as chick diet composition and energy density, and nestling provisioning rates (Lamb et al. 2017c). We are currently comparing contaminant risk exposure, contaminant levels, and health parameters in adult and nestling Brown Pelicans from various colony sites, and looking at the genetics of migration in the species. M.S. student Rochelle Streker is also working on documenting the relationship of local environmental and nest site characteristics to nestling survival and recruitment in the Mobile Bay complex.

References:

- Lamb, J.S. 2016. Ecological drivers of Brown Pelican movement patterns and reproductive success in the Gulf of Mexico. Ph.D. Dissertation, Clemson University
- Lamb, J.S., K. O'Reilly, and P.G.R. Jodice. 2016. Physical condition and stress levels during early development reflect feeding rates and predict pre- and post-fledging survival in a nearshore seabird. *Conservation Physiology*.
- Lamb, J.S., Y.G. Satgé, and P.G.R. Jodice. 2017a. Influence of density-dependent competition on foraging and migratory behavior of a subtropical colonial seabird. *Ecology & Evolution*.
- Lamb, J.S., D.J. Newstead, L.M. Koczur, B.M. Ballard, M.C. Green, and P.G.R. Jodice. 2017b. A bridge between oceans: Overland migration of marine birds in a wind energy corridor. *Journal of Avian Biology*.
- Lamb, J.S., YG. Satgé, and P.G.R. Jodice. 2017c. Diet composition and provisioning rates in eastern brown pelican nestlings determine reproductive success. *Marine Ecology Progress Series*.

Update: Mapping Marine Bird Abundance and Distribution for Oil Spill Preparedness in Atlantic Canada

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Under the Ocean Protection Plan, the Canadian federal government has committed to developing a world-leading marine safety system to prevent and improve response to marine pollution incidents. Within this initiative, the roll of the Canadian Wildlife Service is to provide information on sensitive birds and their habitats. Within the Atlantic Region, CWS is undertaking several projects aimed at understanding the distribution, abundance, and movements of marine birds which may be sensitive to oil pollution. Updates to some on-going and new projects include the following.

- Regional **tracking** of Razorbills (5 colonies) and Black Guillemots (2 colonies) recovered GLS tags in 2018. Assessment of year-round movements is being conducted by MSc student, Mark Dodds, University of New Brunswick Saint John (Razorbills) and honours student Julia Baak, Dalhousie University (Black Guillemots).

- Analysis of Great and Sooty Shearwater **tracking** data from Bay of Fundy mapped local hotspots in relation to shipping lanes.
- Analysis of wintering Harlequin Duck and Purple Sandpiper habitat selection in the Maritimes and Newfoundland was completed by Sarah Gutowski and Mark Mallory of Acadia University.
- Leach's Storm-petrel **colony census** of Kent Island, NB, was completed by Dalhousie honours student Kyle d'Entremont. This study was paired with **acoustic monitoring** study by Dalhousie honours student Ali Gladwell, investigating the utility of automated recordings as indices of breeding population densities.
- Project investigating **cumulative risk assessments** for 14 species of breeding seabirds in Atlantic Canada was completed. This work was led by Bird Studies Canada and Mount Allison University, with CWS as a project partner.

The Seabird Ecological Assessment Network (SEANET)

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The Seabird Ecological Assessment Network (SEANET) was established in 2002. Largely supported by a network of volunteers (i.e. citizen scientists), that brings together interdisciplinary researchers and members of the public to provide baseline information about bird mortality; to help to detect mass mortality events due to oil spills, toxins or disease outbreaks; to examine the spatial pattern of bird carcass deposition and how it varies across time, and to highlight that marine birds can serve as indicators of the marine ecosystem. The SEANET network spans from Maine to Florida. The numbers of SEANET volunteers since 2002 has ranged from approximately 30 - 100+ active volunteers. In February 2017, the SEANET online data entry portal was shut down by the host over internet security concerns. Currently, SEANET volunteers are mailing their completed survey forms to the Interim SEANET coordinator, John Stanton, U.S. Fish and Wildlife Service, for storage and eventual uploading to a new online data portal. Recently, a SEANET volunteer training was conducted in Corolla, NC and ten new SEANET volunteers and their associated SEANET survey routes were established to monitor portions of the northeastern North Carolina coastline (i.e. beaches). For more information, please contact John Stanton, Interim SEANET Coordinator.