

Recent Projects by Members of the Atlantic Marine Bird Cooperative

November 2017



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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 600,000 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>).

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 current projects include quantifying the risks of offshore oil and gas activities, defining conflict areas between birds and fishing activity, as well as defining bird vulnerability to increased levels of shipping through Canada's Arctic. In June of this year, in collaboration with Ewan Wakefield at the University of Glasgow, we led the seabird surveys across the Charlie Gibbs Fracture Zone, where the North Atlantic Current crosses the mid-Atlantic ridge, to investigate its importance as a foraging area for both migratory and locally-breeding seabirds. We also continue to investigate current declines of Leach's Storm-petrels across the region, and deployed 17 GPS tags at a colony in Nova Scotia (Country Island) to identify interactions with offshore gas installations, which occur within their foraging range. A study was also initiated from this same location to monitor reproductive success of Black Guillemots, and identify their wintering distribution used leg-mounted GLS tags.

Additional Statistical Analyses to Support Guidelines for Marine Avian Sampling

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Initial investigations aimed at identifying hot and cold spots of seabird occurrence and abundance in US Atlantic waters, and estimating the statistical power to detect such hot and cold spots, were presented in Kinlan et al. (2012) and Zipkin et al. (2015). As an extension of that previous work, we are investigating how factors such as spatial scale (grid cell size) and effect size affect both the identification of hot and cold spots and the statistical power to detect them. This study uses data on twenty species of marine birds from the US Fish and Wildlife Service's Northwest Atlantic Seabird Catalog. Results of these analyses will be detailed in a technical report to BOEM. A digital appendix with extensive maps of single-species and multi-species summary results will also be included with the report. The report and digital appendix should be available through BOEM in late 2017 or early 2018.

References:

Kinlan BP, Zipkin EF, O'Connell AF, Caldwell C. 2012. Statistical analyses to support guidelines for marine avian sampling: final report. Herndon (VA): US Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2012-101. NOAA Technical Memorandum NOS NCCOS 158.

Zipkin EF, Kinlan BP, Sussman A, Rypkema D, Wimer M, O'Connell AF. 2015. Statistical guidelines for assessing marine avian hotspots and coldspots: a case study on wind energy development in the US Atlantic Ocean. *Biol Conserv.* 191:216–223.

2016 & 2017 AMAPPS Shipboard Surveys – Seabirds

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Two shipboard surveys were completed during the summer of 2016 and the fall of 2017 aboard the NOAA vessel Henry B. Bigelow, i.e. HB1603, and the UNOLS vessel R/V Hugh R. Sharp, i.e. HS1701, respectively (see Figure 1). A total of 4699 birds were seen on HB1603 while surveying 6814.7 km of track line in 15.8 days, and a total 320 birds were seen on HS1701 while surveying 571.3 km of track line in 1.8 days (see Table 1). The majority of sightings on both surveys were of Wilson's Storm-Petrels (*Oceanites oceanicus*), Leach's Storm-Petrels (*Oceanodroma leucorhoa*), and Great Shearwaters (*Puffinus gravis*). Cory's Shearwaters (*Calonectricus diomedea*) and Audubon's Shearwaters (*Puffinus lherminieri*) were also sighted in high numbers in 2016, while Manx Shearwaters (*Puffinus puffinus*) replaced them in 2017. This change in seabird species composition can largely be explained by survey date, with Cory's and Audubon's Shearwaters being predominate during the height of summer and Manx shearwaters becoming relatively more abundant in the fall. For more information, see the [2016](#) and [2017](#) annual AMAPPS (Atlantic Marine Assessment Program for Protected Species) reports.

Table 1: Summary statistics for on-effort segments of the 2016-2017 AMAPPS shipboard surveys regarding seabirds

	HB1603	HS1701
Distance (km)	6814.7	571.3
Duration (days)	15.8	1.8
Sightings (no.)	4699	320
Start date	06/28/2016	09/09/2017
End date	08/24/2016	09/17/2017

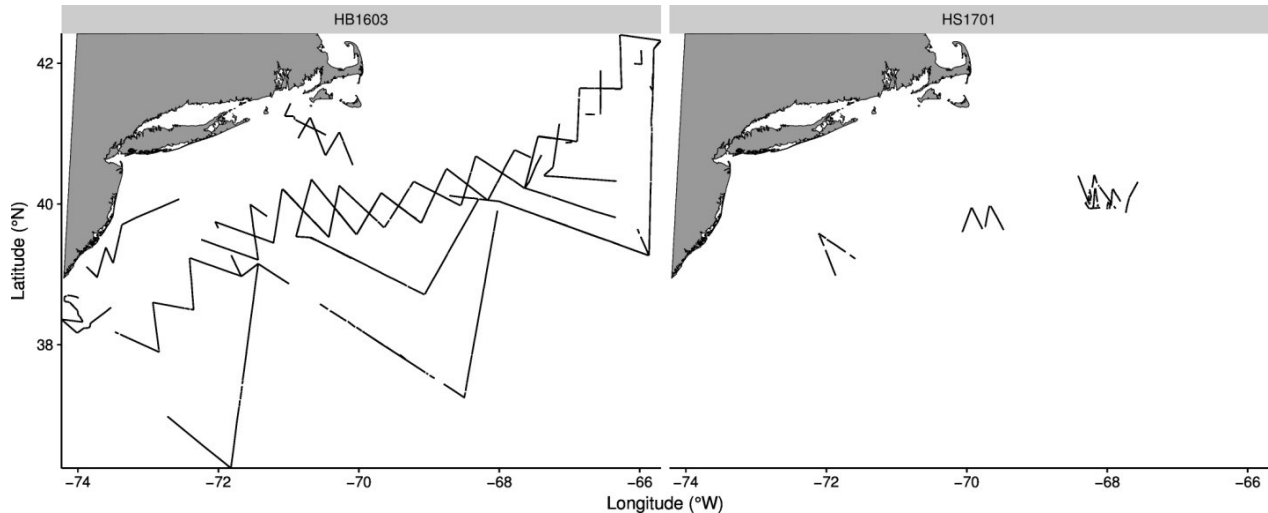


Figure 1: Track lines for on-effort segments of the 2016-2017 AMAPPS shipboard surveys regarding seabirds

Update on Regional Ocean Planning in the Northeast and Mid-Atlantic

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The National Ocean Council certified the Northeast and Mid-Atlantic regional ocean plans in December 2016. Both Regional Planning Bodies are now implementing each plan. Both plans and their associated data portals include robust seabird spatial data products produced by the NOAA National Centers for Coastal Ocean Science (NCCOS), which integrate numerous observations along the Atlantic coast, including those in the Avian Compendium. [The Northeast Ocean Plan](#) includes the AMBC as one resource for decision-makers seeking the latest information about seabird research and data, and also describes several completed and ongoing seabird projects involving AMBC partners (see Appendix 2, pp. 192-193). We hope to continue to incorporate work from the AMBC community in ocean planning data products and materials, and engage interested experts on improving current methods to display and visualize seabird spatial data products through the [Northeast Ocean Data Portal](#) and [Mid-Atlantic Ocean Data Portal](#).

SeaScribe – A *Free* Mobile Avian Survey Data Collection App

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In 2014, the Bureau of Ocean Energy Management (BOEM) contracted with the Biodiversity Research Institute (BRI) and Tilson Technology Management (both headquartered in Portland, Maine) to create a modern offshore survey data collection application specifically for handheld devices (e.g. computer tablets). In 2016, we rolled out the first version of the app, called SeaScribe. We designed SeaScribe to have better, built in, on-the-fly data checking, improved data standardization across surveys, improved data entry, and reduced time to quality-controlled data. The application was designed to collect core offshore survey data but also gives users the flexibility to add data fields as necessary to satisfy specific survey or research needs. It provides an easy-to-use, intuitive application for the collection of wildlife survey data, including geo-referenced effort and observation data, capturing environmental conditions and behavioral information alongside each geo-referenced observation. SeaScribe is being adopted by researchers across the U.S. OCS and beyond, and BOEM has required its use in projects related to offshore wind development. Recently, BOEM contracted Tilson to update and maintain the app, which BRI will assist with. SeaScribe can be used in both Apple and Android operating systems, and BOEM has made the app freely available (via the iTunes App Store and Google Play) for use on all offshore marine wildlife surveys. You can learn more about SeaScribe and download the current User's Manual at www.briloon.org/seascribe.

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

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Since 2013 NOAA's National Centers for Coastal Ocean Science (NCCOS) have been developing maps of 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 is 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, National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science. The project analyzes 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 Environment and Climate Change Canada. A spatial predictive modeling framework is applied to translate the sighting data into comprehensive seasonal maps of the spatial distributions of birds. In brief, the sighting data are related to a wide range of environmental predictor variables, and comprehensive data on those environmental variables are then used to predict the relative density of birds across the project study area. A 'climatological' approach is taken whereby long-term average environmental patterns are 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 have been modeled. Phase I of this project was completed in 2016 (report available at

<https://www.data.boem.gov/PI/PDFImages/ESPIS/5/5512.pdf>), and the Phase I distribution maps have been incorporated in the Northeast and Mid-Atlantic regional ocean data portals. Modeling for Phase II of this project was completed in spring 2017, and the final project report is expected to be completed in early 2018.

Colony Management and Monitoring

Least Tern Migration and Wintering Distribution

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Full life-cycle conservation planning typically involves knowledge of breeding season demographics, abundance estimates for at least one period of the annual life cycle, over-winter survival, and details of migratory connectivity between breeding and wintering populations. Pending funding availability, this project represents a first step toward collecting information required for development of a full life-cycle conservation plan for Least Terns, a threatened beach-nesting seabird distributed along the eastern coast of the U.S. and Gulf of Mexico. During summer months, Least Tern breeding colonies are regularly monitored and protected – with varying degrees of success – by reducing human disturbances and implementing efforts to control predators, ranging from physical removal of offending individuals to erection of electric fences designed to discourage mammalian entry into nesting areas. Yet in contrast to the relatively intense conservation management activities that are devoted to Least Terns from May through August, almost nothing is known about the species’ distribution and ecology during the remainder of the year. The Least Tern wintering area has been variably described as being located in Central America, the Caribbean and northern South America. However, only limited empirical data exists concerning winter distribution along the coasts of Suriname, Guiana and Brazil, and some observations even suggest the possibility of the species may shift to a pelagic existence during the winter months. Although availability of the MOTUS (<https://motus.org/>) system to automatically detect individuals carrying digitally-encoded radio transmitters “nano-tags” is an appealing approach to studying tern winter distribution, much of the Least Tern’s likely winter range extends south of the current extent of most receiving stations in the MOTUS network, and the possible use of pelagic habitats would further decrease the likelihood of transmitter detection. This project proposes to deploy PinPoint GPS geolocators (<http://www.lotek.com/pinpoint-gps.htm>) in 2018 on approximately 10 breeding adults captured at each of approximately 10 stable breeding colonies located from Maine to Connecticut. Recapture of these birds and collection of the geolocation data would be anticipated in 2019.

Monitoring Black-backed and Herring Gulls on Appledore Island, New Hampshire

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Long term sub-colony census data show recent, marked declines in the breeding populations of herring and great black-backed gulls on Appledore Island in the southern Gulf of Maine. New efforts to count and map every nest on the island have reinforced these data. Next year, we plan to deploy GPS loggers on black-backed gulls to build our understanding of habitat use and foraging ecology in that species. We are

also looking at diet using prey remains. We are most interested in collaborating with other folks working on gulls anywhere in the Atlantic and certainly in the Gulf of Maine. We also are looking for some assistance and training before we attempt to place the loggers on birds next summer.

Seabird Monitoring Efforts at Machias Seal Island, New Brunswick

Contact: Tony Diamond, Tonydiamond49@gmail.com

At Machias Seal Island, research and monitoring of the seabird community (begun in 1995) continues as Tony Diamond hands over responsibility to Heather Major in Saint John NB. In 2017 two new Master's students, Mark Dodds and Mark Baran, began studies of movements of razorbills and puffins (respectively) by deploying 21 and 29 GLS tags, respectively. Breeding success of puffins was greatly enhanced over 2016, Arctic Terns continued their slow return with band-resighting detecting several adults 27 years old and several new recruits from other colonies in the metapopulation. Four gannet nests were followed; none succeeded. Monitoring of Leach's Storm-petrel burrows began, contributing to an eastern-Canada-wide initiative by CWS to improve understanding and detect causes of its region-wide decline. Kate Shlepr defended her thesis on Herring Gull diet and movements and is now enrolled in a PhD in Florida. Stephanie Symons' thesis-writing on GPS-tracking of razorbills and puffins is wrapping up, and she is compiling prey samples going back almost 20 years for nutrient analysis. Lauren Scopel had a very productive year with three papers published or in press, including one exploring relationships between seabird chick diets and herring data in the Gulf of Maine (DOI: 10.1139/cjfas-2017-0140).

Monomoy National Wildlife Refuge Hosts the Largest Common Tern Colony in the Northwest Atlantic

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Since 1996, the Refuge has been actively managing habitat for terns including the use of prescribed fire, lethal and non-lethal predator techniques, and the use of nesting and chick structures. In 2017, the colony hosted 11,723 nesting pairs of common terns, 2,714 pairs of laughing gulls, 2 pairs of black skimmer, and 18 pairs of roseate terns. All roseate terns nests are monitored daily throughout the season to determine fledging. A subset of common tern nests enclosed in wire fence productivity plots (~450 in 2017) are monitored every other day to approximate hatch and fledge success of the entire colony. The colony is divided into a 60 by 60 meter grid system and nests are censused annually by grid during peak nesting. Approximately 50 banded adult common terns are trapped each year to determine whether nesting terns were hatched at Monomoy NWR or other sites. Laughing gull nest destruction is performed when necessary and was conducted in 2017. A field camp is established annually in close proximity to the tern colony beginning in early May so that gull harassments may be conducted to prevent larger gulls species (herring and great black-backed) from establishing nests in the tern colony prior to the terns arriving at the site. Camp also enables staff to work during varying hours within the nesting colony. Daily observations are conducted to monitor kleptoparasitism of laughing gulls on common terns, common tern provisioning, and to locate nesting roseate tern nests. Bi-weekly night observations are conducted for predator management purposes and to monitor the colony activities at night. Invasive plant species within the tern nesting area are managed when needed.

Bird Island Restoration Efforts (Massachusetts)

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Bird Island (Marion, Massachusetts) supports about 30% of the Northwestern Atlantic population of the federally Endangered roseate tern and about 15% of the state's common terns (state listed as Special Concern). The island, which was surrounded by a deteriorating revetment, had become severely eroded: of 2 acres of formerly suitable nesting habitat, half had been lost to erosion, threatening the persistence of terns on the island. The Army Corps of Engineers, the Massachusetts Division of Fisheries & Wildlife, and the Town of Marion designed a project to stabilize the island and increase nesting habitat. Between December 2015 and April 2017, the revetment was rebuilt (higher and wider, to accommodate sea level rise and reduce wave energy reaching the nesting area), the island was nourished with sand and gravel, and native plants preferred by terns were installed. Total project cost was approximately \$5 million.

Seabird and Shorebird Monitoring and Management Efforts in South Carolina

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In South Carolina SCDNR continues to post and maintain signs at ~27 sites, public and private beaches, to protect seabird and shorebird nesting habitat. We also provide technical assistance to businesses and property owners of rooftop least tern colonies. Each year we identify active least tern colonies, set up edge fencing and shade structures at 10-22 sites, and recruit volunteers to help in nest monitoring rooftop colonies. Annual censuses of nesting brown pelicans, royal terns and sandwich terns are conducted via aerial surveys in a SCDNR Law Enforcement twin engine fixed-wing Partenavia aircraft. Two biologists accompany the pilot to help locate colonies and to take photographs through the Bombay doors of the aircraft. Nests of seabirds and wading birds are counted from the photographs. Other seabird nesting colonies are annually accessed from the ground. Minimal reproductive success data is collected. SCDNR is working with a PhD student from Patrick Jodice's lab at Clemson University on a satellite telemetry study of brown pelicans. The second year of the study begins spring 2018.

Common Eider Duckling Survival Study

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In 2016, we initiated a common eider duckling survival study at a breeding colony in Casco Bay, Maine. We targeted female eiders for captures using a floating mist-net trap in early May. Females (n=50) were banded, marked with nasal disks, and equipped with a VHF radio transmitter. 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. 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. The tri-annual Colonial Waterbird Survey was conducted from May-June 2017. This statewide effort counts nests of all colonial waterbird species in the coastal region of North Carolina. Counts are timed to coincide with peak of incubation, are usually conducted on foot with observers walking through sites in transects, and data are collected in an online database. The Colonial Waterbird Survey has been taking place since the 1970s. At most sites, little or no productivity monitoring is conducted, with exceptions being some nest tracking and counts of fledgling Black Skimmers, Least Terns, and Common Terns at the south end of Wrightsville Beach and Lea-Hutaff Island. Robert Snowden, a graduate student at UNCW, advised by Dr. Ray Danner, conducted research on Least Tern behavioral responses to extreme temperatures using an on-site micro-weather station, artificial egg dataloggers in nests, and behavioral observations at the south end of Wrightsville Beach in 2017. Through the partnership of site managers, John Weske bands most Royal Tern and Sandwich Tern chicks fledged in the state, as well as a smaller proportion of Brown Pelicans. Like the Colonial Waterbird Census, this work has been ongoing since the 1970s.

Stable Isotope Analysis of Atlantic Puffin, Common, Arctic, and Roseate Tern Eggshells

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

Rachel Bratton, an Undergraduate student at the University of Massachusetts Amherst completed a Five College Coastal and Marine Sciences Program (<https://www.fivecolleges.edu/marine>) internship this past summer in collaboration with Project Puffin and the Northeast Climate Science Center. Her summer internship and Honors Thesis work (graduation date spring 2018) will evaluate the pre-breeding foraging ecology of seabirds nesting on Maine Coastal Islands National Wildlife Refuge. Stable carbon and nitrogen isotopes in eggshell tissues collected during the 2016 and 2017 nesting seasons will test 1) inter-specific differences among Arctic tern, Common tern, Roseate tern, and Atlantic Puffin populations nesting on shared islands?; 2) intra-specific differences of Arctic tern, Common tern, and Roseate tern populations nesting across different Maine Coastal Islands in the same year?; 3) inter-annual differences among seabird populations nesting on shared islands?; and 4) of isotopic signals by hatch date within species? Results will provide new insights into the habitat and trophic level at which these seabirds species are feeding just prior to nesting in the Gulf of Maine.

Stable Isotope and Fecal DNA Analysis of Seabird Blood and Feces to Document Foraging Behavior and Diet Composition

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

Maine Coastal Islands NWR is working with Boston University (BU) and the University of New England (UNE) to try and better understand foraging behavior and diet composition in Atlantic Puffins, Common,

and Arctic Terns. UNE is currently conducting fecal DNA analysis of samples 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 seabird chicks, but we don't currently have information on adult seabird diet. We are hoping the DNA analysis will help answer that important management question. BU is conducting the stable isotope analysis of blood and fecal samples, as part of a larger effort to understand seabird and forage fish interactions throughout the Gulf of Maine. Sample collection will continue in 2018.

Colonial Seabird Monitoring in Atlantic Canada

Contact: Sabina Wilhelm, Environment and Climate Change Canada, sabina.wilhelm@canada.ca

The Canadian Wildlife Service (CWS) Colonial Seabird Monitoring Program focuses on assessing the population size and trends of 20 species of seabirds across the four Canadian Atlantic provinces, namely Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador. Over the past year, focus has been on continuing to update the status of major Leach's Storm-Petrel colonies in the region in light of recent surveys having revealed that several of Newfoundland's significant colonies, including Baccalieu Island, the world's largest, have experienced declines of 40-50% over the past 20-30 years. In response to these declines, Bird Life International assessed this species as globally threatened and listed it as Vulnerable on the IUCN Red-List in December 2016. Current efforts are also being placed on updating the status of major puffin colonies in Newfoundland and Labrador (specifically on the Gannet Islands which have not been surveyed since 2000 and host over 40,000 pairs), to assess the health of the regional population. On a more local note, the 2017 breeding season appeared to be very favorable for puffins breeding in the Witless Bay Islands Seabird Ecological Reserve, Newfoundland, the largest puffin colony in the NW Atlantic, with the most number of puffins rescued by the Puffin Patrol (<https://www.facebook.com/Puffin-Petrel-Patrol-NL-156013017813145/>) and the highest fledgling mass since the program was initiated in 2012. To complement the data being collected through the Puffin Patrol, we initiated this past field season a long-term study site on Gull Island, Witless Bay, by permanently marking burrows and banding adults to monitor adult survival and productivity. The 2017 field season also saw the conclusion of the three-year survey along Newfoundland's coast to update the distribution and abundance of terns, gulls, kittiwakes and cormorant colonies.

Potential Interaction Analysis of Offshore Wind Energy Areas and Breeding Avian Species on the US Atlantic Coast

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Due to increasing US interest in developing wind energy sites in offshore waters, we aim to synthesize existing data on colonial breeding seabird populations with the potential risk of interacting with lease areas. Previous efforts by BOEM and NOAA have synthesized distribution of species using at-sea survey data, and our effort seeks to complement this work by focusing specifically on birds during the critical and energetically-demanding breeding life history stage. Colonial information has been collected on numerous seabird species including: American oystercatchers, black skimmers, bridled terns, brown pelicans, common terns, Forster's terns, great black-backed gulls, great egrets, gull-billed terns, herring gulls, laughing gulls, least terns,

and roseate terns via USGS's Colonial Waterbird Database. A literature review was conducted to determine foraging ranges of each of these species, preferably during their breeding season. Colony size and location for each species along the US Atlantic Coast from Massachusetts to North Carolina was integrated with buffers around the colonies that correlate with the species' foraging range. Species richness across foraging ranges, population-level sensitivity and other metrics will be calculated and overlaid onto BOEM lease areas. This information can be used to focus conservation efforts and determine seabird species of heightened risk from offshore wind energy infrastructure during breeding seasons in critical nesting areas along the Atlantic Coast.

Seabird Tracking Studies

Experience the Migration of Brown Pelicans of the Chesapeake Bay

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A collaboration connecting Smithsonian Migratory Bird Center (SMBC) science with interpretive messaging and collections at the National Zoo, to inspire visitors to protect native birds and their habitats.

Visitors to the Smithsonian's National Zoo in Washington, D.C. experience Brown Pelicans as a part of the American Trail exhibit, yet many may not be aware they are a local bird. The first nesting pairs of Brown Pelicans in the Chesapeake Bay were recorded in 1987. Today, over one thousand pairs breed each summer on the marshy, iconic islands of the Eastern Shore of Maryland, having expanded northward from the southeastern United States. Banding data suggest our Chesapeake Bay pelicans spend their winters in Florida, and even Cuba, but little is known about daily habits of these birds in the Chesapeake Bay, how long into the winter they stay, or their full range of over-wintering habitats and stop-overs. To begin to answer these questions, Autumn-Lynn Harrison, Research Ecologist at SMBC initiated a new Brown Pelican project in the Chesapeake Bay this summer. In collaboration with the Wildlife and Heritage Service of Maryland Department of Natural resources, and with input from Clemson University, she deployed 5 GPS-Argos satellite tags (GeoTrak) and 1 GPS-GSM tag (Cellular Tracking Technologies) on breeding Brown Pelicans at Adam Island, Maryland in July, 2017. The results of this work will be linked with work accomplished by Pat Jodice's group at Clemson University and the USGS Co-op Unit, to gain information about movements of Brown Pelicans throughout their breeding range in the Atlantic Coast of the United States. Plans to expand the work in 2018 are pending funding, but hope to include a collaboration with Smithsonian Environmental Research Center to sample prey availability in the Chesapeake in areas of high use and low use by tagged pelicans. The movements of these birds are displayed on a public map found at www.migratoryconnectivityproject.org/livetracks/

Update on Digital VHF Telemetry Studies of Common and Roseate Terns, Piping Plovers, and Red Knots

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Since 2013, the USFWS Division of Migratory Birds, in collaboration with the University of Massachusetts, Amherst, the University of Rhode Island, and various partners have conducted BOEM-funded studies to track the movement of high-priority bird species along the U.S. Atlantic Coast using digital VHF transmitters and automated radio telemetry stations. The primary objective of these studies is to determine the extent to which Common Terns, endangered Roseate Terns, threatened Piping Plovers, and threatened Red Knots fly over Federal waters that have the potential to be developed for offshore wind energy facilities. We are currently analyzing movement data from over 150 Piping Plovers, 400 Red Knots, and 350 Common and Roseate Terns that were tagged by study partners during the past 5 years. We are modeling offshore movements relative to temporal, demographic (i.e. sex, breeding population), and atmospheric (i.e., weather) conditions. The data and results from these studies will allow for better informed decisions regarding offshore energy siting along in the U.S. Atlantic coast.

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

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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. Productivity for the five tagged birds was similar to control nests, and tracking data showed the birds flying more than 70 km round trips to forage. 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 South America. These two birds remain on the coast of French Guiana. The remaining three birds (all males) eventually made their way to Cape Cod where they staged for 4-6 weeks. Two of the terns eventually had close encounters with multiple hurricanes, apparently flying straight through (or over??) Hurricane Maria. These birds also flew to the north shore of South America. Three of the five tags continue to transmit data from French Guiana as of late October.

Distribution, Abundance, and Habitat Associations of Wintering Sea Ducks in Rhode Island

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Since 2008, RI DEM and the University of Rhode Island, along with USGS, BOEMRE, and RI CEC, have conducted research to determine the distribution, abundance, and habitat associations of wintering sea ducks in Rhode Island waters. As part of a comprehensive survey of Rhode Island's marine biodiversity to inform offshore energy development (the RI Ocean Special Area Management Plan, RI OSAMP), aerial and shipboard surveys were conducted from 2010-2012 over 3,800 km² of open water to

determine the distribution of sea ducks and other seabirds. The survey data identified inshore habitats and shallow waters (< 20 m depth) as key habitats for sea ducks, and the results of the surveys have been used to help inform the siting of the first operational offshore wind energy facility in the United States. Additionally, the project has involved individual bird-borne GPS tracking of four species of sea ducks (Common Eider, Black Scoter, Surf Scoter, and White-winged Scoter) captured on winter habitats in Rhode Island waters. The GPS location data has been used to model habitat associations for each of the four species. In addition to confirming the importance of shallow inshore waters to sea ducks, these data have identified finer-scale features selected by sea duck species, particularly areas with coarse-grained sediments and high proportions of hard-bottom habitat. Individual tracking has also confirmed that sea ducks show strong fidelity to specific winter locations, indicating the population-scale importance of Rhode Island waters to the sea ducks of eastern North America. To date, this project has produced more than five peer-reviewed scientific articles as well as numerous professional reports.

Significant Numbers of Pre-migratory Roseate Terns Stage on Cape Cod and Nantucket, Massachusetts

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The Northwest Atlantic population of the Roseate Tern (*Sterna dougallii*; ROST) was listed as “endangered” in 1987 under the US Endangered Species Act. Despite intensive efforts to protect nesting colonies, the population has sustained significant losses and gains over three decades, and has not yet achieved the abundance recovery goal of 5,000 pairs. Although historical records document large, pre-migratory flocks of ROST staging in July and August at sites in southeastern Massachusetts, spatial and temporal use of this region has not been systematically quantified. In addition, many important staging sites occur within the Cape Cod National Seashore (CCNS), a unit of the US National Park Service providing recreational opportunities for 4M visitors annually. We investigated the spatial and temporal distribution of Roseate Terns at staging sites in CCNS and Nantucket during Jul-Sep 2014-2015. We surveyed tern flocks at 16 staging sites, and recorded observations of field-readable bands used on pre-fledglings (HY) and adults at nine colony sites in the population’s breeding range. We recorded maximum mixed-species tern flocks of 8,000 terns (8% ROST) in 2014 and 10,000 terns (25.6% ROST) in 2015. The largest number of ROST documented at one location was 2,560 (12.5% HY). Approximately 76% of banded HYs (n=2,322) from all colonies was resighted at CCNS and Nantucket staging sites during 2014 and 2015. We resighted proportionally fewer HYs from colonies south and west of the staging grounds than from other colonies. Maximum flock counts and band resights show the critical importance of staging sites in CCNS to the Northwest Atlantic population of Roseate Tern. Identification of key sites within the Seashore used by terns throughout the 3 month staging season will assist CCNS in developing management strategies for protecting ROST flocks and habitat.

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

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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: 2017 Report

Contact: Dr. Jeff Spendelow, USGS-Patuxent Wildlife Research Center, JSpendelow@usgs.gov

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. While many cooperators continue to work at ROST breeding colony sites, I 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) coming from 10 colony sites in different parts of the breeding range. Some preliminary results from prior years have been presented at recent AMBCC meetings. Our 2017 SSS results appear to be considerably different in several ways from those from past years, but we were able to document that even ROSTs originally banded as chicks in Maine and Nova Scotia are 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. A combination of our relatively inexpensive (low tech) resighting studies and more expensive projects involving radio-tagged birds to record where they are in 3-dimensional space throughout the more than 4-month staging period are needed to properly judge the risk of offshore wind-energy generation to this endangered population.

Determining Fine-scale Use and Movement Patterns of Diving Bird Species in Federal Waters of the Mid-Atlantic United States Using Satellite Telemetry

Contact: Caleb Spiegel, USFWS Migratory Birds Division, caleb_spiegel@fws.gov

The Bureau of Ocean Energy Management (BOEM)-funded “Diving Bird Tracking Study” was completed in mid-2017, with the submission of a final project report (<https://www.boem.gov/BOEM-2017-069/>). Between 2012 and 2016 the study tagged and tracked nearly 250 Northern Gannets, Red-throated Loons, and Surf Scoters using PTT and GSM-GPS tags, and analyzed tracking data for over 400 individuals, making it one of the most comprehensive satellite tracking studies of marine birds ever conducted in Atlantic North America. The primary study objective was to better understand how three representative diving marine bird species used Federal waters (5.6 km from shore) of the mid-Atlantic U.S. during migration and winter, in order to inform siting decisions of offshore energy facilities (particularly wind turbines), and provide pre-construction baseline data. Major project partners included: BOEM, Biodiversity Research Institute, Memorial University of Newfoundland, USGS Patuxent Wildlife Research Center, Sea Duck Joint Venture, and USFWS. Results indicated that study species had primarily near-shore, coastal, or in-shore distributions within the focal area (NC to Long Island), with use concentrated in or around large bays (e.g., Delaware, Chesapeake, Pamlico Sound; especially at bay mouths). Northern Gannets ranged much farther offshore than the other two species. Winter use by all three species was primarily inshore of current Wind Energy Areas (WEAs) and Lease Areas. However, Northern Gannet distribution overlapped with the entirety of all WEAs and Lease Areas between North Carolina and New York. This indicates that gannets have the potential to use waters encompassed by WEAs and Lease Areas during winter. However, the entire footprint of all WEAs and Lease Areas combined made up a very small proportion (just over 4%) of the total area used by gannets in winter. All species ranged farther offshore during migrations compared to winter, with more WEAs and Lease Areas overlapping migratory distributions for each species, but small overall portions of distributions overlapping. The project also included resource selection analyses for all three species during winter, and identified locations of breeding areas and associated migratory distances traveled by the three species.

Tracking Movements and Foraging Habits of Great Shearwater

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For the past five years, Stellwagen Bank National Marine Sanctuary has been tagging great shearwater (n=60) with solar satellite tags to document habitat use and movements throughout the Gulf of Maine. The shearwaters have been caught on Stellwagen Bank or in the coastal waters east of Cape Cod. This tracking project is part of a larger collaborative effort to understand the ecological role of sand lance in this region of the Gulf. We are collecting information on molt, and collecting various samples for stable isotope analysis (i.e. feathers, exhaled gases, and blood). Results from the combined shearwater tagging efforts in New Brunswick (R, Ronconi), Maine (USFWS), and this tagging 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, Vol 574: 211-226.

Evaluation of Common Tern (*Sterna hirundo*) Collision and Distribution Risk Posed by Offshore Wind Energy Development

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This project aims to quantitatively measure collision and disturbance risk posed by offshore wind energy development on coastal Virginia breeding seabird populations using data collected through satellite telemetry. Thirteen common terns (*Sterna hirundo*) were tagged during their nesting season in June 2017 on Dawson Shoals near Wachapreague, Virginia. Existing risk models have been developed using observer survey data, which potentially overestimates the effects of wind energy sites on seabirds. By using miniaturized GPS transmitters, this project will be one of the first to utilize tracking data to create spatially-explicit collision and disturbance risk models for seabirds in the region. Residence time analyses will be conducted to analyze and determine animal movement and behavior. Home range analyses, such as kernel density or gridded utilization distributions, will be used to determine animal distribution of tagged common terns. Additionally, we will determine flight heights from on-board altimetry sensors, if data proves reliable. Collision and disturbance risk models will be created using a combination of two existing modeling frameworks to highlight areas of high and low risk from wind energy development, however preliminary data suggests that the studied population of common terns are unlikely to forage in the offshore lease areas. This project will be continued in the breeding season of 2018 and will expand to include additional species, particularly black skimmers and gull-billed terns, and similar analyses will be conducted, including risk models. This project will provide insight into minimizing collision and displacement of seabirds while developing an offshore wind energy industry in Virginia that will stimulate economic and job growth along with enhancing human and ecosystem health.

Bycatch and Disease Monitoring

Seabird Bycatch Projects - U.S. Atlantic Pelagic Longline:

Virginia Tech & NOAA NMFS, SE Fisheries Science Center (2017-2018)

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Seabirds are one of several groups of species of special concern caught as bycatch in the world's pelagic longline fisheries. Observers have monitored seabird bycatch, along with other bycatch, in the U.S. pelagic longline fishery in the Western North Atlantic since 1992, although seabird bycatch has not been the focus of their effort. From 1992 through 2016, only 158 seabirds from only about 10 species have been recorded caught, but observer monitoring has covered less than 10% of fishery effort, less than 50% of seabirds caught have been identified to species, and most of the seabirds have been recorded from a stretch of ocean along the US eastern seaboard where as many as 80 seabird species forage. Against this background, the Seabird Project at the Southeast Fisheries Science Center, NOAA National Marine Fisheries Service (NMFS), was established with funding mainly from the NMFS National Seabird

Program. This project has three broad objectives pertaining to the seabird bycatch of the U.S. Atlantic pelagic longline fleet: 1) Improving identification and other reporting aspects of individual seabird bycatch observations by the Pelagic Observer Program (POP), 2) improving analyses of POP data to better characterize the bycatch and improve annual estimates of the total fleet bycatch. Plans for addressing these objectives in Fiscal Year 2018 include upgrading and augmenting materials and approaches used in training observers at the SEFSC Miami, Florida Laboratory. New analytical methods being developed and applied by NOAA cooperators at Virginia Tech entail: 1) improving the manner in which the abnormally high number of singleton catches is handled in analyses, 2) quantifying the undercounting that occurs because of systemic loss of birds caught in the line-setting stage of the fishing operation, and 3) addressing the probability, based on relative rarity, that a seabird species has been (or will be) caught, and, if caught, that the capture will be witnessed and recorded by an observer.

Memorial University of Newfoundland Bycatch Research Program (2016 - 2017)

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Bycatch is major global concern for fishers, marine biologists and conservation organizations. Most research with bycatch has been collected on long-line fisheries in southern oceans and focused on albatrosses. In the Northern Hemisphere, the most destructive gear for non-target bycatch is the translucent monofilament gillnet, the ubiquitous gear of choice by fisheries owing to high catch rates. In 2016 and 2017, researchers from Memorial University of Newfoundland and commercial inshore fishers on the NE coast of Newfoundland engaged in a collaborative study of factors influencing the unwanted bycatching and reducing it via modifications in fishing gear and fishing activity. We compared the catch and bycatch of gillnets with high-contrast black/white high contrast warning flags with simultaneously unmodified control gillnets. Twenty tests were run with surface-set herring nets and 20 tests with deep-set cod nets. There were no differences in target catches between modified and control nets [fishers' first concern]. Seabird bycatch [gannets, murre] appears to be high [initial estimate = 3.9 birds/1000m net days] in surface-set herring gillnets which are not systematically studied. Other bycaught species in herring gillnets included SARA-listed porbeagle shark and Atlantic salmon. No birds were caught in the cod gillnets which had considerable bycatch of invertebrates including crabs, jellyfishes and corals. We also compared bycatch and catch efficacy and quality among gillnets, hand-lines and cot pots, with less bycatch and higher quality fishes from the latter two gears. We interviewed fishers about gear use and safety. We will 1) continue and expand tests with warning flags and with more crews to achieve more statistical power and wider geographic coverage, 2) attach lights to hand-lines to attempt to enhance alternate gear catches, 3) introduce and assess automated hook-and line gears, 4) study fisher behavior with different gear and assess repetitive strain and injury risk, 5) assess logbooks and engage phone surveys with DFO, and 6) continue outreach activities and address policy and management issues. Sponsors = USFWS, NRDA, NSERC, Memorial and Westfjords Universities.

Comprehensive Estimates of Seabird-fishery Interactions for the U.S. Northeast and Mid-Atlantic

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

Abstract:

1. Relatively little is known about seabird–fishery interactions (i.e. bycatch) for the U.S. Northeast and mid-Atlantic, despite concerted efforts to document observed interactions since 1989.
2. Fisheries observer data were used to estimate seabird-fishery interactions for 10 species and six gear types that operated within the US Northeast and mid-Atlantic from 1996 to 2014.
3. Hierarchical Bayes estimation was used and accounted for temporal, spatial, and operational considerations inherent in the data through post-stratification.
4. Over the 19-year study period, 48 821 (coefficient of variation [CV] = 0.03) seabirds were estimated to have interacted with commercial fishing gear, resulting in an average of 2570 interactions per year.
5. Trends in estimated interactions were explored using the marginal posterior distributions, with the majority of interactions pertaining to gillnets and shearwaters / fulmars.
6. Comparison with previous work highlighted the need for consistency in data preparation, making it easier to compare relative trends in seabird bycatch estimates for the region.
7. Future assessments should focus on providing context for the interaction estimates, so that population-level impacts can be inferred and the necessary conservation measures enacted.

Estimates of seabird bycatch are currently being updated by analysts to include data from 2015 – 2016.

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

<https://doi.org/10.1002/aqc.2812>

Determining the Source Population of Common Eiders Impacted by Wellfleet Bay Virus Using Mitochondrial DNA

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Continued annual mortality events of American common eiders (*Somateria mollissima dresseri*) during the fall migration on Cape Cod, MA, USA associated with the Wellfleet Bay virus (WFBV) have led to questions regarding the geographic origin and potential impacts (if any) of this disease on various population segments of common eiders. The relatively few band recoveries of eiders found dead on Cape Cod has included birds that were previously banded in Maine, Nova Scotia and Quebec. However, there continues to be insufficient numbers of band recoveries for use in identifying the source population(s) of eiders affected, and likely many areas across the breeding range of common eiders where banding is not occurring. Gaining a better understanding of the source population(s) of common eiders involved in these mortality events has become increasingly important given the growing concern over population trends in various portions of their range. Project Investigators: U.S. Fish and Wildlife Service, USGS Alaska Science Center, USDA/APHIS Wildlife Services, Université du Québec à Montréal, Maine Department of Inland Fisheries and Wildlife, Nova Scotia Department of Natural Resources.

Narrowing the Focus of the Wellfleet Bay Virus Investigation: Annual Movement Patterns of Satellite-Marked Common Eiders Breeding in Boston Harbor, Massachusetts, USA

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We recently concluded a 4-year (2013-16) common eider satellite tracking study in which we deployed 47 implantable satellite transmitters in male and female eiders from a Boston Harbor breeding colony. Our goal was to identify potential areas of concern for exposure or transmission of the Wellfleet Bay Virus, which has been responsible for killing over 6,000 common eiders in Cape Cod during 1998-2016. We mapped individual eider movements to identify their molting, wintering, and migration pathways and seasonal phenology. Project investigators: U.S. Fish and Wildlife Service, Biodiversity Research Institute, USGS Patuxent Wildlife Research Center, Massachusetts Department of Conservation and Recreation, Massachusetts Division of Fisheries and Wildlife, USDA/APHIS Wildlife Services, Maine Department of Inland Fisheries and Wildlife.

The Seabird Ecological Assessment Network (SEANET)

Contact: John Stanton, USFWS, john_stanton@fws.gov

In the fall of 2002, Tufts Center for Conservation Medicine / Wildlife Clinic (Tufts CCM) established SEANET, the Seabird Ecological Assessment Network (<https://vet.tufts.edu/seanet/>). The network consisted of seabird and ecological health organizations from Canada to New Jersey that was later expanded southward to Florida. This project sustained a long-term marine and coastal ecosystem health monitoring project using seabirds as sentinels that also fostered participation by citizen scientists. In 2007, an online database to store and manage SEANET survey data was created in association with the USGS National Wildlife Health Center and National Biological Information Infrastructure and with the Northeast Information Node of the NBII. Unfortunately, this online database was shut down in February 2017 because of security reasons identified by the hosting site. When the database was shutdown, greater than 14,800 individual records and 505 beach segments were described in the SEANET database. Some portion of SEANET volunteers have continued collecting SEANET survey data and have retained their field data sheets or mailed them to the interim SEANET Coordinator John Stanton. SEANET has gained a certain level of name recognition among researchers and agencies, that has helped raise the level of visibility of some of the critical issues facing our coastal/marine environment and the bird species it supports. The involvement of hundreds of citizen scientists and students has been critical in spreading our findings and an overall conservation message. An urgent need currently exists to create and manage a new SEANET online database to sustain this important project. For more information, please contact John Stanton, Interim SEANET Coordinator.

Forage Fish

Tern Vulnerability at Staging Grounds: Understanding Prey Availability

Contact: Katharine C. Parsons, Mass Audubon, kparsons@massaudubon.org

According to long-term demographic studies which demonstrate low recruitment, the NW Atlantic population of the Roseate Tern (*Sterna dougallii*) has shown a pattern historically of losing individuals during the period after fledging and before reaching sexual maturity at 3 years. The most vulnerable time in this period is when fledglings are preparing for their first migration to South America—the time they are staging with a care giving adult at locations in the region with abundant forage fish. At fledging, adult terns accompany hatch years to staging grounds and provide fish to them at roosting beaches. In time, the fledgling learns to fish for itself but is thought to remain with the adult throughout the staging and migratory periods. The nesting ecology of Roseate and Common Tern (*Sterna hirundo*)—a co-occurring species in staging flocks—has been well-studied including diet studies of birds at colony-sites. At many colony-sites and in most years, Roseate Terns have been documented to specialize on sand lance (*Ammodytes sp.*; 80+% of chick diet). In contrast, relatively little is known about foraging of staging terns. Prey availability/provisioning is likely to be a significant factor influencing successful staging of juvenile terns (evidence does not point to disturbance at staging sites), yet little is known about foraging locations, prey delivery rates, prey size or species while young birds are on staging beaches being fed by parents. In addition, there is no understanding of how a major shift in the marine community at critical staging sites on Cape Cod and Nantucket with the exponential growth of another sand lance specialist—Gray Seal (*Halichoerus grypus*)—may be impacting tern foraging. We are investigating the foraging ecology of staging Roseate and Common Terns on Cape Cod and Nantucket by documenting foraging locations, identifying prey species delivered to terns in roosting flocks, and quantifying prey size and delivery rate to staging terns.

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

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

Keenan Yakola, a Master's student with Michelle Staudinger and Adrian Jordaan at UMass Amherst and a fellow with the DOI Northeast Climate Science Center, has recently completed digitizing a historic chick provisioning dataset from seven different seabird colonies managed by the National Audubon Seabird Restoration Program and the Maine Coastal Islands NWR in the Gulf of Maine. This dataset includes data on three different tern species (Common, Roseate and Arctic) and ranges from 1986 - 2001. It adds to an already digitized set of data ranging from 2002 - 2017 expanding dietary data for some species up 30 years. This data is now being explored and summarized and soon will be incorporated into models exploring the impact of diet on nesting success and how diet may be influenced by changing environmental conditions in the Gulf of Maine

Workshop on the Ecological Role of Sand Lance

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

On May 8-9th, USFWS and NOAA hosted a 2 day workshop for 55 managers and researchers on the ecological role of sand lance in the northeast. Talks on sand lances' life history, ecosystem function, role as a forage fish, threats from climate change, and management issues were presented. Sand lance are not currently harvested in New England but are critical prey items for endangered roseate terns, humpback whales, and several other high priority species. We were able to bring two scientists from the UK to the meeting to discuss the collapse of the sand eel fishery in the UK and corresponding declines in seabird populations. Participants in the workshop are currently developing a white paper to summarize data presented at the workshop and address conservation issues for sand lance.

Multi-Topic & Miscellaneous Updates

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

Contact: Rob Ronconi, Canadian Wildlife Service, Environment and Climate Change Canada, Dartmouth, NS, Canada, Robert.ronconi@canada.ca

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. Some recent and on-going projects include the following.

- Aerial **surveys** of Razorbills (winter), phalaropes and shearwaters (autumn migration), and Common Eiders (spring breeding and august moult periods) in key locations around New Brunswick and Nova Scotia.
- Regional **tracking** of Razorbills (5 colonies) and Black Guillemots (2 colonies) using GLS to map year-round movements.
- GPS **tracking** of alcids and gulls to quantify breeding season foraging ranges.
- Spatial and habitat analysis of winter Harlequin Duck and Purple Sandpiper distribution in the Maritimes.
- Hotspot **mapping** of marine bird distributions; provision of data layers to the ECCC National Environmental Emergencies Centre.

Additional projects:

Outside of the Ocean Protection Plan, I am also involved in other seabird projects which are a result of collaborations between CWS, Bird Studies Canada (BSC), and several universities in the Maritimes region:

(1) Lead by BSC and Mount Allison University, we are developing cumulative risk assessments for breeding seabirds in Atlantic Canada. Major components of this project include an analysis of expert opinion to assess species vulnerabilities to risks, use of tracking data from 14 species to create predictive distribution models during the breeding, and collation of risk layers such as fisheries effort, vessel transportation, and oil spill risk. These components are then linked together to provide spatially explicit and species-specific cumulative risk assessments.

(2) Another major effort lead by BSC is the coordination of regional monitoring, sampling, and tracking studies of Leach's Storm-petrels across 5 sites in Atlantic Canada. This coordinated approach aims to standardize sampling across sites in order to probe the causes and consequences of recently observed population declines in this species.

(3) Lastly, CWS has undertaken four years of colour banding Herring Gulls in the Big Meadows Bog, Brier Island, in order to monitor changes in abundance and dispersal during a wetland restoration project. Coming years will shift away from banding in order to focus on a local re-sighting program.

Stellwagen Sanctuary Seabird Stewards (S4) program

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The Stellwagen Sanctuary Seabird Stewards (S4) seabird research and monitoring program has trained over 125 volunteer Stewards to help us collect, enter and quality check seabird data and provided opportunities for 12 college interns since the program's pilot season in 2011. Anne-Marie Runfola, sanctuary Volunteer Program Coordinator and Acting Deputy Superintendent, runs five standardized, strip and line transect cruises across Stellwagen Bank per year on the Research Vessel Auk and send volunteers out on 20-40 whale watch cruises a year, depending on availability, to collect non-standardized data. We have completed QAQC for 2012-2016, and Kevin Powers effort-corrected the dataset, which we will use as a crucial base layer in sanctuary research. Kevin is also helping the S4 team learn how to use R to analyze the data and run an annual report. NOAA National Centers for Coastal Ocean Science (NCCOS) accepted the S4 dataset for inclusion in the USFWS Northwest Atlantic Seabird Catalog. Recently, Kevin Powers used S4 data to ground truth the Integrative Statistical Modeling and Predictive Mapping of Seabird Distribution and Abundance on the Atlantic Outer Continental Shelf authored by Arliss J. Winship, Brian P. Kinlan, Timothy P. White, and John Christensen. S4 data will be included in these models in future. Anne-Marie Runfola worked with NOAA Office of National Marine Sanctuaries to create an S4 photo essay of photographs taken by S4 volunteers and her for Earth is Blue magazine (*see <https://sanctuaries.noaa.gov/magazine/2/stellwagen-sanctuary-seabird-stewards/>*). Anne-Marie also wrote an article on sanctuary seabirds, the S4 program, shearwater tagging and sand lance study for the Massachusetts state magazine: (*see <https://www.mass.gov/files/documents/2017/09/13/extract-masswildlife-2017-02-stellwagen-seabirds-life-in-the-open-ocean-lowres.pdf>*, Runfola, Anne-Marie. "Stellwagen Seabirds: Life in the Open Ocean." *Massachusetts Wildlife* 67 (2) (2017): 4-13).

Book on Common Loons Under Development

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I am writing a book about my 30 years (since 1988) of intermittent study of Common Loon migration, winter biology, and mortality on all three North American coasts. Chesapeake Bay will also be prominent, with a bit of Baja N. and S. (both coasts) and the Gulf of St. Lawrence (5 provinces). Science, life history, ecological process, and coastal ecosystem ecology will all be there. But I intend this to be an accessible book about The Sea, written from personal experience, in the Rachel Carson tradition. Relevant e-correspondence is welcomed.