



Ongoing Project Updates and New Project Summaries by Members of the Atlantic Marine Bird Cooperative - 2025

February 2026

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At-Sea Surveys

Vessel-based Seabird Surveys in eastern Canada

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Collaborator: Dave Fifield, Wildlife Research Division, Environment and Climate Change Canada, Newfoundland and Labrador

Project summary: The Canadian Wildlife Service (CWS) continues to conduct systematic marine bird surveys from ships-of-opportunity through the Eastern Canada Seabirds at Sea (ECSAS) program. In 2025, the program added an additional 39,000 km of data from the western North Atlantic. These data are used to identify threats to seabirds at sea, support the designation of marine protected areas, and inform emergency response and environmental damage assessments. With the emergence of offshore wind energy development in Canada, dedicated vessel surveys are now being planned for 2026. These surveys will collect systematic seabird and marine mammal observations along designed line transects. The objective is to inform offshore wind farm siting and development decisions and to support sustainable offshore wind planning and operations in eastern Canadian waters.

Northeast Canyons and Seamounts Marine National Monument Research Expedition

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Partners and affiliations:

FWS staff: Monument Superintendent, Patrick Moffett and Assistant Refuge Supervisor, Rick Nye. NOAA staff from the Greater Atlantic Regional Fisheries Office (GARFO), Northeast Fisheries Science Center (NFSC), and the Smithsonian Natural History Museum: Jim Vasslides, Cori Kane, Dave Packer, Matthew Poti, Martha Nizinski (Chief Scientist), and Emily Salonia. Delaware Museum of Nature and Science: Elizabeth Shea, ROV specimen collection and processing. Mississippi State University: Max Woolsey, Remote Operated Vehicle (ROV) Operations. Additional partners/staff included the Global Explorer ROV team, and NOAA Ship Nancy Foster Crew.

Project summary:

The goal of this project was to simultaneously complete multiple research objectives during a 14-day expedition (August 28-September 11) in the Northeast Canyons and Seamounts Marine National Monument. Research objectives included ROV exploration at Oceanographer Canyon and each of the four seamounts, Bear, Retriever, Mytilus, and Physalia, eDNA collection at each location and opportunistic collections at other stationary points, and pelagic seabird surveys within the monument and along transit routes.

Unfortunately, the combination of equipment issues with the ROV and weather shortened the expedition by three days and forced repeated transits in and out of the monument to avoid severe weather, severely impacting ROV operations. However, two ROV dives were completed, one at Bear Seamount, and the other at Hydrographer Canyon. The Hydrographer ROV dive was opportunistic due to weather/sea-state conditions but serves as a comparison site for the Monument as it is the next major canyon along the continental shelf just west of the Monument boundary.

Fortunately, the weather and equipment challenges were less impactful on the pelagic seabird surveys and eDNA collection. Seabird surveys were completed each day of the expedition, sunrise to sunset, with only brief interruptions when weather was too severe and surveyors were forced off the deck for safety reasons. In total, 28 species were documented and 530 total birds were observed. While this number may seem low when compared with terrestrial bird surveys, long spells with no sightings were limited, and the surveyors frequently had moments where it was a struggle to keep up with sightings, counts, and identifications. Highlights included a large group of Hudsonian godwit, two brown boobies well north of their normal range, and some more unusual sightings including a male and female Baltimore oriole, and an American redstart, each paying a visit to the ship's deck on separate days. The most numerous species, expectedly, were shearwaters and petrels within the Monument boundary, and a variety of gull species on the transits closer to shore.

Though weather did somewhat limit eDNA collections, the crew persevered, often completing collections in the evenings and working to process through the night. Data will take time to process and analyze, so no further information is available at this time, but collections were conducted at Bear, Physalia, and Retriever seamounts, and several other locations within and adjacent to the Monument.

Two additional expeditions are planned for the summer of 2026; one led by the Monument partners at Mystic Aquarium and the other with the NOAA/FWS science team. Each expedition will include pelagic seabird surveys and eDNA collection, while blue water dives will be conducted during the Mystic trip, and ROV operations will occur on the available NOAA ship or other contracted vessel.

2025 Northeast Fisheries Science Center Shipboard Surveys – Seabirds

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Project partner list and affiliations: Harvey Walsh Harvey.Walsh@noaa.gov

NOAA Fisheries, Northeast Fisheries Science Center

Project summary and accomplishments: Six shipboard surveys with seabird observers were completed by the Northeast Fisheries Science Center in 2025. Survey missions included Ecosystem Monitoring Surveys (EcoMon), an Atlantic Marine Assessment Program for Protected Species (AMAPPS), a Beaked Whale survey, and a larval Bluefin Tuna survey (Table 1). EcoMon cruises surveyed shelf waters of the Northeast US Shelf from Cape Hatteras, North

Carolina, to the Gulf of Maine (Figure 1). The AMAPPS, Beaked Whale survey, and larval Bluefin Tuna survey also surveyed waters from the shelfbreak to the US Exclusive Economic Zone (Figure 1). A total of 26,802 sightings of birds were recorded on the six surveys. The majority of seabird species for each cruise varied by survey season and region. The winter AMAPPS cruise (PC2501) surveyed both shelf and offshore waters. Counts were dominated by sightings of Northern Gannet (*Morus bassanus*), Dovekie (*Alle alle*), Herring Gull (*Larus argentatus*), Bonaparte's Gull (*Chroicocephalus philadelphia*), and Great Back-backed Gull (*Larus marinus*). The spring EcoMon cruise (HB2503) surveyed shelf waters and highest sightings were recorded for Sooty Shearwater (*Ardenna grisea*), Wilson's Storm-Petrel (*Oceanites oceanicus*), Cory's Shearwater (*Calonectris borealis*), Great Shearwater (*Ardenna gravis*), and Herring Gull. The three summer cruises (HB2504, PC2502, and PC2503) surveyed both shelf and offshore waters. The highest counts were for Great Shearwater, Wilson's Storm-Petrel, Cory's Shearwater, Leach's Storm-Petrel (*Hydrobates leucorhous*), and Unidentified Phalarope (*Phalaropus* spp.). The fall EcoMon cruise (PC2601) surveyed shelf waters and counts were dominated by Herring Gull, Northern Fulmar (*Fulmarus glacialis*), Great Shearwater, Northern Gannet, and Great Back-backed Gull.

Table 1. A summary of 2025 NEFSC 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 include only counts of seabirds.

Cruise	Program	Start Date	End Date	Primary Survey Area	Number of Sightings
PC2501	AMAPPS	1/6/2025	2/15/2025	Northeast US Shelf and Offshore Waters	9690
HB2503	EcoMon	5/27/2025	6/5/2025	Northeast US Shelf Waters	4006
HB2504	Beaked Whale Survey	7/4/2025	7/16/2025	Offshore Waters of the Northeast US	3276
PC2502	Larval Bluefin Tuna Survey	7/16/2025	7/22/2025	Offshore Waters of the Northeast US	1130
PC2503	EcoMon	8/1/2025	8/14/2025	Northeast US Shelf Waters	6638
PC2601	EcoMon	10/22/2027	11/7/2025	Northeast US Shelf Waters	2062

Management Applications with Large-vessel Survey Data (2010-2025) for Marine Birds in the Gulf of America (Gulf of Mexico)

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Collaborators: *Jeffrey S. Gleason*, U.S. Fish and Wildlife Service, Migratory Birds/Science Applications; *Kathy M. Hixson* and *Yvan G. Satgé*, South Carolina Cooperative Fish & Wildlife Research Unit, Department of Forestry and Environmental Conservation, Clemson University; *Timothy White*, Office of Environmental Programs, Environmental Studies Program, Bureau of Ocean Energy Management; *R. Randy Wilson*, U.S. Fish and Wildlife Service, Division of Migratory Birds; *Patrick G. R. Jodice*, U.S. Geological Survey, South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University; *Brian Spears*, U.S. Fish and Wildlife Service, Natural Resource Damage Assessment and Restoration Program; *Christopher Swingley*, ABR, Inc.

Project summary and accomplishments: For decades, the marine avifauna of the Gulf of America (= Gulf of Mexico) was poorly studied compared to outer continental shelf (OCS) regions elsewhere in North America. The Gulf provides critical breeding, staging, migration, and wintering habitats for more than 400 bird species, however, yet also qualifies as one of the most heavily-commercialized seas in the world. Information about Gulf marine birds now has even more urgency given an acceleration in industrial uses. Offshore wind energy and aquaculture are being considered alongside existing high use levels from commercial fishing, shipping traffic, and, especially, the extraction plus storage of hydrocarbons (*Figure 1*).

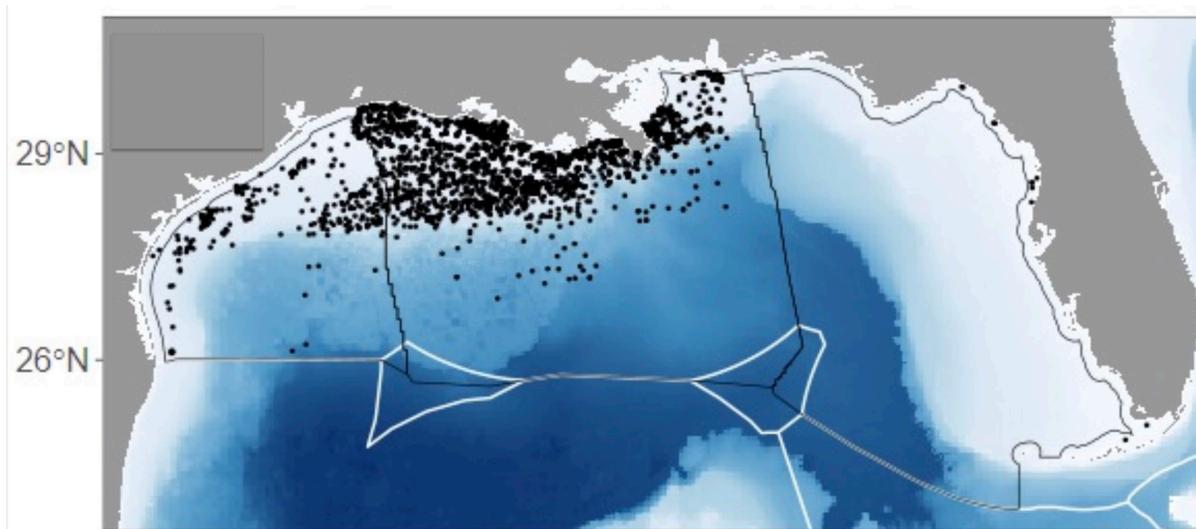


Figure 1. Anthropogenic infrastructure in the Gulf encompasses thousands of oil and gas platforms, especially in the central and western BOEM planning areas (designated by dark lines). White lines show the exclusive economic zones (EEZs) of

the U.S., Cuba, and Mexico. The basemap was constructed using the ggOceanMaps package (Vihtakari 2024) in R (R Core Team 2024).

Prompted by the 2010-2011 *Deepwater Horizon* well blow-out and oil spill, three large-vessel projects based on 300-m strip transects were completed across the northern Gulf to bridge knowledge gaps for the region’s marine birds. Supplemented with smaller projects and NOAA repositioning cruises in the eastern Gulf, this merged data set now consists of >700 on-effort survey days and >74,000 km of total survey distance. Beginning in 2023, the Gulf’s USFWS Natural Resource Damage Assessment and Restoration Program funded a project to prepare this large data set for applications to various management and conservation needs of migratory and endangered birds. The USFWS Migratory Division of Migratory Birds and BOEM Environmental Studies Program also sponsor complementary studies in the Gulf. Here we update some results from Gulf studies that were either started or completed in calendar year 2025.

Three peer-reviewed publications on Gulf marine birds reached a final, public release in 2025. Michael *et al.* (2025) reported how flying fish (**Figure 2**) play a key role in marine webs of the pelagic Gulf, linking sub-surface and aerial apex predators via a mechanism of facilitated foraging. Sooty Terns *Onychoprion fuscatus* are near-obligate commensals with tuna and act as catalysts for aggregating mixed-species flocks of marine birds over ephemeral but productive feeding hotspots wherein predatory fish drive the flying fish near the surface (**Figure 5**).

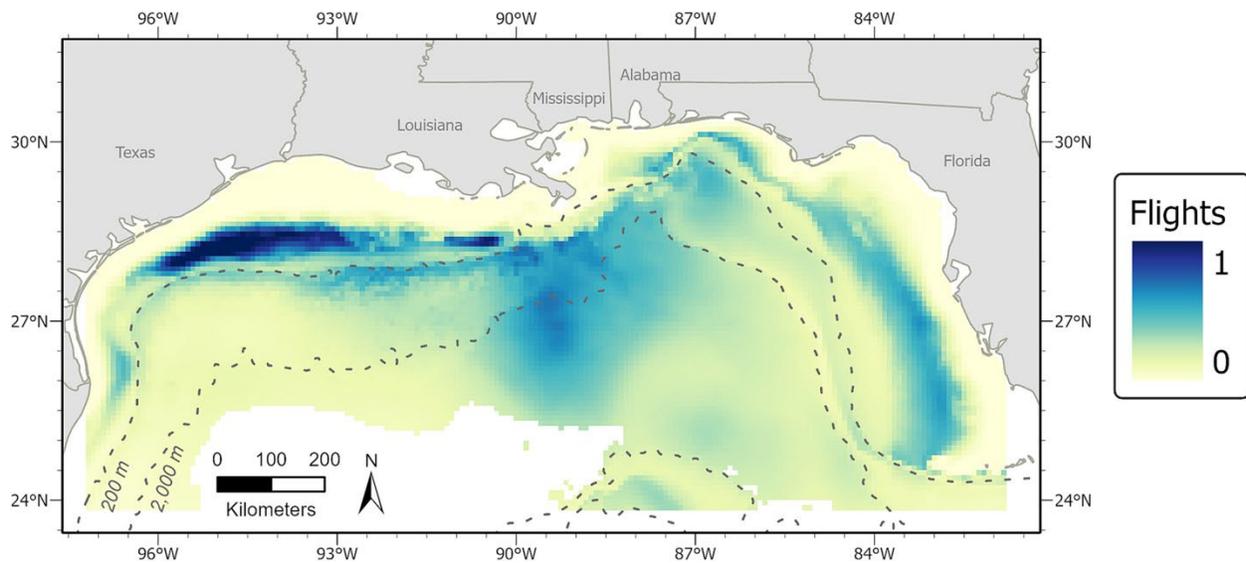


Figure 2. Predicted flying fish flights (a proxy for abundance) as derived from Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) surveys conducted in the northern Gulf of Mexico, 2017–2019. Predictions were based on a model tuned with original data and predicted based on the average value of each environmental covariate across days with survey effort. Predicted flying fish flights are scaled from 0 (low)

to 1 (high). Spatial resolution of modeled data and environmental covariates used to predict the flying fish flights is 10×10 km. See Michael *et al.* 2025.

Haney *et al.* (2025) provided the first update in a half century for relative abundance, seasonal occurrence, and distribution of 117 taxa of marine and water birds reported from the northern Gulf. That study attributed a high species richness of marine birds in the region to: (1) the temperate-to-tropical gradient facilitating diverse marine environments year-round; (2) varied geographic origins of marine bird species using the Gulf; and (3) a mostly enclosed sea basin acting as a vagrant trap for wide-ranging species. Sutherland *et al.* (2025) examined how vagrancy of marine birds from the Pacific Ocean into the Gulf may be more prevalent than typically recognized, arising from unrecognized migratory movements, tropical storm displacement, ship-following through the Panama Canal, and long-distance wandering. Gleason *et al.* (2025) gave the final summary from the marine bird surveys under the auspices of the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS).

BOEM's Environmental Studies Program sponsored several analyses for Gulf marine birds in 2025. Depending on region and federal agency, most U.S. large-vessel surveys for marine birds rely on one of three software input systems for recording field observations: *SeaLog/QAQSea*, *SeaScribe*, or *SeeBird*. Each software system has strengths (and weaknesses) not found in counterparts, however, so there is pressing need to improve capabilities, performance, and, most of all, technical support for this software. In spring 2025, we conducted a side-by-side performance test of *SeaLog* vs. *SeeBird* in the northern Gulf aboard NOAA R/V *Gordon Gunter*. Among attributes tested were: (1) ease of obtaining the software, (2) installation and operating requirements, (3) ability to customize input coding, (4) ease of initialization, speed, and troubleshooting, (5) program stability during long operating periods, (6) observation input entry speed, (7) easy of QA/QC procedures, (8) any unique functionalities, and (9) spatiotemporal resolution. Results from BOEM's 2025 field test are currently building enhanced capabilities in newer versions of survey input software (Metheny *et al.* unpublished; also ABR, Inc).

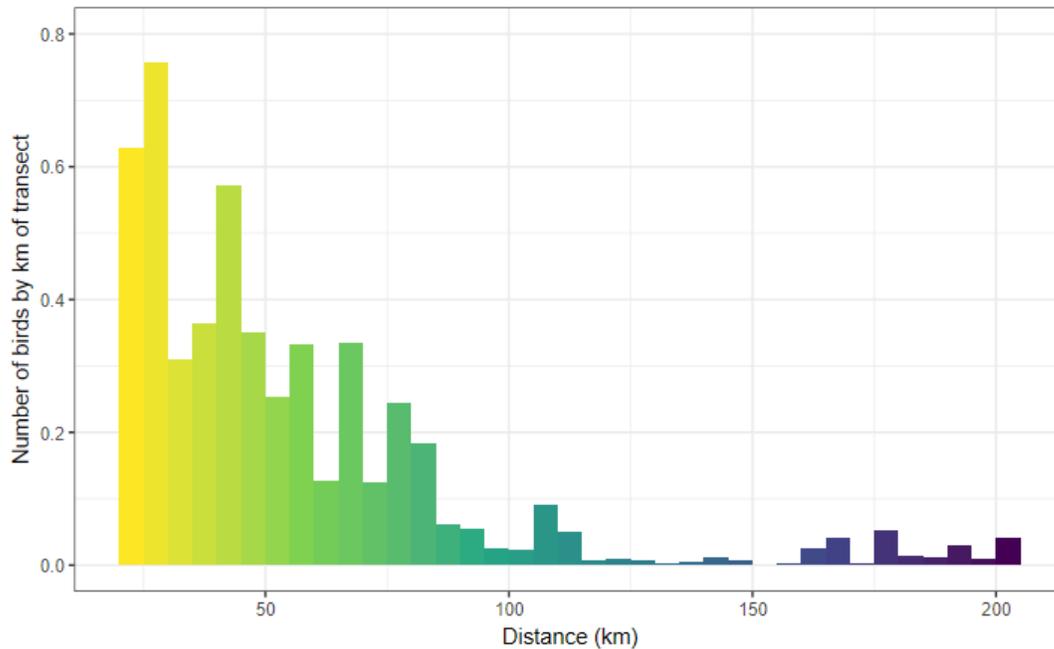


Figure 3. Relative abundances (adjusted for effort) of all marine bird species by distance from the coastline (in km) across the LATEX continental shelf in the western Gulf. The entire Gulf survey data set was screened for the best spatially-explicit information, with the best survey coverage is this instance from NRDA Bird Study 6 (2010-2011). Gulf collaborators are building out capability to use the data set for applications of any scale and location, e.g., oil spill assessment.

To help BOEM better understand energy resource planning needs in the western Gulf, we piloted several region-based analyses to test capabilities of the merged Gulf data set from all large-vessel surveys of marine birds. Desk-top analyses on the Louisiana-Texas (LATEX) continental shelf will help plan new, spatially-targeted winter surveys, especially with respect to distance offshore in the vicinity of recently-proposed BOEM energy planning and lease areas (**Figure 3**). These same analyses are also furnishing inter-disciplinary and -agency teams with better information about species composition and ranked abundance of marine birds for BOEM studies using AI-driven object identification from photographs obtained by Gulf aerial surveys.

Particularly in the Gulf, the horizontal and vertical air spaces traversed by marine birds are obstructed given the extensive ‘marine sprawl’ found in this region. Consequently, both USFWS and BOEM have supported research into the flight heights and attraction behaviors of the Gulf’s marine birds. A key advantage of routine Gulf survey protocols is collection of fine-scale locations of birds within three-dimensional space along the survey track (**Figure 4**).

Figure 4. Generic snap-shot procedure during strip transect surveys of marine birds in the Gulf. Along with bearing and flight direction, the objectives are to estimate each bird's location in both horizontal and vertical dimensions using, e.g., a hand-held range finder and the ship's deck heights, respectively.

After screening 59 candidate species, one element in this study summarized the percentage of individuals from each of 47 species attracted to offshore anthropogenic structures in the Gulf, including a breakdown by structural type (e.g., fishing vessels, channel markers, navigation buoys, oil and gas platforms). A second element analyzed avoidance vs. attraction of marine birds in proximity to the moving survey vessel. We also evaluated proportions of each species' use of different flight heights, including heights relative to hypothetical rotor-swept zones (RSZs) of offshore wind turbines. Initial work has been completed to a full draft stage in preparation for a journal submission (Haney *et al.* in review). Future work will explore how wind speed, wind direction, and other environmental co-variates may shape the flight heights used by Gulf marine birds.

Gulf marine bird survey programs represent considerable investments by federal agency sponsors, the Departments of Interior (USFWS, BOEM, USGS) and Commerce (NOAA). From the outset, field experiences revealed that the Gulf environment, its marine avifauna, survey vessels, and technology then available all combined to create unique conditions under which survey methodology could be implemented. Those conditions required Gulf marine bird programs to implement certain adaptations to improve survey efficiency in this OCS region.

Consequently, we created a protocol manual that preserves a permanent, replicable history of Gulf survey methodology (Haney *et al.* unpublished). The manual will facilitate continuity with other, large-vessel projects that may be conducted either in or outside the region. A secondary objective of this manual is to describe why and how program *SeeBird* was applied and adapted specifically for operating in Gulf survey conditions. As of late 2025, the user guides for software program *SeeBird* were no longer accessible, so this Gulf manual serves to address that deficiency as well. The protocol manual is awaiting final agency review prior to its release on the web where it can be freely downloaded by the public.

Project Accomplishments:

Peer-reviewed publications and reports (final release in 2025)

Gleason, J. S., A. L. Sussman, K. L. Davis, J. C. Haney, K. M. Hixson, P. G. R. Jodice, J. E. Lyons, P. E. Michael, Y. G. Satgé, E. D. Silverman, E. F. Zipkin, and R. R. Wilson. 2025. Gulf of Mexico Marine Assessment Program for Protected Species (GOMMAPS): seabird surveys in the northern Gulf of America, 2017–2020. U.S. Department of the Interior, Bureau of Ocean Energy Management, New Orleans, LA. 301pp. Obligation No.: M17PG00011. Report No.: BOEM 2025-026. https://espis.boem.gov/Final%20Reports/BOEM_2025-026.pdf

Haney JC, Michael PE, Gleason JS, Wilson RR, Satgé YG, Hixson KM, Jodice PG. 2025. Relative abundance, seasonal occurrence, and distribution of marine birds in the northern Gulf of Mexico. *Marine Ornithology* 53: 171–188. <http://doi.org/10.5038/2074-1235.53.1.1634>

Michael PE, Haney JC, Gleason JS, Hixson KM, Satgé YG, Jodice PG. 2025. Flying fish habitat and co-occurrence with seabirds in the northern Gulf of Mexico. *Fisheries Oceanography* 34: e12712. <https://doi.org/10.1111/fog.12712> (see also **Figures 1 & 2**)

Sutherland KE, Metheny NJ, Haney JC. 2025. First US Atlantic record of Nazca Booby *Sula granti*, with implications for vagrancy by Pacific seabirds into the Gulf of Mexico. *Marine Ornithology* 53: 165–169. <http://doi.org/10.5038/2074-1235.53.1.1632>

Conference abstracts and project presentations (prepared or submitted in 2025)

Gleason, J.S., J.C. Haney, P.E. Michael, Y.G. Satgé, R.R. Wilson, and P.G.R. Jodice. 2026. Co-production to inform transboundary management of seabirds in the Gulf of America. Gulf of America Alliance Conference, May 4-7, 2026, Mobile, AL.

Gleason, J.S., P.E. Michael, J.C. Haney, K.M. Hixson, Y.G. Satgé, R.R. Wilson, and P.G.R. Jodice. Non-marine avifauna observed during seabird vessel surveys in the northern Gulf. Gulf of America Alliance Conference, May 4-7, 2026, Mobile, AL.

Haney, J.C., and P.E. Michael. 2026. Consequences of low statistical power for corroborating mitigation of adverse impacts during offshore wind energy development. State of the Science on Offshore Energy, Wildlife, and Fisheries, June 8-11, 2026, Stony Brook, NY.

- Haney, J.C., P.E. Michael, J.S. Gleason, Y.G. Satgé, R.R. Wilson, and P.G.R. Jodice. 2026. Obstructed waters: flight heights and attraction to man-made structures by marine birds in a sub-tropical, industrialized sea. 4th World Seabird Conference, September 7-11, 2026, Hobart, Tasmania, Australia.
- Michael, P.W., J.C. Haney, Y.G. Satgé, R.R. Wilson, J.S. Gleason, and P.G.R. Jodice. 2026. Seabird abundance with proximity to vessel: attraction and avoidance in sub-tropical species in the Gulf of America (Gulf of Mexico). State of the Science on Offshore Energy, Wildlife, and Fisheries, June 8-11, 2026, Stony Brook, NY.
- Michael, P.E., J.C. Haney, Y.G. Satgé, R.R. Wilson, J.S. Gleason. 2026. Seabird flight height profiles and association with offshore infrastructure: 435 days of vessel-based observations and insights. 52nd Annual Meeting of the Pacific Seabird Group, February 23-27, 2026, virtual and on-line.
- Michael, P.A., J.C. Haney, J.S. Gleason, K.M. Hixson, Y.G. Satgé, and P. Jodice. 2025. Flying fish habitat and co-occurrence with seabirds in the northern Gulf of Mexico. 52nd Pacific Seabird Group/Waterbird Society Annual Meeting, January 6-9, 2025, San José, Costa Rica.
- Reports, manuscripts, other Gulf marine bird-related documents (full draft finalized in 2025)
- Haney, J.C., P.E. Michael, J.S. Gleason, P.G.R. Jodice, Y.G. Satgé, and R.R. Wilson. In review. Vessel surveys for marine birds in the Gulf of America (Gulf of Mexico): protocol manual (2017-2025). U.S. Department Interior. Unpublished report. 70 pp. + ix with appendices.
- Metheny, N., A. Black, and J.C. Haney. In review. *SeeBird* vs. *SeaLog*: a side-by-side comparison of survey software performance capabilities. Unpublished report. 15 pp.
- Haney, J.C., P.E. Michael, Y.G. Satgé, J.S. Gleason, R.R. Wilson, and P.G.R. Jodice. In review. Obstructed waters: flight heights and attraction to man-made structures by marine birds in a sub-tropical, industrialized sea. Unpublished manuscript, v2.0. 32 pp. with 4 tables, 5 figures.



Figure 5. A feeding flock of Sooty Terns *Onychoprion fuscatus* circles over tuna in offshore waters of the Gulf of America (= Gulf of Mexico). This species figures prominently in several recent projects that are described in this report, including a published study of Gulf flying fish as well as a species-wide analysis of marine bird flight heights and attraction to anthropogenic structures in the region. Photo by *J. Christopher Haney*.

Gulf of Mexico Marine Assessment Program for Protected Species (GOMMAPPS): Seabird Surveys in the Northern Gulf of Mexico, 2017–2020

Project Contact: *Jeff Gleason, Gulf of Mexico Migratory Bird Coord., USFWS R4 Migratory Birds Program, jeffrey_gleason@fws.gov

Collaborators: Jeffrey S. Gleason^{1*}, Allison L. Sussman², Kayla L. Davis^{3,4}, J. Christopher Haney⁵, Kathy M. Hixson^{6,7}, Patrick G. R. Jodice^{6,8}, James E. Lyons², Pamela E. Michael⁵, Yvan G. Satgé⁶, Emily D. Silverman^{9,10}, Elise F. Zipkin³, R. Randy Wilson¹¹

Collaborator Affiliations: ¹ U.S. Fish and Wildlife Service, R4 Migratory Birds Program, Chiefland, FL; ² U.S. Geological Survey, Eastern Ecological Science Center, Laurel, MD; ³ Department of Integrative Biology, Ecology, Evolution, and Behavior Program, Michigan State University, East Lansing, MI; ⁴ University of Saskatchewan, Department of Biology, Saskatoon, Saskatchewan, CANADA; ⁵ Terra Mar Applied Sciences, Washington, D.C.; ⁶ South Carolina Cooperative Fish & Wildlife Research Unit, Department of Forestry and Environmental Conservation, Clemson University, Clemson, SC; ⁷ Accepted new position with Portland State University, Portland, OR; ⁸ U.S. Geological Survey, South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University, Clemson, SC; ⁹ U.S. Fish and Wildlife Service, Migratory Bird Program, Branch of Monitoring and Data Management, Laurel, MD; ¹⁰ Accepted

new position within DOI, ¹¹ U.S. Fish and Wildlife Service, R4 Migratory Birds Program, Grenada, MS

Project Summary: Research was conducted in the northern Gulf of Mexico (nGOM) from the coastline out to ~50 nm (for aerial surveys) and from the continental shelf out to the EEZ between roughly 81° and 98° W and 24° and 31° N. We utilized experienced seabird observers aboard USFWS Kodiak amphibious aircraft and NOAA Vessels of Opportunity to document distribution and abundance of seabirds across seasons and across the three BOEM planning areas in the nGOM. From the aerial survey platform, we also collected data on wintering waterfowl, marine mammals, and sea turtles, and from the vessel survey platform, we also collected data on non-marine birds, marine mammals, and flying fish. Aerial seabird observers detected and recorded a total of 52 species of birds with representatives from five taxonomic groups: 23 seabird species, 15 waterfowl species, 10 wading bird species, 3 raptor species, and 1 shorebird species. Vessel seabird observers recorded 1,345 detections of 6,980 birds classified as non-marine avifauna representing 77 species. Vessel seabird observers recorded 9,347 detections of 44,029 seabirds representing 44 species; 47 species of seabirds were identified across survey platforms, years, and seasons. Seabird observations accounted for 87.4% of all avifauna detections, 86.3% of all individual birds, and 39.3% of all birds identified to species. Species composition differed among years and between seasons irrespective of survey platform. Predictive models of species distribution and abundance and the relative influence of a suite of environmental covariates varied considerably depending on the survey platform and model used, season, and species or guild. The inclusion of individual environmental covariates within a predictive modeling framework should be evaluated at the species-level within a specific season ensuring there is spatio-temporal overlap of environmental covariates with seabird observations. Observations of the federally listed (endangered under ESA) Black-capped Petrel (*Pterodroma hasitata*) collected during this study represents a major improvement in our knowledge of at-sea distribution for this species.

BOEM Final Report:

Gleason, J. S., A. L. Sussman, K. L. Davis, J. C. Haney, K. M. Hixson, P. G. R. Jodice, J. E. Lyons, P. E. Michael, Y. G. Satgé, E. D. Silverman, E. F. Zipkin, and R. R. Wilson. 2025. Gulf of Mexico Marine Assessment Program for Protected Species (GOMMAPPS): seabird surveys in the northern Gulf of America, 2017–2020. U.S. Department of the Interior, Bureau of Ocean Energy Management, New Orleans, LA. 301pp. Obligation No.: M17PG00011. Report No.: BOEM 2025-026. Available at: https://espis.boem.gov/Final%20Reports/BOEM_2025-026.pdf

Peer-reviewed Publications:

Davis, K. L., E. D. Silverman, A. L. Sussman, R. R. Wilson, and E. F. Zipkin EF. 2022. Errors in aerial survey count data: identifying pitfalls and solutions. *Ecology and Evolution* 12(3): <https://doi.org/10.1002/ece3.8733>

Haney, J. C., P. E. Michael, J. S. Gleason, R. R. Wilson, Y. G. Satgé, K. M. Hixson, and P. G. R. Jodice. 2025. Relative abundance, seasonal occurrence, and distribution of offshore marine birds

in the northern Gulf of Mexico. *Marine Ornithology* 53:171-188. <http://doi.org/10.5038/2074-1235.53.1.1634>

Jodice, P. G. R., P. E. Michael, J. S. Gleason, J. C. Haney, and Y. G. Satgé YG. 2021a. Expanding the marine range of the endangered black-capped petrel *Pterodroma hasitata*: occurrence in the northern Gulf of Mexico and conservation implications. *BioRxiv*: <https://doi.org/10.1101/2021.01.19.427288>

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Davis, K. L., et al. 2026. Evaluating waterbird distribution and abundance to inform resource management: long-term monitoring insights from the Gulf of Mexico. In Prep. Target journal: TBD

Gleason, J. S., P. E. Michael, J. C. Haney, K. M. Hixson, Y. G. Satgé, R. R. Wilson, and P. G. R. Jodice. 2026. Opportunistic at-sea observations of non-marine birds in the northern Gulf (2017–2019). In Prep. Target journal: *Southeastern Naturalist* or *Birds* (MDPI)

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<https://www.ncei.noaa.gov/archive/accession/0247205>

DOI Minted: <https://doi.org/10.25921/vyg0-tv44>

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Vessel survey, NCEI Accession 0247206:

<https://www.ncei.noaa.gov/archive/accession/0247206>

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Colony Management and Monitoring

Seabird monitoring at Machias Seal Island, New Brunswick

Primary Contact: Heather Major, University of New Brunswick, hmajor@unb.ca

At Machias Seal Island (MSI), 2025 marked the 31st consecutive year of research and monitoring of the seabird community. MSc student Daniel Olikier was crew lead and MSc students Maddy Talpt and Clare Taylor worked with him. Breeding success of alcids was near our long-term averages and phenology was once again earlier than recent years. Chick diet was mostly composed of sandlance and herring. Arctic Terns had no reproductive success; adult terns were easily flushed off their nests and displayed very little aggression. We deployed 27 GLS tags on adult Common Murres, 35 on fledgling Common Murres, and 20 on adult Razorbill. We retrieved 16 GLS tags deployed in 2024 and 2025 from adult Razorbill.

Manx Shearwater status update, Lawn Islands Ecological Reserve, Newfoundland and Labrador, Canada

Primary Contact: Carina Gjerdrum, Canadian Wildlife Service, Environment and Climate Change Canada, carina.gjerdrum@ec.gc.ca

Collaborators: Sabina Wilhelm and Chris Ward, Canadian Wildlife Service, Environment and Climate Change Canada, Newfoundland and Labrador

The Manx Shearwater is the northernmost breeding species of any shearwater, with the majority of the global population (approximately one million individuals) breeding in the eastern North Atlantic. In North America, a small breeding colony was discovered in 1977 on Middle Lawn Island, Newfoundland and Labrador; this remains the only known breeding colony in Canada. The breeding population was estimated at approximately 360 individuals at its peak in 1981 but has declined substantially since that time. During surveys conducted in June 2025, a total of 20 potential shearwater burrows were identified, of which only eight showed evidence of occupancy (e.g., feathers, eggs, or birds). Five of these burrows contained relatively fresh carcasses of adult birds. Necropsy results later confirmed that mortality was caused by a mammalian predator, most likely American mink. Without active predator management on Middle Lawn Island (planned for 2026), the long-term viability of Canada's only breeding population of Manx Shearwaters remains highly uncertain.

Examining Tern Chick Diets and Camera-Based Provisioning Monitoring in Buzzards Bay, Massachusetts

Primary Contact: Sarah Guitart, University of Massachusetts, sguitart@umass.edu

Collaborators: Michelle Staudinger, School of Marine Sciences, Darling Marine Center, University of Maine, michelle.staudinger@maine.edu, Carolyn Mostello, Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, Ian Nisbet

Project Summary: For my Master's research, I tested motion-triggered Browning® trail cameras and GoPro® video-recording cameras against the standard in-person monitoring protocol on a mixed Roseate (*Sterna dougallii*) and Common Tern (*Sterna hirundo*) colony on Bird Island, Massachusetts, during the 2022 and 2023 field seasons. To measure camera

performance, I monitored six nests per tern species simultaneously with trail cameras, GoPros, and in-person observers, and developed utility metrics that quantified each of the three method's effectiveness in capturing different components within chick provisioning monitoring protocols. In-person observation produced the most comprehensive data and more often determined delivery fate (successful or unsuccessful delivery to chicks) for the most nests in this study and cost less money than the camera-based methods. However, the GoPro® continuous video recording captured the most prey deliveries, and both camera-based methodologies provided post-hoc identification and the possibility of more accurate prey size estimates and increased identification of novel or infrequently delivered prey. This study demonstrated that, with adjustments, GoPro® cameras can provide colony managers with similar data to in-person Observers, and that while the trail camera technology likely cannot replace in-person chick provisioning monitoring, their field-hardiness could provide important insight into prey diversity. I used the diet data collected through visual monitoring to compare how Bird Island Common Tern chick diets in 2022 and 2023 differ from diets collected in 1971 and 1992. Prey diversity, delivery rates, and sand lance (*Ammodytes* spp.) and herring (*Clupea* and *Alosa* spp.) occurrence varied significantly among the years, which reflects the interannual variability in Common Tern diets demonstrated throughout the literature. I identified that shrimp was a declining prey group, with lower frequency of occurrence in chick diets as the years progressed, and that squid was an emergent prey group, with higher frequency of occurrences in 2022 and 2023 chick diets. These trends are consistent with other studies that summarized Common Tern chick diets at Bird Island, and reinforces the need for consistent, long-term diet monitoring to identify trends in prey consumption.

Lastly, I collected dropped prey items at Bird and nearby Ram Island in 2022 and 2023 and compared nutritional quality among herring, sand lance, squid (*Loliginidae* spp.), and Atlantic Silverside (*Menidia menidia*). Herring and silversides had significantly lower mean percent lipids per sample than sand lance and squid, significantly lower mean percent proteins than sand lance, squid, and silversides, and significantly lower energy densities than sand lance and squid. This contradicts much of the available literature on herring nutritional quality. The difficulties in identifying late larval to early juvenile herring to species, as well as the variability in nutritional quality of sand lance and squid within the literature, indicates the need for further research on this subject. This study demonstrates that apparent foraging adaptations and high-quality emergent prey groups may be mitigating possible negative population-level impacts for tern colonies in the northeast.

Data releases and potential publications will be announced at a later date. Contact Michelle Staudinger for questions regarding data release.

Great Gull Island Colony Monitoring and Management

Primary Contacts: Peter Paton, Univ of Rhode Island, ppaton@uri.edu, Margaret Rubega, Univ of Connecticut, margaret.rubega@uconn.edu, Joan Walsh, Am Museum of Natural History jwalsh@amnh.org

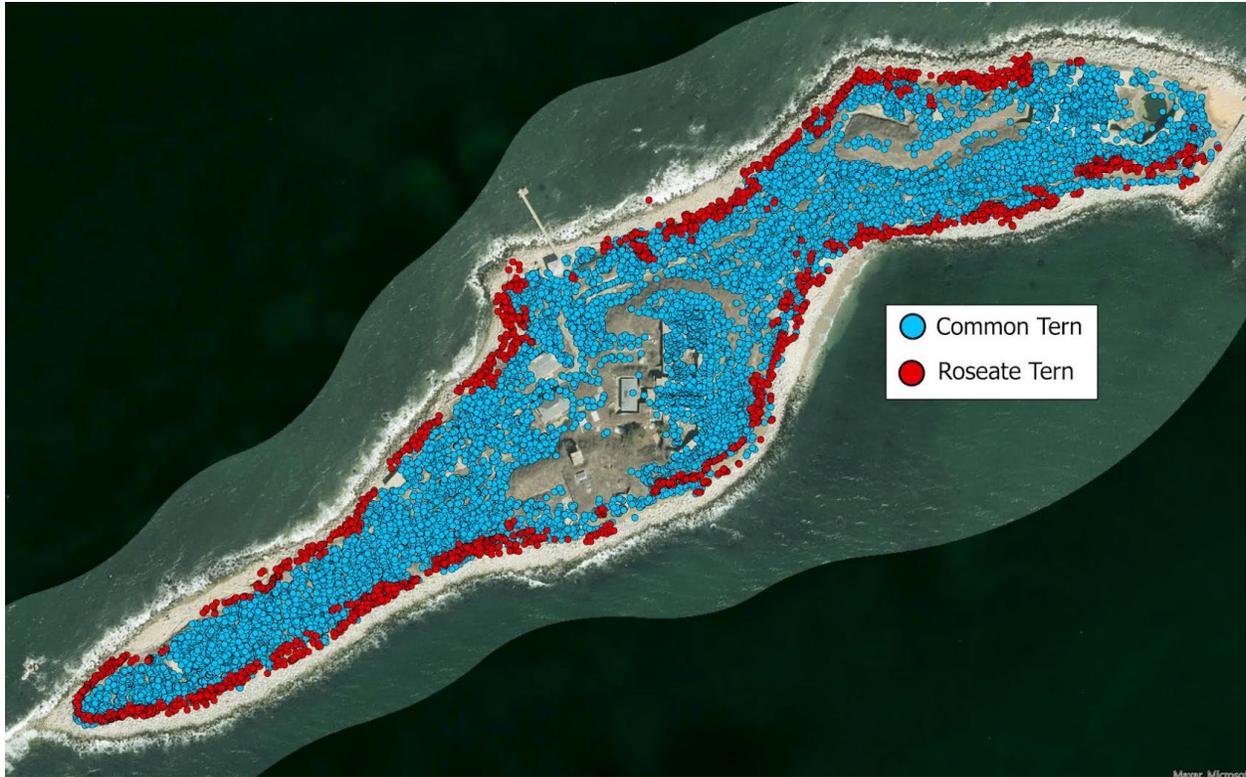
Collaborators: Juliet Lamb, The Nature Conservancy Juliet.lamb@TNC.org, Johanna Harvey Univ of Rhode Island j_harvey@uri.edu

Project Summary: Great Gull Island, NY, is 17 acres and a former US Army fort until 1949, when the American Museum on Natural History was awarded the island. The first Conservation

Plan for the island was completed in 2025 by Joan Walsh and Margaret Rubega (see www.greatgull.org) In 2025, 28 biologists conducted the bi-annual census of breeding Common Terns on Great Gull Island, New York, and documented 11,190 nests. Mean productivity for Common Terns in 2025 was 1.09 ± 0.58 fledglings per nest, while Roseate Terns had a mean productivity of 1.45 ± 0.5 fledglings per nest; both estimates were based on observing banded chicks until fledging. A crew of 5 biologists censused breeding Roseate Tern nests and counted 2,331 nests, which was a record high count since active research has been conducted on Great Gull since 1949. In 2025, Margaret Rubega and crew members conducted extensive work was done to control invasive plant species on the island and restore tern nesting habitat. Crews spent 431 hours in blinds in 2025 resighting banded Roseate Terns and detected 1,394 unique individuals, which included birds originally banded at colonies from Connecticut to Canada. These resight data will be used to assess apparent survival rates of Roseate Terns on Great Gull. Working with Juliet Lamb, 20 Common Terns and 24 Roseate Terns were tagged with GPS transmitters to track their breeding and post-breeding movements, with individuals regularly foraging at Montauk at the eastern tip of Long Island (~25 km) and Block Island (~45 km). Johanna Harvey sampled captured Common Terns for diseases and coordinated sampling of carcasses. Jess Espinosa completed her PhD at UConn, studying the potential impact of sea level rise on tern nesting habitat, and explored the use of nest boxes to enhance nesting habitat for Roseate Terns.



Common Tern chicks on Great Gull, note plastic field readable bands. P. Paton



Locations of 11,190 Common Tern and 2,331 Roseate Tern nests censused in 2025 on Great Gull Island, NY. Map created by Alison Koczek (USFWS Coastal Program)

Waterbird Research on Poplar Island

Primary Contact: Diann Prosser, USGS Eastern Ecological Science Center, dprosser@usgs.gov

Partners: USFWS, USACE, Maryland Environmental Service, Maryland DNR

Project summary: We continue to work to understand how management and research activities impact colonially nesting waterbirds.

Our team continues to conduct a variety of research with colonially nesting waterbird species on Poplar Island, a beneficial dredge use project in the Chesapeake Bay. Our first umbrella of work includes efforts to understand reproductive success and breeding ecology at this site. We are currently working to develop multi-state models aimed at improving nest success estimates for Common Terns relative to more traditionally used proportional hazard models with provisional results indicating marked improvement in model precision. We hope to make these methods available in 2026. The second major umbrella of our work focuses on exploring how management activities impact success of focal species. Following major predation over recent seasons, we will be working to explore approaches to reduce impacts from Black-crowned Night Herons and other avian predators, along with a pilot effort to assess suspected predation of tern nests by white-tailed deer. We will continue exploring efficacy of management activities as opportunities and challenges arise. Finally, we conducted sampling efforts to assess the exposure

of non-traditional waterbirds to avian influenza. For instance, while antibodies remain prevalent in Double-crested Cormorant we detected no active infection and no antibodies in Common terns at either of Maryland's two primary breeding colonies.

Colonial Seabird Monitoring and Conservation in Atlantic Canada

Primary Contact: Sabina Wilhelm, Canadian Wildlife Service, Environment and Climate Change Canada, sabina.wilhelm@ec.gc.ca

In 2025, the Canadian Wildlife Service updated population trends and/or productivity of Black-legged Kittiwakes, Common Murres, Thick-billed Murres, Northern Gannets and Razorbills at various important breeding sites in eastern Newfoundland, including Baccalieu Island, Funk Island and the Cape St. Mary's Ecological Reserves. We also continued to indirectly monitor Atlantic Puffin productivity in the Witless Bay Ecological Reserve through data collected from rescued fledglings found stranded through the Puffin Patrol.

The cliffs of Cape St. Mary's were photographed by boat, and analyses are still underway for Black-legged Kittiwakes, Common and Thick-billed Murres, and Razorbills. However, direct counts from boat-based survey around Baccalieu Island revealed significant changes to the cliff-nesting seabird population since the last survey was conducted in 2012. Most notably was the relative absence of murres and kittiwakes. We counted only 448 individual Common Murres (down from 1,441 individuals in 2012) and no Thick-billed Murres (survey in 2012 counted 73 individuals); most of the Common Murres were observed in crevice-nesting habitat. We counted a total of 1,719 pairs of kittiwakes (down from 5,096 pairs in 2012) and these were mainly concentrated in two colonies with the largest (~1,200 pairs) below and just south of the Northern Gannet colony and a smaller one (~370 pairs) north of Woody Cove. While circumnavigating the island, we counted 13 Bald Eagles (immatures and adults). Similar to what was observed in the Witless Bay Ecological Reserve in 2024, we suspect that the presence of large numbers of eagles is having a negative impact on the population of cliff-nesting seabirds on Baccalieu Island. Conversely, the number of crevice-nesting Razorbills has increased significantly on Baccalieu Island, with notable large rafts of birds occurring around the island; we estimated the total breeding population at ~2,500 individuals compared to ~ 400 pairs in 2012.

The Newfoundland Northern Gannet breeding population (spread over three colonies: Funk Island, Baccalieu Island and Cape St. Mary's) continues to show signs of recovery following mass mortalities of adults from the Highly Pathogenic Avian Influenza outbreak in 2022. The 2023 survey documented a decline of -42% from its peak population size of 29,050 pairs in 2018; in 2025, the population size totaled 20,450 pairs, representing a -30% decline from 2018. Breeding success of gannets obtained from aerial photographs in 2025 was deemed high on Funk Island (0.78 fledged chicks/nest) but low on Baccalieu Island (0.58 fledged chicks/nest).

Black-legged Kittiwakes experienced above average breeding success in eastern Newfoundland in 2025 with 0.95 fledgers/nest observed at Cape St. Mary's and 0.93 fledgers/nest on Gull Island in Witless Bay Ecological Reserve. In contrast, during the latter part of the Atlantic Puffin's fledging period, we observed a mass starvation event affecting chicks in the Witless Bay Ecological Reserve, resulting in very few fledglings being found stranded through the Puffin

Patrol (despite high search effort). Further, the mean body mass of fledglings found in 2025 was the lowest (210 grams) since monitoring began in 2011.

Atlas of Breeding Sites for Waterbirds in the Northern Gulf of Mexico is now publicly available

Primary Contacts: Patrick Jodice, U.S. Geological Survey South Carolina Cooperative Fish and Wildlife Research Unit, pjodice@clermson.edu.

Collaborators: Yvan Satgé, Clemson University; Kathy Hixson, Clemson University; Jeff Gleason, U.S. Fish and Wildlife Service.

The Atlas of Breeding Sites for Waterbirds in the Northern Gulf of Mexico is now publicly available at <https://experience.arcgis.com/experience/5b50ef24f8a94e8ebbf3bc4810c0356e>. The online tool aims at facilitating the management of waterbirds along the Gulf coast. The atlas integrates existing data from 2010 to 2022, including 38 datasets from 9 data providers, representing more than 44,000 surveys of 42 breeding species at 1,740 sites in all five coastal states. We build the Atlas in the ArcGIS Online environment, with all data manipulations done in R; R scripts are available at this link: <https://doi.org/10.5066/P14SQSCU>. We encourage first-time users to read the Atlas methodology (available under the Methodology tab in the top-right corner of the page).

With the expansion of marine energy development in state and federal waters of the Gulf, a coast-wide spatial inventory of breeding sites was needed to support habitat management, monitoring and research, as well as marine spatial planning, oil spill response plans, and post-*Deepwater Horizon* oil spill restoration. This resource can now provide critical contemporary information to understand the distribution and status of breeding waterbirds in the northern Gulf.

Atlas of Breeding Sites for Waterbirds in the Northern Gulf of Mexico

Version 1.2 April 2024

- Background and objectives

The coastal zone of the northern Gulf of Mexico is a complex system of bays, estuaries, beaches, tidal marshes, and barrier islands with substantial freshwater input. Stretching from the south Texas coast to the Florida Keys, these coastal habitats range from subtropical to temperate, and from xeric to mesic. The coastal zone of the northern Gulf also supports a diverse array of breeding nearshore seabirds (also often referred to as beach-nesting birds or colonial waterbirds) and wading birds, collectively referred to as 'waterbirds'. Most of these species are colonial and nest on islands, marshes, mainland beaches, or human-made structures. Although nest-site fidelity is common among these species, the dynamic nature of the coastal zone in the northern Gulf (and elsewhere in the southeastern U.S.) can result in inter-annual shifts in the locations of colonies and in the existence, size, or stability of the islands or habitats that support them. Such changes can subsequently affect not only the location of breeding sites, but also the population size or structure, as well as likely foraging locations. Overlaid on this dynamic system is a stakeholder network responsible for management of these species and their breeding habitats that includes natural resource agencies from five states, multiple federal agencies (e.g., USFWS, NPS, BLM, DOD, ACOE), and numerous private organizations (e.g., National Audubon Society, American Bird Conservancy, The Nature Conservancy).

In an effort to coordinate and facilitate the management and conservation of avian taxa throughout this wide range of habitats and across this complex network of stakeholders, the Gulf of Mexico Avian Monitoring Network (GoMAMN) released strategic monitoring guidelines. The guidelines included assessments of ecological drivers and management actions, and suggested approaches for long-term monitoring including the need for a spatial inventory of breeding sites. Currently, there is no single source of information for nesting sites of either seabirds or wading birds in the northern Gulf of Mexico that is both contemporary and/

species	2010	2011	2012	2013	2020
White Pelican	150	740	500	370	
Tring	85	35	57	41	
Wading	7300	11500	12200	14500	
Red Night-Heron	640	530	630	750	

The Atlas of Breeding Sites for Waterbirds in the Northern Gulf of Mexico is an open-access resource mapping the breeding locations of coastal breeding waterbirds in the northern Gulf of Mexico. (Y. Satgé).

Colonial Waterbird Management and Monitoring in North Carolina

Primary Contact: Carmen Johnson, NC Wildlife Resources Commission,
carmen.johnson@ncwildlife.org

Collaborators: Lindsay Addison, Audubon North Carolina; Elizabeth Pinnix, Paul Gillikin, North Carolina Coastal Reserve; Jon Altman, Chelsey Stephenson, Will Thompson, Paul Doshkov, Amy Thompson, National Park Service, Cape Lookout National Seashore, Cape Hatteras National Seashore; Brian VanDruten, U.S. Fish and Wildlife Service, Pea Island National Wildlife Refuge; Kip Futch, Jake Vitak, North Carolina State Parks, Fort Fisher State Recreation Area, Hammocks Beach State Park; Hailey Grossman, U.S. Marine Corps Camp Lejeune.

Project summary: Agencies and NGOs around the state post signs and, where needed, symbolic fencing at colonies across the state annually. The majority of nesting colonial waterbirds are within these protected areas. Level of monitoring varies by site, with Least Terns counted annually statewide and several partners counting pairs or nests of other species annually as well. Predator management takes place at most managed barrier islands, primarily to address coyotes and raccoons. Vegetation management occurs at two dredge-material islands on the Cape Fear River. Two of the sites, south Wrightsville Beach and Emerald Isle, have volunteer bird steward programs that conduct onsite outreach to the public. When possible, site managers coordinate with the USACE for the beneficial placement of dredged material on bird-nesting islands.

Cooperative Roseate Tern Metapopulation Project (CRTMP)

Primary Contact: Dr. Jeff Spendelow, Emeritus Research Wildlife Biologist, USGS,
JSpendelow@usgs.gov

Partners: Nova Scotia: Julie McKnight & Jen Rock (EC-CWS), Shawn Craik (Université Sainte-Anne); Maine: Paula Shannon, Keenan Yakola & Don Lyons (National Audubon Society's Seabird Research Institute); NH: Liz Craig (Shoals Marine Lab); MA: Kacey Srubas (USNPS Cape Cod National Seashore [CCNS]), Eileen McGourty (USFWS Monomoy NWR), Shea Fee (The Trustees), Carolyn Anderson & Silas Beers (Biodiversity Works); NY: Peter Paton, Margaret Rubega & Joan Walsh (Great Gull Island Project [GGNY]); CT: Kris Vagos (USFWS McKinney NWR); Brazil: Pedro Lima and Rafael Revoredo

Project Summary: I have been coordinating the CRTMP, a research program on the metapopulation dynamics and ecology of the endangered NW Atlantic breeding population of Roseate Terns (ROSTs, *Sterna dougallii*) for 35+ years. The primary goal of the CRTMP is to determine the major factors limiting the recovery and growth of this population. I rely on many cooperators to band and identify individual terns at their breeding colony and wintering sites, and since 2011 have focused my fieldwork on staging terns in the "Cape and Islands" area of southeastern Massachusetts. This research involves sighting individuals with 3-character plastic field-readable (PFR) bands to analyze temporal and geographic variation in the use of staging sites by ROSTs of different ages coming from about a dozen colony sites spanning the entire breeding range.

Compared to 2023 and 2024, in 2025 there was an increase in the number of ROST chicks banded at the “coldwater colony sites” in Nova Scotia (NS), ME & NH, and in CT, but a large decline in the number banded in NY which led to a slight drop in the overall number banded in 2025 (558) compared to 2024 (572). In 2024 and 2025, respectively, 19 and 42 adult ROSTs received PFRs as part of GPS tracking studies. Also, whereas in the winter (Oct-March) of 2022-2023 there were 342 adults given PFR bands in Brazil, in the winters of 2023-2024 and 2024-2025 only 80 and 29 adults, respectively, got PFR bands.

I spent 56 days from 7-22 to 9-22 in 2024 and 60 days from 7-24 to 9-24 doing fieldwork around Cape Cod (CCMA). I did not make any trips to the Nantucket-Tuckernuck-Muskeget area, but I received staging site data from Shea Fee (The Trustees) and several people from Biodiversity Works on Marthas Vineyard, and also from Kacey Srubas and other staff members of CCNS in both years. Most of my time in 2024 and 2025 was spent at Hatches Harbor (HHP, south of the Race Point Lighthouse in Provincetown) and at North Beach, Chatham (NBC, south end of Nauset Spit), with a few trips to the Nauset Estuary, Eastham.

Table 1 shows the average number of ROST and Common Tern (COTE) PFRs read/day on a weekly basis. In 2024 the average numbers of PFRs read/day in all periods were fairly similar to those read in 2023, but in 2025 higher numbers were read for Periods 9-11 than in the preceding two years. Numbers read in all three years (2023-2025), however, were considerably less than those read in 2022. Weekly average PFRs read/day exceeded 100 only in Period 10 in 2024, but exceeded 100 for three periods (9 to 11) in 2025.

In 2024, 106 COTEs of all ages and for ROSTs with PFRs: 304 (53% of 572) HYs, 1372 known-age adults first banded as chicks, and 161 banded as unknown-age adults (including 100 from Brazil) were read, for a total of 1837 ROST PFRs and 2023 PFRs of both species identified on CCMA in 2024. Two COTE chicks (of 177 banded) from GGNV and one COTE from Maryland were seen as HYs. Also of interest, on 8-22 at HHP and on 9-10 through 9-13 at NBC I saw a 2-year-old ROST originally banded as a chick in Maine that had been seen 7-06 through 7-10 in Ohio (the first state record for this species!).

In 2025, 160 COTEs of all ages and for ROSTs with PFRs: 359 (64% of 558) HYs, 1199 known-age adults first banded as chicks, and 239 banded as unknown-age adults (including 126 from Brazil) were read, for a total of 1797 ROST PFRs and 1957 PFRs of both species identified on CCMA in 2025. Two COTE chicks (of 123) from GGNV and 3 (of 13) COTE chicks from North Brother Island, NS were seen as HYs. Also of interest: on 8-14 at HHP I read the first 3 characters of a metal field-readable band on a ROST and even though I didn't get the 4th character, all 10 possibilities had been banded as chicks on 7-1-1995 at GGNV by Grace Cormons, making this bird at least 30 years and 44 days old, a new age record for this species.

Table 1. Weekly average observation statistics of staging terns with PFR bands on Cape Cod, MA (CCMA). Shown are the weekly average number of Roseate Terns and Common Terns (combined) with plastic field-readable (PFR) bands identified/day by Jeff Spendelow over a 14-week period starting as early as 20 June each year. Note the relatively low values (highlighted in yellow) for periods 10-13 in 2017 compared

to the values from 2015-2016 and 2018-2024. nd = no data. Also note the drop in PFRs identified in periods 12-14 in 2021-2022 compared to 2018-19 & 2023-25.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year	6-20	6-27	7-04	7-11	7-18	7-25	8-01	8-08	8-15	8-22	8-29	9-05	9-12	9-19
2014	3.7	1.4	1.3	1.6	3.3	2.5	41	27	32	59	64	19	10	6
2015	0.3	0	0.4	0.9	1.7	6.9	25	nd	43	36	55	66	49	15
2016	nd	4	4.7	6.1	14	34	58	77	50	40	50	49	38	nd
2017	nd	nd	nd	5.5	20	55	44	44	50	16	15	15	22	8.4
2018	nd	nd	nd	nd	nd	26	41	49	54	61	72	89	36	12
2019	nd	0	3.3	5	19	52	59	69	67	77	120	134	44	32
2020*	nd	0.5*	76	38	4.4									
2021	nd	nd	nd	nd	38	76	84	60	99	144	136	7	14	1
2022	nd	nd	nd	nd	nd	102	86	86	134	131	53	15	18	0.25
2023	nd	nd	nd	nd	45	57	54	54	95	47	58	72	48	22
2024	nd	nd	nd	nd	28	47	67	68	67	103	70	62	40	nd
2025	nd	nd	nd	nd	11	41	75	61	118	106	110	50	37	16

Seabird Tracking

Using GLS, TDR, and GPS to track alcids on the Newfoundland and Labrador Shelf

Primary Contact: Gail Davoren, University of Manitoba, Department of Biological Sciences, gail.davoren@umanitoba.ca

Project Partners: Megan Dalton, Emily Runnells, Abigail Muscat, University of Manitoba, Department of Biological Sciences

Project Summary: The Davoren Lab continued their decadal scale research on seabirds and their prey on the east coast of Newfoundland. Recent work has focused on alcids breeding on James Island. Between 10-15 GLS loggers were deployed on Atlantic Puffins and Razorbills each year between 2019-2022, with 33 and 43 tags per species recovered to date, respectively. In

2021-2022, 30 combination GLS-TDR loggers were deployed on Razorbills, with 18 tags retrieved to date. In 2025, 6 additional GLS-TDR loggers were deployed on Razorbills to continue building our long-term database. These GLS and GLS-TDR datasets, combined with stable isotope analysis on multiple tissues (feather, eggshell membrane, blood), will be used by students to study carry over effects and migratory connectivity, as well as to calculate location-specific time-activity budgets during key under-studied parts of the annual cycle (e.g., moult, pre-laying) to investigate the timing and location of energetic bottlenecks. During 2023 & 2024, GPS-TDR loggers were simultaneously attached to chick-rearing Atlantic Puffins (n = 22) and Razorbills (n = 36) for short-term (1-5 day) deployments. GPS tracking data will be combined with long-term monitoring of spawning capelin biomass to assess whether inter-annual variation in prey biomass differentially influences the foraging effort and breeding success of these two species. These tracking data will also be used to inform ongoing ship-based research on sand lance and capelin density and distributional patterns in coastal Newfoundland.

Acoustic Motus Offshore Monitoring at the Dominion Commercial Offshore Wind Project, Virginia

Primary Contacts: Greg Forcey, Normandeau Associates, Inc., gforcey@normandeau.com; Julia Robinson Willmott, Normandeau Associates, Inc., jwillmott@normandeau.com

Collaborator: Dominion Energy

Project Summary: Dominion Energy will be constructing the Coastal Virginia Offshore Wind (CVOW) Commercial Project located on the Outer Continental Shelf of Offshore Virginia. As part of this project, Dominion will be conducting an extensive post-construction bird and bat monitoring program using acoustics and Motus receivers. Acoustic detectors will be installed on substations and turbines around the project's perimeter. Motus receivers will be installed throughout the wind facility on 16 turbines. Half of the Motus receivers will prioritize the 166 MHz frequency and the other half will prioritize the 434 MHz frequency. Acoustic data will provide an index of bird and bat activity around the turbines, while the Motus receivers and tagged birds will provide large-scale movement data on Motus-tagged animals moving through and around the wind facility.

Project WOW Northern Gannet Tracking

Primary Contact: Julia Gulka, Biodiversity Research Institute, Maine, julia.gulka@briwildlife.org

Collaborators: Evan Adams, Kimberly Lato, Katheryn Williams, Biodiversity Research Institute; Esther Nosazeogie, Lesley Thorne, Stony Brook University; Doug Nowacek, Duke University; Juliet Lamb, The Nature Conservancy

Project Summary: As part of the larger [Project Wildlife and Offshore Wind \(WOW\)](#) with funding by the Department of Energy and Bureau of Ocean Energy Management under DOE Award No. 10287, BRI deployed n=60 GPS-GSM tags (Ornitela Ornitrack OT20D/OT30D) with built in depth recorders on non-breeding Northern Gannets (*Morus bassanus*) in Nov-Dec 2023 and Jan-April 2025 off the coast of Massachusetts, Rhode Island, and New York to understand

fine-scale movement patterns and behavior in relation to the first commercial-scale offshore wind development in the region. We used both night spotlighting and diurnal hoop-netting techniques and attached tags via tail-mount with a combination of tesa tape, cable ties, and UV glue. Of note, early winter deployments were challenging due to birds still molting tail feathers. Tags lasted an average of 40 days (range 1-112) for a total of 1912 tracking days across individuals. Data analysis is underway using hidden Markov models to distinguish between behaviors (resting, foraging, transit) along with an analysis of dive data to understand patterns in relation to environmental conditions and anthropogenic stressors (presence of turbines and vessels).

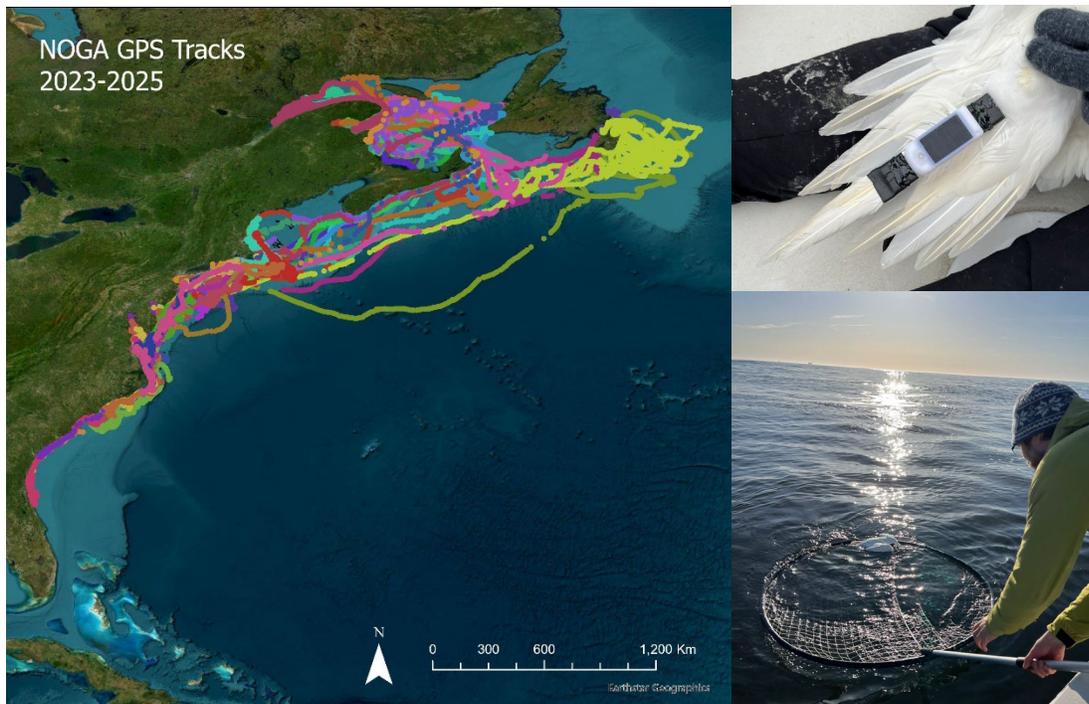


Figure 1. Map of raw tracks of Northern gannets tagged in Nov-Dec 2023 and Jan-April 2025 to understand non-breeding season movement and habitat use in relation to offshore wind development. Photos on the right include tag attachment and capture using hoop netting techniques.

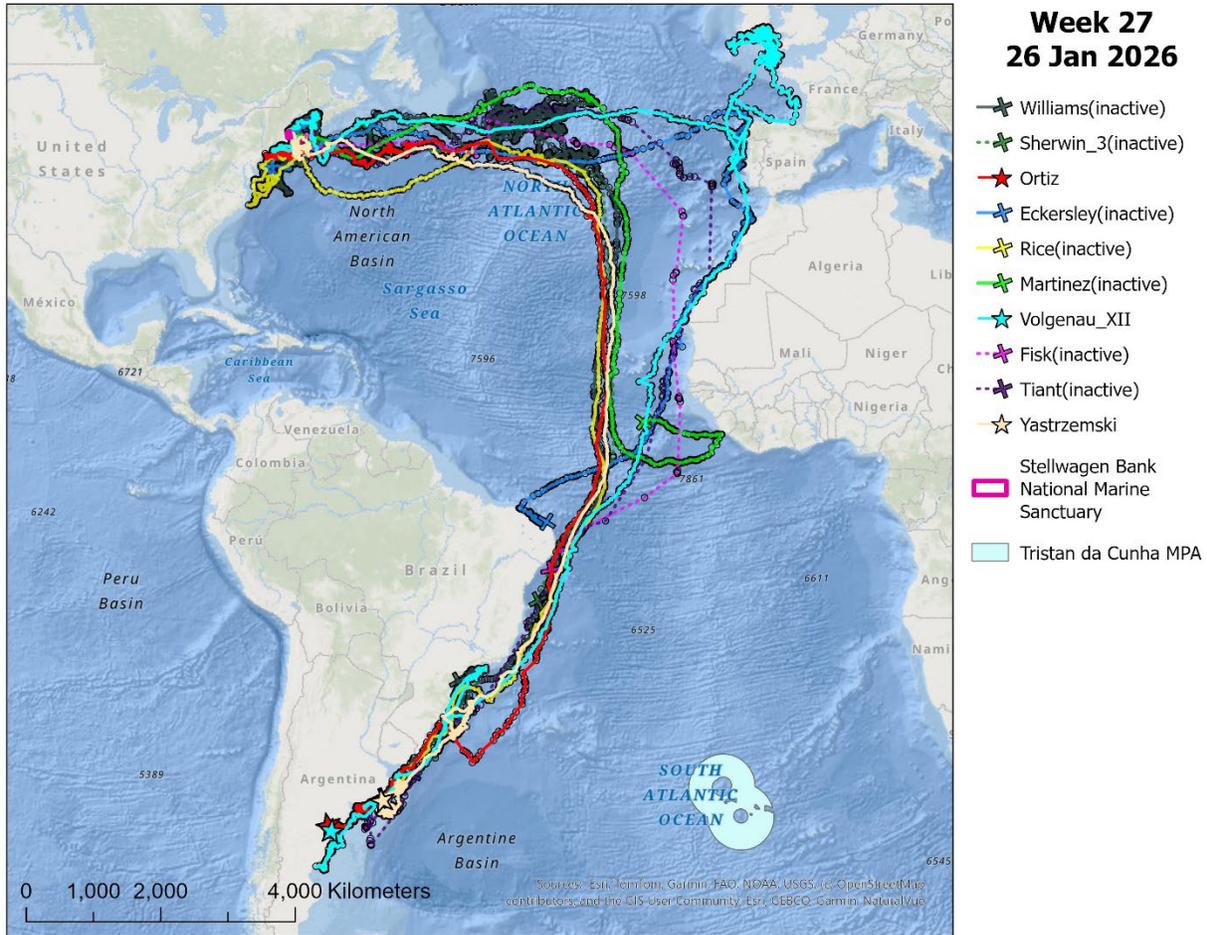
Preliminary Overview of the 2025 Tracking of Non-breeding Great Shearwaters (*Ardenna gravis*) from Stellwagen Bank National Marine Sanctuary

Primary Contacts: Liam Waters, liam.waters@noaa.gov, & David Wiley, david.wiley@noaa.gov, Stellwagen Bank National Marine Sanctuary

Collaborators: Linda Welch, U.S. Fish and Wildlife; Kevin Powers, Tammy Silva, Michael Thompson, Stellwagen Bank National Marine Sanctuary

Project Summary: Stellwagen Bank National Marine Sanctuary (SBNMS) continued its ongoing (2013 – present) research investigating the movements, habitat use, and foraging habits

of Great Shearwaters (*Ardenna gravis*) through the use of PTTs (10+ per year), stable isotope analysis of exhaled gas, blood and feather samples, and fecal DNA. 2025 marked the most successful year of data collection for this project with PTTs lasting longer than they have in any prior year. We deployed 10 PTTs (MTI PTT-100 12g Solar PTT) on Great Shearwaters and had our first PTT loss on day 99 of deployment. Three PTTs are still transmitting at the time of this submission (6 months post deployment), and the median duration was 5 months. PTTs were deployed in mid-July in the waters east of Chatham, MA and birds were tracked across the Gulf of Maine, North Atlantic, and South Atlantic. More analysis and results to come. See below for a figure of all tracked birds.



Winter GPS tagging of Roseate Tern in Northeast Brazil

Primary Contact: John Herbet, jherbert@massaudubon.org

Project partner list and affiliations

John Herbert – Mass Audubon

Rafael Revorêdo - Centro de Estudos e Monitoramento Ambiental (CEMAM), PCCB-UERN, Universidade Federal do Rio Grande do Norte

Keenan Yakola – Oregon State University

Don Lyons - National Audubon Society, Seabird Institute

Project summary/accomplishment description:

We completed our second year of GPS tagging Roseate Tern (*Sterna dougallii*) in northeast Brazil. This study is aimed at closing knowledge gaps in the full annual cycle ecology of Roseate Terns, and where in the Western Hemisphere they are most exposed to conservation threats. In February 2025, we equipped 20 Roseate Terns with PathTrack GPS devices, increasing our sample size to 35 tagged individuals over two years. The data gained from this project has furthered our understanding of Roseate Tern offshore movements and habitat use during the winter period, northbound and southbound migratory pathways, migratory stopover behavior, migratory flight height, and exposure to threats. This project highlights the need for continued research on Roseate Terns during the nonbreeding period of the annual cycle, and its value in guiding risk assessments and conservation planning.

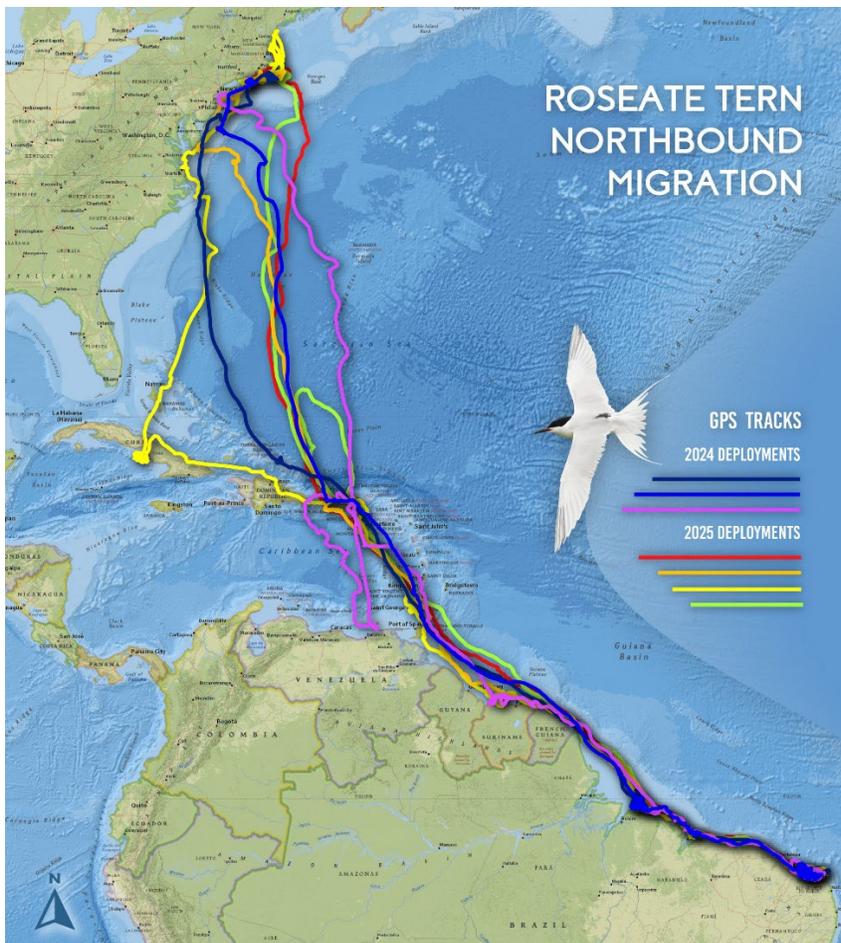


Figure 1. Complete northbound migratory pathways of seven Roseate Terns (*Sterna dougallii*) in 2024 and 2025. Individuals were fitted with PathTrack nanoFix GPS tracking devices. Tagging occurred from February-March in 20024 and 2025 in Galinhos, Brazil.

Royal and Sandwich Tern Tracking in North Carolina

Primary Contacts: Kate Goodenough and Lindsay Addison

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Project Summary: In 2024, Larid Research and Conservation and Audubon North Carolina began a project to study nesting Royal Tern movements in the Lower Cape Fear River of North Carolina. In 2025, we

expanded our activities to include both Royal and Sandwich Terns. Our research goal is to use a combination of mark-recapture and GPS technology to identify critical migration stop-over areas and winter locations for crested terns species nesting in the South Cape Fear River, North

Carolina. Initial results of our pilot project for 2024 resulted with six ROYT providing information on migratory routes and timing of migration. This is the first complete

documentation of migratory routes and wintering grounds for Royal Terns nesting in North America. The movement data suggests a diverse migration strategy with individuals wintering in SE Florida, the Florida Keys, Dominican Republic, Panama, and Columbia. This project is

beginning to reveal the hemispheric footprint of these terns and provide supporting evidence to move conservation towards a hemispheric approach. The project will continue through 2026 with a third deployment of GPS trackers.

Assessing the spatial ecology of the Threatened Rufa Red Knot

Primary Contacts: Felicia Sanders, South Carolina Department of Natural Resources, SandersF@dnr.sc.gov; Patrick Jodice, U.S. Geological Survey, South Carolina Cooperative Fish and Wildlife Research Unit, pjodice@clermson.edu; Yvan Satgé, Clemson University, ysatge@clermson.edu

Collaborators: Camille Duquet, Janet Thibault, South Carolina Department of Natural Resources; Fletcher Smith, Tim Keyes, Georgia Department of Natural Resources; Melissa Chaplin, USFWS; Abby Sterling, Allie Hayser, Manomet Conservation Sciences.

Project Summary: The Rufa Red Knot (*Calidris canutus rufa*) is a threatened shorebird that relies on the South Carolina–Georgia coast during its spring migration from its wintering grounds along the Gulf of Mexico, the Caribbean, and South America. Red Knots spend several weeks along the U.S. Southeast coast, where they feed on invertebrates (including horseshoe crab eggs) to increase body weight, and molt before continuing their northwards migration. Since 2023, we captured Red Knots in South Carolina and Georgia and tracked 43 of them with satellite transmitters. We received breeding data for 29 individuals, 20 of which were also tracked during their south-bound migration. We are currently analyzing the data to locate stopover and breeding sites, assess the timing of migration, and estimate the effects of weather partners like storms on migration routes.

The project is a collaboration between the South Carolina Department of Natural Resources, Georgia Department of Natural Resources, U.S. Geological Survey South Carolina Cooperative Fish and Wildlife Research Unit at Clemson University, Wildlife Restoration Partnerships, Manomet Conservation Sciences, and U.S. Fish and Wildlife Service.

Forage Ecology, Diet & Prey

DNA Metabarcoding Through Poop Sampling: Black Skimmers, Common Terns, Royal Terns, and Sandwich Terns

Primary Contacts: Carmen Johnson and Lindsay Addison
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Project Summary: In 2024, partners around the state began collecting poop samples for a diet study using DNA metabarcoding analysis by Gemma Clucas with the Cornell Lab of Ornithology. In addition to samples collected from Common Terns and Black Skimmers, the focal species in the AMBC's Project Poop collaborative, we also collected samples from Royal and Sandwich Terns. We continued this same work in 2025. Samples in both years were collected at sites managed by the NCWRC, NPS, and Audubon NC.

Testing the utility of a new protocol for collecting dropped prey for seabird diet studies

Primary Contact: Michelle Staudinger, michelle.staudinger@maine.edu

Partner list and affiliations:

Michelle Staudinger^{1,2}, Linda Welch³, Grace Leschey¹, and Natasha Gownaris⁴

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²Darling Marine Center, University of Maine, Walpole, ME, USA

³U.S. Fish & Wildlife Service, Maine Coastal Islands NWR, Milbridge, ME, USA

⁴Department of Environmental Studies, Gettysburg College, Gettysburg, PA, USA

Project summary/accomplishment description: Over the summer of 2025, we tested the potential of a novel protocol for collecting dropped seabird prey at breeding colonies, many of which do not have access to a freezer or oven. We deployed this protocol and sampling kits across 11 colonies managed by the US Fish and Wildlife Service and the Audubon Seabird Institute. Sampling kits relied on inexpensive and accessible materials, with each kit costing approximately \$40. These materials included a hanging herb dryer, plastic baggies, printed waterproof labels, and a small kitchen scale; we assumed that island staff had access to a ruler. We asked island staff to record weight, length, collection date, and preservation method (drying or freezing) at the time of prey collection. Most samples were dried using the provided kit, rather than frozen.

A total of 291 fish and invertebrate specimens from nine colonies including Eastern Egg Rock, Jenny, Metinic, Outer Green, Pond, Petit Manan, Ship, Seal, and Stratton Islands were collected. Measured prey ranged in size from 13 to 165 mm. Unsurprisingly, some of the most commonly collected prey were those that are often rejected by seabird chicks (American butterfish, n = 36;

three-spined stickleback, n = 39). However, we also received large numbers of key prey species, including herring species (n = 79) and sandlance (n = 26). Rarer but interesting finds included polychaetes (n = 2), sculpin (n = 1), and moonfish (n = 5).

Once specimens were received in the laboratory, body condition was assessed based on two metrics: 1) percentage of intact body mass and 2) presence of external contaminants such as mold, sand, or other debris. If the sample had 95% or greater intact body mass and lacked major contamination, it was selected for further processing and analysis for energetic content (measured in Kcal) via bomb calorimetry and stable isotopic indicators of habitat ($\delta^{13}\text{C}$) and trophic level ($\delta^{15}\text{N}$). These criteria resulted in 254 usable samples (87%) from over 35 species. Results of this pilot provide a cost-effective collection method that is repeatable in future years and transferable to other regions with interests in understanding regional variation in prey quality and diet composition of seabird populations.

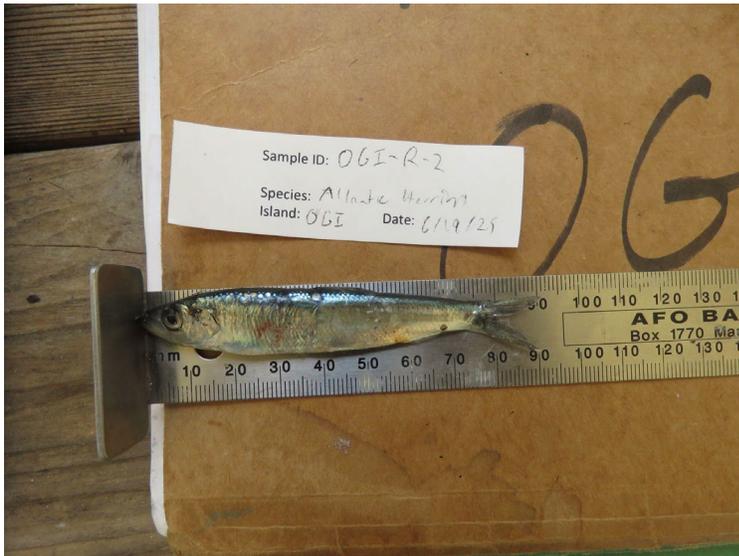


Image 1: Outer Green Island was one of our top collectors of dropped prey. This image shows an Atlantic herring collected for the project, along with its sample tag.



Image 2: Among our more interesting prey were polychaetes collected on Ship, where common terns will feed these invertebrates to chicks.

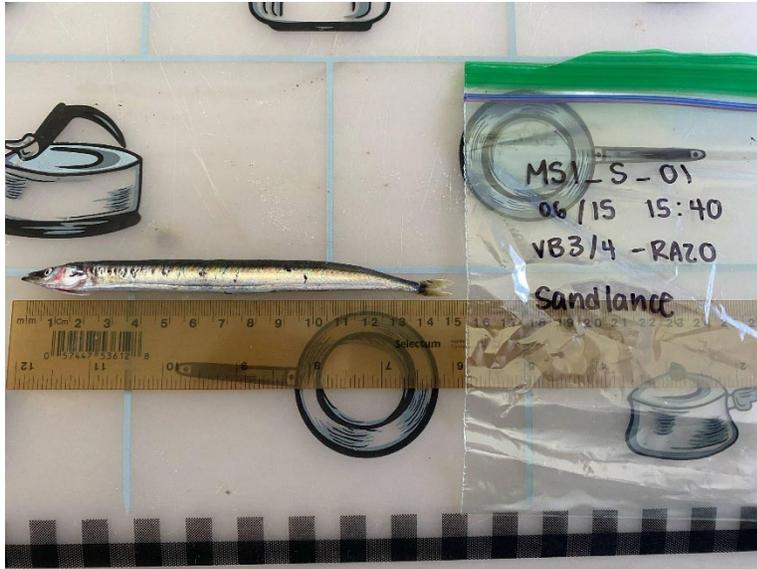


Image 3: Although we were sent many three-spined stickleback and butterfish, we were also excited to receive so many herring and sand lance samples

Ospreys, Menhaden--and Us

Primary Contact: Paul Spitzer, 31672 Old Orchard Road, Trappe, MD 21673

Project Summary: Every spring, we host nesting ospreys when they migrate back from their winter vacation in the tropics. With cooperation from the Coast Guard, we allow them to nest on channel markers, all along the East Coast. And we “garden” them, maintaining predator-proof wooden nest platforms: Notably the famous Great Island osprey colony—a field of 25 such nests on this 500-acre salt marsh wildlife sanctuary at the mouth of the Connecticut River estuary, in Old Lyme. The larger estuary breeding population, probably 100 nests, extends upriver to a nest that crowns the old swing bridge in East Haddam. So our osprey study is laced with humanism; we conserve and enjoy these inspirational fish hawks, as our guests in spring and summer.

And the ospreys reciprocate: Their stable, accessible, manmade nest sites enable us to study them as indicators of ecosystem health. Thus fifty years ago, Osprey Science gave us critical understanding of the pesticide DDT, and its drastic harmful effects on birds. In the early 1970’s, the Ct. R. ospreys dwindled to one active nest. Since then, post-recovery, our detailed study has yielded a precise understanding of ospreys’ dependence on their fish food supply. In many locales, ospreys rely on the menhaden, a fish of the herring family, for successful breeding. Menhaden are schooling fish that feed close to the water’s surface, and they are perfect prey for the osprey’s spectacular dive. So every year--and into the future—osprey reproduction measures the regional abundance or depletion of Menhaden! Thus ospreys serve as sentinels of the balanced and productive coastal ecosystem that supports us.

Atlantic Menhaden are abundant planktivores, forming a base for our coastal food chain. When left in the water, Menhaden are a prime prey of Bluefish and Striped Bass. Those succulent fish feed us and support a huge sport fishery, with financial impact. But menhaden are also commercially harvested in huge numbers. Their dense surface-active schools make them

extremely vulnerable to large purse seines—a big industrial fishery. Those harvested Menhaden then fall directly within our human food chain: They are prime crab and lobster bait (in MA and ME); and are also reduced to fish-meal pellets for pen-reared salmon in Canada. These are all seafoods which we love to eat! As an ecologist, I have witnessed these competing uses of the menhaden resource for 60 years—since I began my osprey studies at age 20.

Menhaden can be subject to population fluctuations, with potential negative impact on their predators. The extent to which this variation is “natural”, vs. caused by human overharvest, has been the focus of scientific study, management harvest quotas, and political debate for the last 75 years. Some menhaden population variation is normal, so if they are harvested too hard in low years, the problem may be exacerbated. This unpredictability complicates harvest quota projections.

Menhaden are a Marine Commons. In CT and NY coastal waters, hard-fought conservation laws now protect the menhaden resource, leaving the fish in the water, to benefit the ecosystem, and us as its stakeholders. Previously this was not so, and locally failing osprey reproduction, with mass starvation of nestlings, offered us scientific evidence of menhaden scarcity. The prime regional example was Gardiners Island, NY, surrounded by miles of open salt water; the site of a centuries-old famous osprey nest colony, currently dependent on menhaden. During food-limited decades it could not recover from DDT, stumbling along at roughly 20 active nests that fledged few young. In 2012, menhaden harvest quotas affecting NY waters were much reduced. The benefit to Gardiners ospreys was immediate, and they have now increased to 80 active nests. The next great regional menhaden protection came in 2019, when NY State banned use of the commercial purse seine “reduction fishery” (for oil and meal) in NY waters. This protection extends to Long Island Sound, which is mostly a menhaden sanctuary. The Ct. R. estuary was always a prime sanctuary habitat for abundant menhaden. Cool water from its big northern watershed held adequate dissolved oxygen for the fish—which are high-oxygen operators, swimming constantly while they sieve plankton on their gill rakers. And the nutrient-rich estuary supported abundant plankton for the filter-feeding menhaden. This local ecology allows the Ct. R. osprey colony to flourish.

Our well-balanced menhaden-to-osprey ecology in CT and NY stands in painful contrast to current acute osprey reproductive failures in Virginia, Maryland, and southern New Jersey, where the Canadian-based Omega firm has essentially conducted a “Menhaden Removal Experiment” for many decades. Because menhaden are a Marine Commons, Omega’s excessive harvests are depleting the fish for everyone and everything else.

In conclusion: We need better, more comprehensive and holistic “menhaden science” to regulate the very large-scale commercial menhaden fishery. Long-term osprey studies at key East Coast menhaden-dependent nesting sites are part of that fundamental approach. Annual osprey reproduction and long-term population density provide quantitative measures of menhaden abundance. Osprey failure is occurring at many Chesapeake Bay sites, and is spreading to southern New Jersey, despite well-paid “professional population modelers” claims of menhaden abundance. Baitfish harvest operations and sport fisheries are also reporting extreme menhaden scarcity. We cannot allow the resulting “overharvest” quotas of the Federal Atlantic States Marine Fisheries Commission to hide behind abstract “menhaden population models”. The ospreys call their bluff.

Fisheries Bycatch

Reducing Risk of Seabird and Non-target Bycatch in Inshore Newfoundland Fisheries

Primary Contact: Robert Blackmore, Memorial University of Newfoundland and Labrador, rblackmore@mun.ca

Collaborators: Paul Winger, Fisheries and Marine Institute of Memorial University of Newfoundland and Labrador; William Montevercchi, Memorial University of Newfoundland and Labrador; Jessika Lamarre, Memorial University of Newfoundland and Labrador; Noah Careen, Memorial University of Newfoundland and Labrador; Jill Conway, Fisheries and Marine Institute of Memorial University of Newfoundland and Labrador; Caleb Spiegel, U.S. Fish and Wildlife Service

Project Summary: Fisheries bycatch is a globally significant source of mortality for seabirds and other non-target taxa. Gillnets are an ongoing source of seabird mortality in northeastern North America, where substantial populations of breeding and migrant seabirds occur throughout the year. Surface-set gillnets, which are suspended in the water column at depths less than 2 meters, frequently entangle and drown diving species, and are of particular concern to northern gannets and alcids in marine environments. Bottom-set gillnets, which rest on the seafloor, tend to entangle both surface-feeders and divers, especially shearwaters and alcids. Many of these bycaught birds are breeding adults, which carry demographic and population consequences, including chick mortality due to disrupted biparental care and the severance of long-term pair bonds. Under this project, we are testing various seabird bycatch mitigation strategies in fisheries operating out of Newfoundland and Labrador. In 2024, we examined whether altering the timing and duration of gear soaking reduced seabird bycatch in surface-set gillnets deployed as part of the Atlantic herring (*Clupea harengus*) bait fishery. We compared catch, bycatch, and seabird activity among control (ca. 24 h) and short (ca. 12 h) set durations that were left to soak either overnight or only during daylight hours. Target catch did not differ between control and short overnight sets but was greatly reduced during short daytime sets. Seabird bycatch occurred exclusively under the control condition when gillnets filled with herring had been left to soak throughout daylight hours (Figure 1). Since herring are typically caught at night, outside the primary foraging period of most coastal seabirds, our recommendations included that fishers haul their nets on a daily basis at sunrise to minimize the duration that surface-set nets remain soaking while filled with prey during daylight hours (see Figure 2). Across 2025 and 2026, we are testing a deterrent strategy in the same fisheries to evaluate its effectiveness in preventing birds from approaching soaking gear and fishing operations. Scarybird kites shaped like birds of prey are commonly used in agricultural fields, landfills, and urban environments, and have now shown some promise in certain European gillnet fisheries. Our current research involves testing scarybird kites in Newfoundland conditions by flying them over all fishing operations

(deployment, fish gutting, and hauling), as well as over the gear during the entire soak period, to deter birds during both active and passive fishing efforts. Kites deployed from the vessel are flown directly over all active fishing activities, while kites deployed from a high-flyer are positioned to fly over a fleet of gillnets or longlines throughout soaking to cover the full period of passive fishing (Figure 3). The effects of the scarybird kites on the birds behaviours are assessed by collecting data on seabird bycatch, seabird presence around the vessel, presence/absence of direct interactions with the gear, and distance of the birds from the vessel. Additionally, we are collecting fishers' perspectives and feedback regarding the feasibility of implementing scarybird deterrents in their normal fishing operations.

Reducing gillnet soak duration mitigates bycatch and maintains target catch

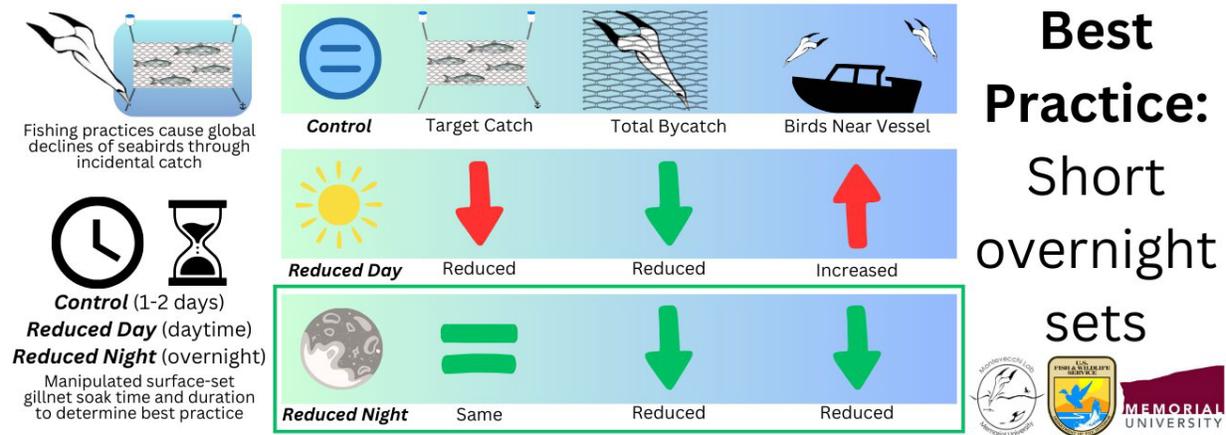


Figure 1. Best practices recommended for seabird bycatch mitigation in surface-set gillnets targeting Atlantic herring. The full study can be found here: <https://doi.org/10.1371/journal.pone.0325725>. (Collins et al. 2025. PLoS One 20(6): e0325725).

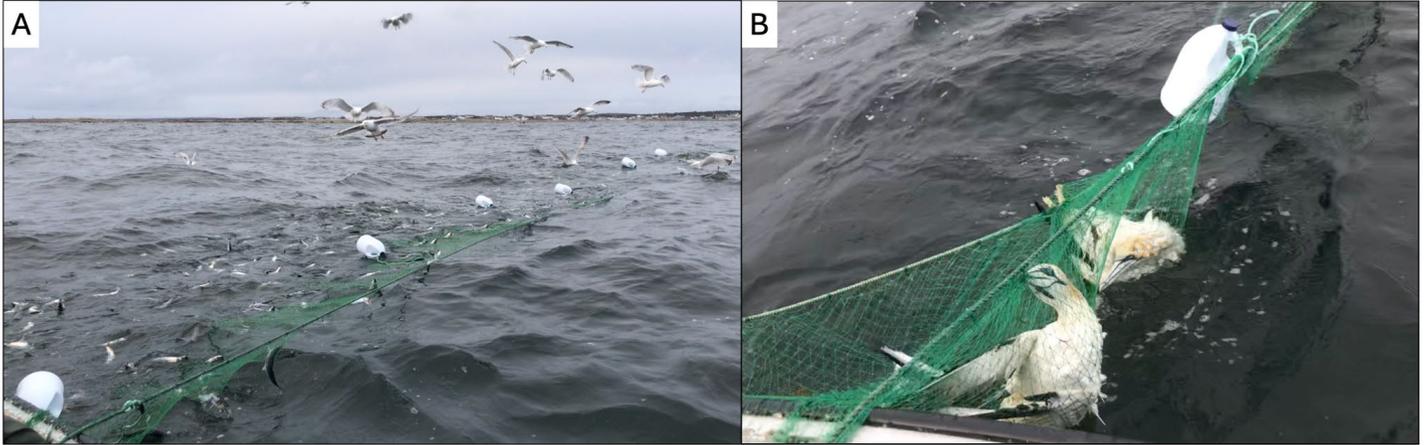


Figure 2. Bycatch risks posed by surface-set gillnets deployed as part of the herring bait fishery. A) Gillnets filled with herring after an overnight soak attract several seabirds (*Larus* sp. shown here) during hauling. B) Northern gannets incidentally caught in a control fleet of gillnet following an extended soak duration caused by stormy weather.

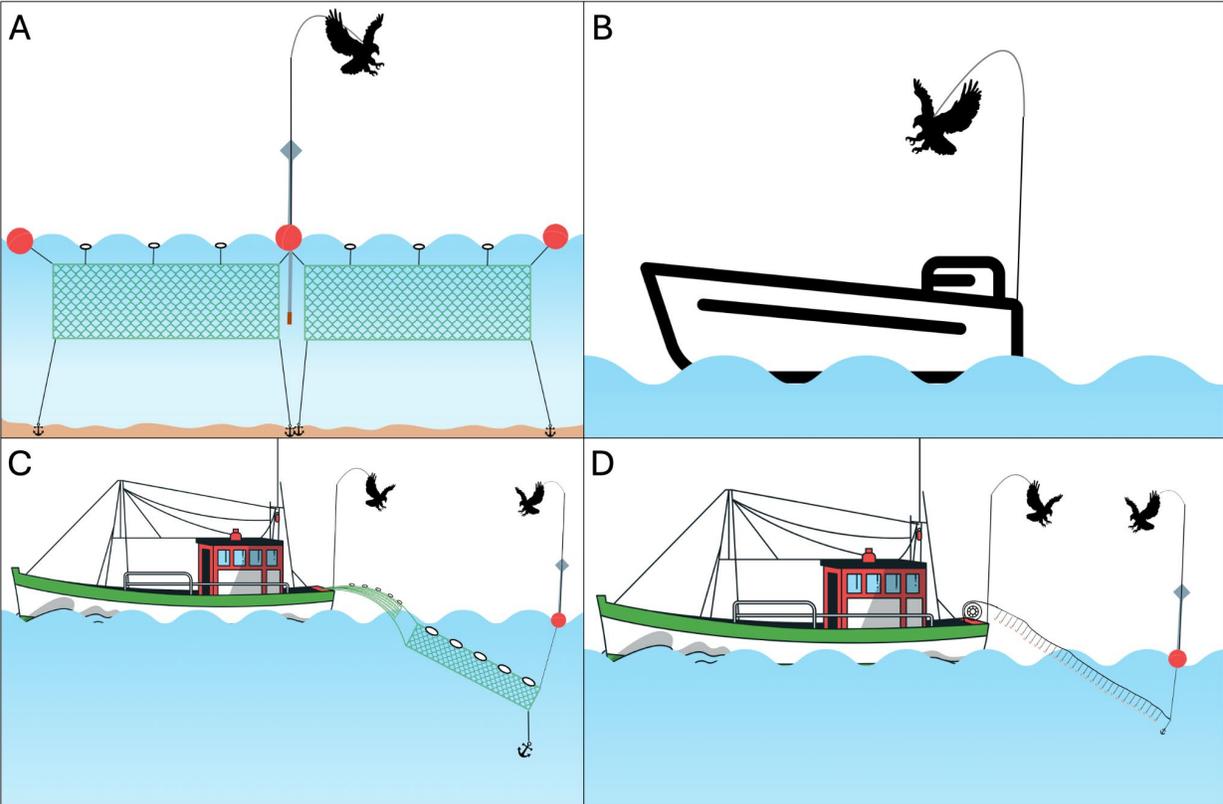


Figure 3. Schematic showing the method of deployment for scarybird kites during inshore fishing operations in Newfoundland, Canada. For surface-set gillnets used in the herring bait fishery, kites are flown from a high-flyer buoy deployed in the middle of a fleet of gear (A) and from the vessel to fly over all active fishing operations (B). For both bottom-set gillnets (C) and

longline gear (D) used during the cod fishery, kites are flown from the vessel over all deployment (C-D) and hauling operations, in addition to being flown from a high-flyer buoy attached to the far end of the gear.

Impacts of Baiting Practices on Catch and Bycatch in Gillnets and Design of an Effective Outreach Program to Minimize Seabird Bycatch

Primary Contact: Liese Siemann, Coonamessett Farm Foundation (CFF), lsiemann@cfarm.org

Collaborators: Natalie Jennings, Kelly Alves, and Emily O'Toole (CFF); Melissa Sanderson, Aubrey Church, and Doreen Leggett (Cape Cod Commercial Fishermen's Alliance); Greg Connors, John Our, Matt Hamilton. Sean Connors, and Scott MacAllister (commercial fishermen)

Summary: Incidental mortality of seabird species continues in many commercial fisheries, including species impacted by the 2010 *Deepwater Horizon* oil spill. The Open Ocean Trustees Implementation Group is using settlement money to fund research to restore populations of birds impacted by this oil spill, including Great Shearwaters (*Ardenna gravis*) found in New England waters. Bycatch of Great Shearwaters occurs in gillnets targeting spiny dogfish (*Squalus acanthias*) in the waters off Cape Cod, MA. Vessels participating in this fishery travel to and from fishing grounds during time windows limited by the tides, so fishermen bait their gillnets to shorten the time they are on bottom and increase catch efficiency. The shearwater bycatch spikes when fishermen toss bait directly on their gillnets while they are being deployed and near the surface. Baiting in front of the nets during setting (forward baiting), over the net string after setting (after baiting), or up-tide at the end of a set (end baiting) could increase dogfish catch per unit effort (CPUE) while minimizing or eliminating shearwater bycatch. We tested these methods during two field seasons through a collaboration between scientists and commercial fishermen. After baiting consistently resulted in a significant increase in dogfish catch per unit effort relative to control nets with no bait, and no Great Shearwaters were caught during after-baiting trials. This consistent increase in catch efficiency was not observed with forward or end baiting, and the three seabird bycatch events (27 Great Shearwaters and one Common Loon in total) occurred when forward or end baiting was being tested. The next phase of the project will focus on working with early adopters to engage the broader Cape Cod fishing industry and promote adoption of after baiting to reduce seabird bycatch.

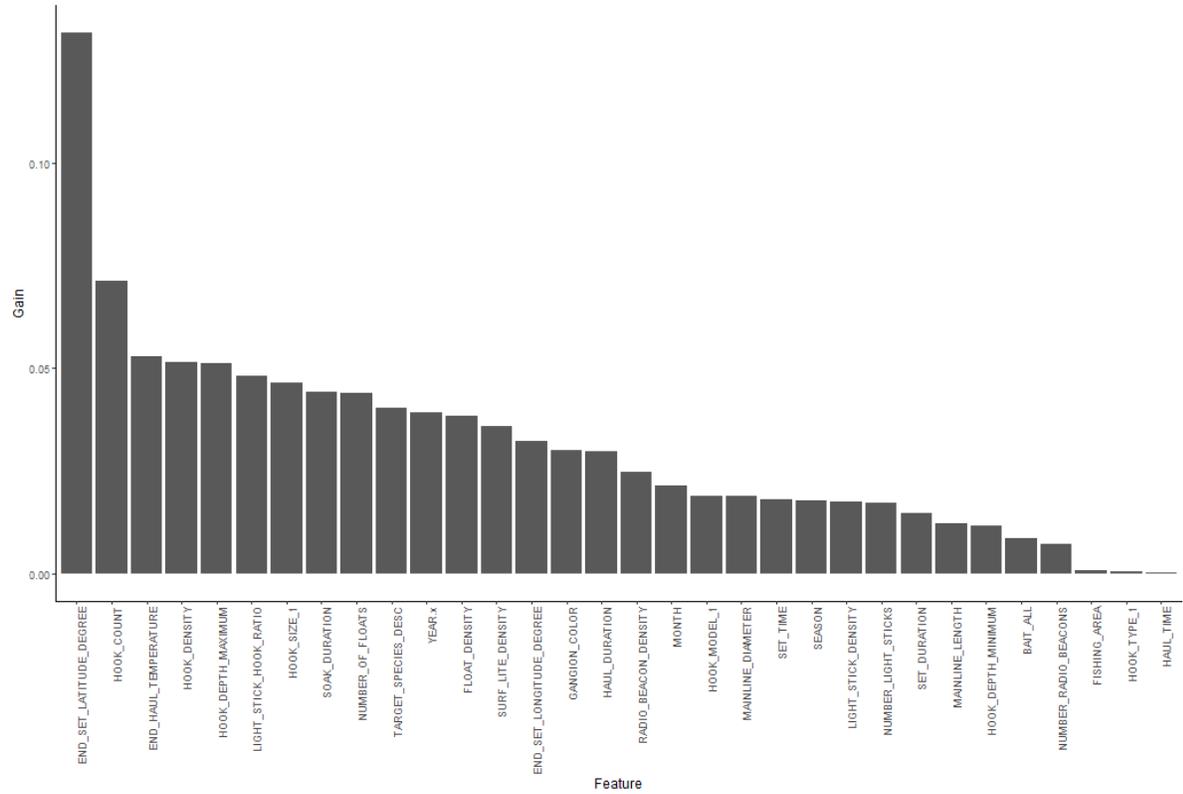
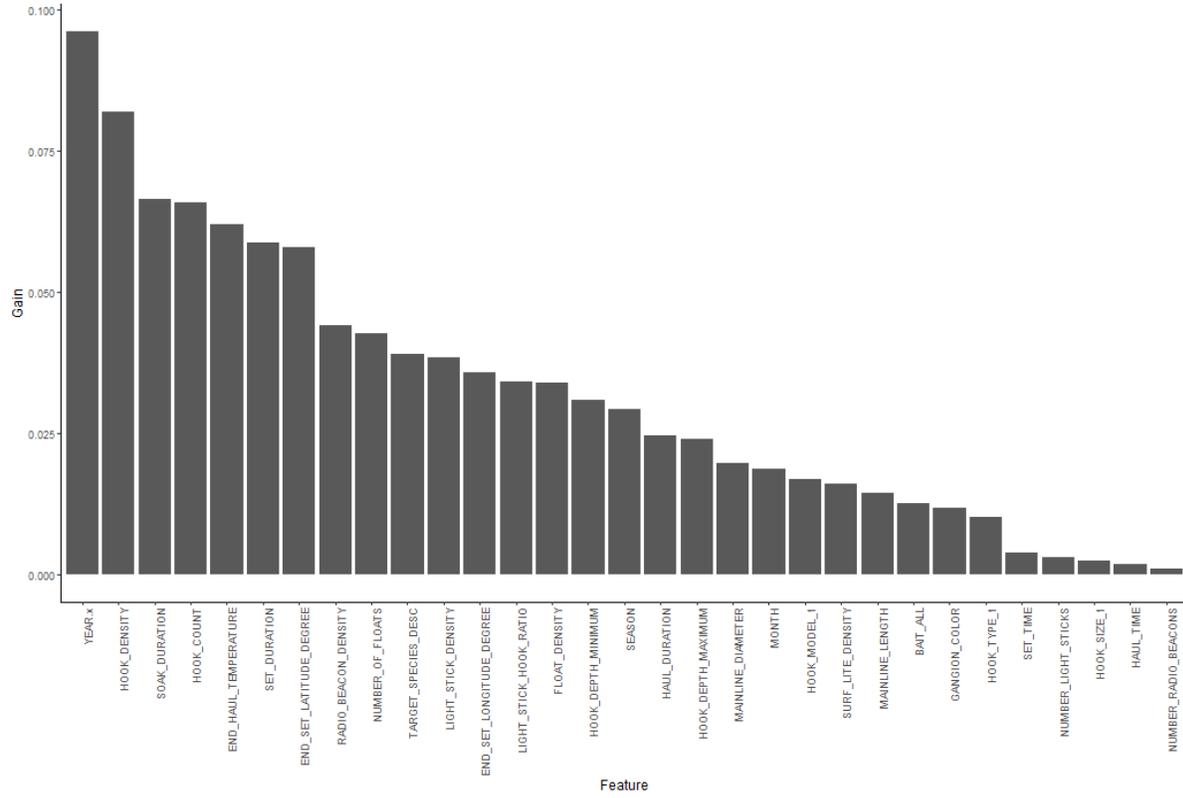
Evaluating the performance of machine learning approaches for estimating seabird bycatch in U.S. Atlantic pelagic longline fisheries

Primary Contact: Iman Pakzad, Department of Fish and Wildlife, Virginia Tech,

ipakzad@vt.edu **Collaborators:** Yan Jiao, Department of Fish and Wildlife, Virginia Tech

Project Summary: In the Western North Atlantic U.S., seabird bycatch in the pelagic longline fishery continues to be a serious concern. Previous analysis of the Pelagic Observer Program (POP), which monitors the Atlantic longline fishery bycatch, including seabirds, showed that there were significant differences in the gear usage between vessels that catch seabirds and those

that do not. This study aims to use those differences found in previous studies to create machine learning models that may predict which vessels are likely to catch birds based on the gear and fishing tactics used. The objective of this study is to develop a machine learning model to predict seabird bycatch events and further identify vessel-related fishing tactics that might affect seabird bycatch probabilities. In total 25 different tactics across four categories: effort, depth, lures, and miscellaneous, as well as 7 environmental variables were used to random forest and XGBoost models. Because the events with seabird bycatch observed are less than 1%, relatively rare, using both raw and weighted data sets ranging from 2x to 20x weighting were used. and was bootstrapped with 50 random stratified samples. Accuracy, sensitivity, recall and F-score were used to evaluate the model performances. With classification performance, both models performed nearly identically achieved an average of 80% or higher Accuracy and sensitivity with the 2x or higher weighting. Additionally, both models achieved an average of 99% recall and F-Score with 5x and higher weighting. Variable selection varied both by model type and by the level of weighting. The random forest model identified 7 to 9 variables as influential and with a linear decline in influence between variables. Alternately, XGBoost was more varied, selecting between 4 and 9 variables as influential and becoming more parsimonious with increased weighting. Additionally, as weighting increased, the influence of the top 2 variables increased drastically (see Figure 1 and 2). Both model types consistently identified haul latitude, haul temperature, float density and hook density as significant but varied in the ranking of importance of the remaining variables. The random forest model would typically rank the other gear related variables and spatial variables higher while the XGBoost would rank temporal variables more highly on average. This difference in variable selection would significantly influence future bycatch mitigation recommendations.



Figures 1 and 2: Gini plots of variable importance for the XGboost unweighted model (above) and the 20x weighted model (below).

Marine Debris & Pollution

Accumulation of Per- and Polyfluoroalkyl Substances (PFAS) in Coastal Birds and Related Movements in South Carolina

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Collaborators: Rainer Lohmann & Rachel Nelson, University of Rhode Island, Graduate School of Oceanography; Anna Robuck, U.S. Environmental Protection Agency; Janet Thibault & Felicia Sanders, South Carolina Department of Natural Resources

Project summary: PFAS are anthropogenic pollutants that are ubiquitous in human and natural environments and highly persistent. PFAS are released into the environment via several pathways, including use and disposal of consumer products, manufacturing activities, and application of aqueous firefighting foam (AFFF), particularly at DoD sites. Joint Base Charleston is a known location of AFFF contamination, with high concentrations of PFOS, PFOA, and PFBS previously observed in soil, surface water, and groundwater on or surrounding the base. Multiple taxa within Charleston Harbor, including both prey and predator species, have been documented to contain elevated concentrations of PFOS, and recent work from our group likewise identified high levels of PFOS and other PFAS in the eggs of brown pelicans from the region for the first time (Wilkinson et al. 2021). To investigate the bioaccumulation and biomagnification of PFAS in coastal birds that rely on environments and food webs downstream from Joint Base Charleston within the Charleston, SC region, we combined field sampling with biologging efforts and have continued to analyze PFAS levels in spatially explicit samples. Thus far, we have analyzed the water, sediment, marsh grass, eggs, and trawled fish samples for 54 target PFAS compounds using a high-resolution liquid phase chromatography mass spectrometer.

During the summer of 2024, we deployed satellite tags with high temporal resolution on breeding adults of brown pelicans (*Pelecanus occidentalis*) and American oystercatchers (*Haematopus palliatus*). As a majority of PFAS uptake comes from food intake, we aim to extract potential foraging locations from both species and compare individual PFAS body burdens to environmental samples from heavily used foraging grounds. Analyses are ongoing but we have used a combination of a cluster analysis from accelerometry data and more traditional hidden Markov modeling from GPS relocations to determine the most likely foraging locations for each species (Figure 1). Next steps will include synthesizing the PFAS and movement data while also pursuing stand-alone papers on movement and habitat use of the two focal bird species.

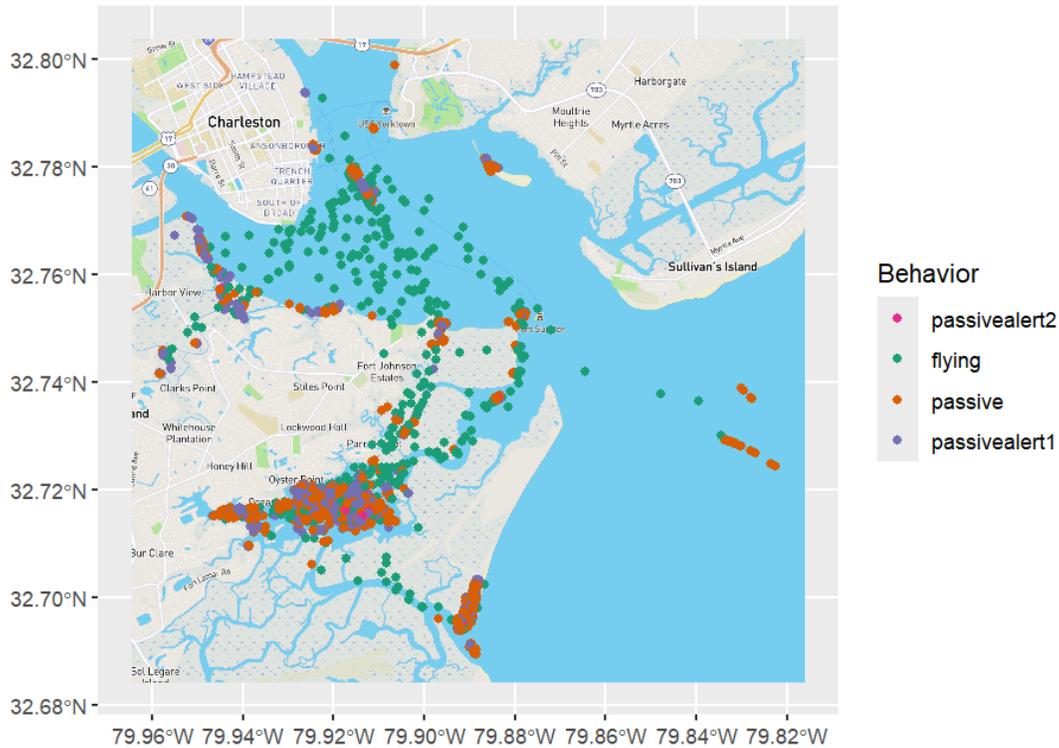


Figure 1. GPS relocations of an individual American oystercatcher tagged during the summer of 2024 showing behavioral guesses from unsupervised cluster analyses.

PFAS exposure and potential health effects in juvenile Cape Fear River Brown Pelicans (*Pelecanus occidentalis*)

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Project Summary: Per- and polyfluoroalkyl substances (PFAS) are a group of environmentally persistent anthropogenic compounds that have been widely used in a variety of industrial and commercial products for nearly a century. The adverse effects of widespread PFAS contamination on wildlife health are of increasing concern, due in part to bioaccumulation of multiple PFAS in animals positioned higher in the food chain. Evidence of PFAS bioaccumulation has been established in large-scale avian predators such as piscivorous seabirds and raptors, yet physiological impacts on avian species are still largely understudied. Adverse health effects are of particular concern for juvenile birds, due to the well documented effects of PFAS exposure to the developing immune systems of juvenile mammals.

In 2017, a fluoropolymer production facility in Fayetteville, NC was identified as a source of PFAS to the Cape Fear River Estuary (CFRE), a critical wild bird nesting site. Subsequent chemical residue analyses identified numerous types of PFAS in deceased juvenile Brown Pelicans (*Pelecanus occidentalis*) collected in the CFRE, sparking questions regarding effects on the species' health. Between 2023 and 2025, we collected plasma samples from juvenile Brown Pelicans from three locations in the CFRE (N. Pelican Island, S. Pelican Island, Battery Island) and one reference location in the Ocracoke Inlet, NC (Beacon Island), to 1) assess the potential effects of PFAS exposure on pelican health and 2) identify the type and concentration of PFAS within exposed brown pelican plasma. We are assessing a variety of physiological endpoints, examining possible effects on the immune and endocrine systems, and metabolic and organ health.

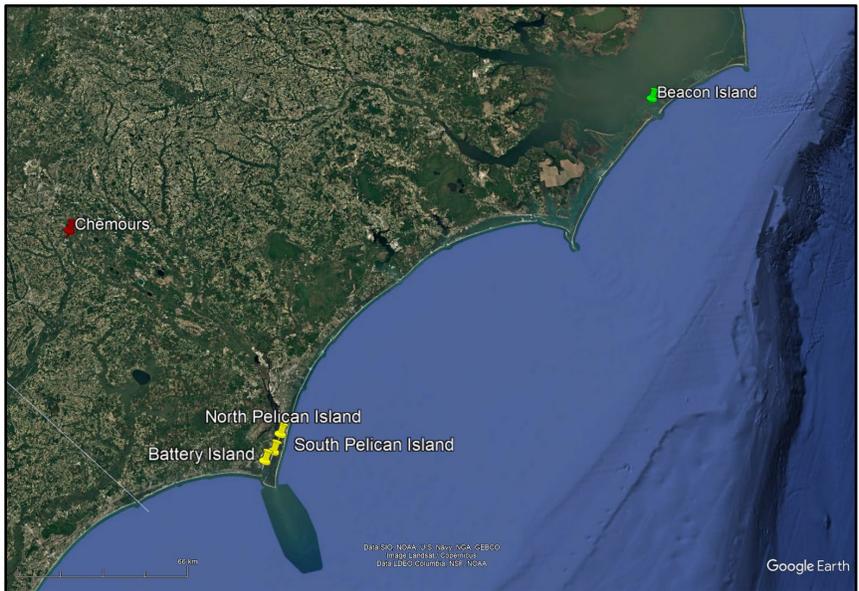


Figure 2. Location of pelican colonies sampled relative to PFAS point source.



Figure 3. Sample collection from juvenile pelican.

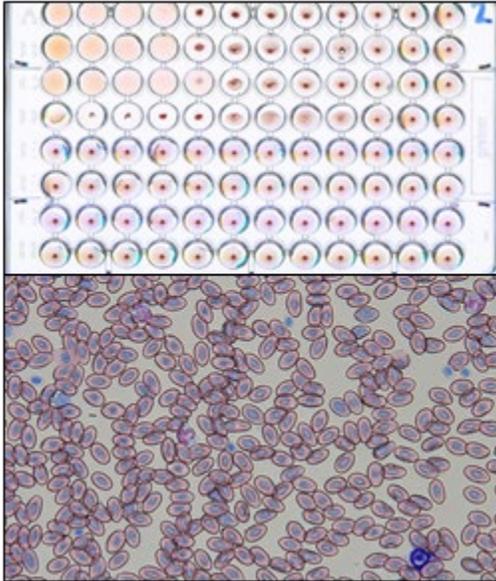


Figure 4. Health indicators monitored in pelicans include hemagglutination-hemolysis assay for characterizing constitutive innate humoral immunity and blood cell counts

Offshore Wind Development – Assessment, Guidance & Planning

Assessing the Cumulative Effects of Pressures from Offshore Wind Energy Development and Other Sources on Northern Gannets (*Morus bassanus*) in Atlantic Canada

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Project Summary

Offshore wind energy development (OSW) is pivotal for renewable energy transition and climate resiliency. However, OSW activities may negatively affect wildlife, contributing to cumulative effects (CE) from human activities and natural processes. To support the emerging offshore wind industry in eastern Canada, Environment and Climate Change Canada, the Biodiversity Research Institute and others are collaborating on a *demonstration* of a flexible, regional, species-centric framework for assessing the CE of OSW and other pressures on wildlife

(<https://doi.org/10.1016/j.eiar.2025.107912>), drawing on best practices used in Europe, the USA, and Canada. The demonstrating this framework a case study on the Northern Gannet population (*Morus bassanus*) in Nova Scotia, a province preparing for large-scale offshore wind development. The aim of our study is to show how this framework (1) handles species with different levels of information quality, (2) integrates data from multiple pressures, and (3) uses a combined CE metric to evaluate alternative wind farm arrangements.

Pressures considered include OSW-related behavioral disturbance (e.g., displacement) and collision, as well as oil pollution, fisheries bycatch, and behavioral disturbance from vessel traffic. We use spatial optimization to generate alternative wind farm arrangements that reduce predicted collision mortality for gannets, then calculate a CE metric to evaluate arrangements across future development scenarios defined by build-out, turbine technology, and turbine density. With refinement, this approach could support early OSW planning by providing a structured way to weigh multiple pressures and identify development options associated with lower cumulative risk for wildlife.

Multi-topic & Other

Computational model of biparental care in Leach's Storm-Petrels (*Hydrobates leucorhous*)

Primary Contact: Liam U. Taylor, Bowdoin Scientific Station (Kent Island),
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Collaborators: Robert A. Mauck, Kenyon College; Mark F. Haussmann, Bucknell University; Patricia L. Jones, Bowdoin College.

Project Summary:

It takes two seabirds to hatch an egg. While one parent is out foraging, the other remains at the nest to incubate. As a result, reproductive success in seabirds depends not only on the energetic investment of an individual parent, but also on the coordination within a pair. We investigate this complex system of biparental care in the Leach's Storm-Petrel (*Hydrobates leucorhous*), a small tubenose with enduring pair bonds, exceptionally long incubation periods, and vast open-ocean foraging trips. Using computer simulations, we examine how parental care schedules influence hatching success and parental body condition. Parameterizing our models with long-term field data from North Atlantic populations, we show that biparental care allows storm-petrel parents to buffer against environmental uncertainty through simple behavioral rules. At the same time, this

reliance on coordination creates a vulnerability: small changes in foraging conditions can cause incubation schedules to collapse. Critically, the model reveals that egg cold tolerance is a major player in reproductive success. Even attentive parents in favorable environments can fail if embryos are not highly cold tolerant. Our results underscore both the resilience and fragility of seabird reproduction in a changing marine environment.

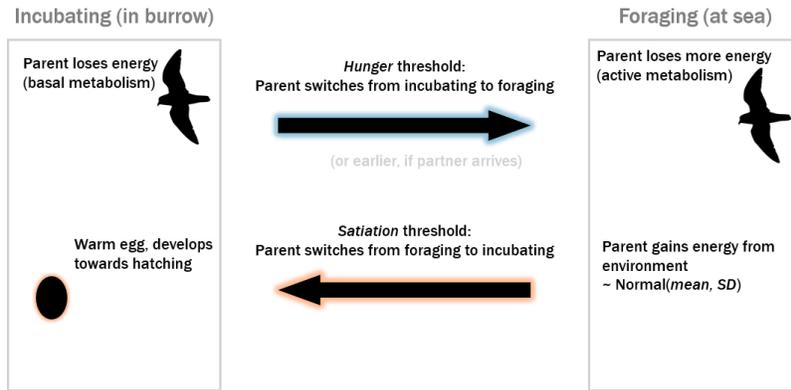


Figure 1. By combining simple behavioral and energetic rules for parents and eggs, we simulate incubation in storm-petrels. The model is implemented in C++ and analyzed in R.

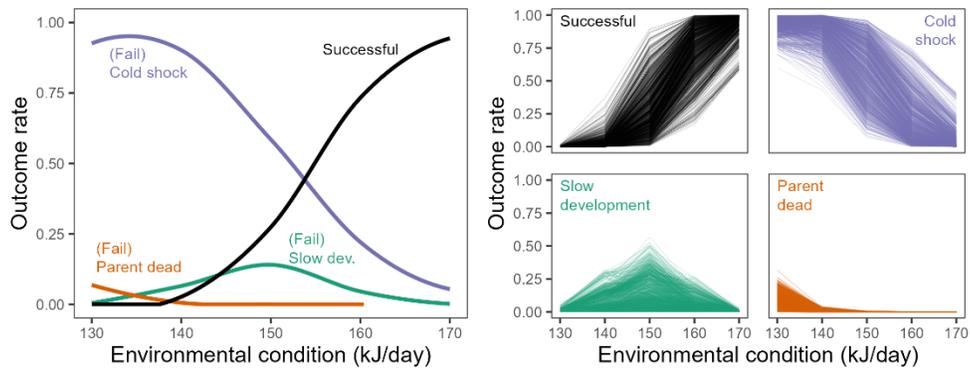


Figure 2. Computer simulations of storm-petrel incubation show that as marine environments degrade and foraging becomes more difficult, reproductive success can collapse. The model suggests that most incubation failures result from egg cold shock (i.e., when eggs are left unattended for too many days in a row).

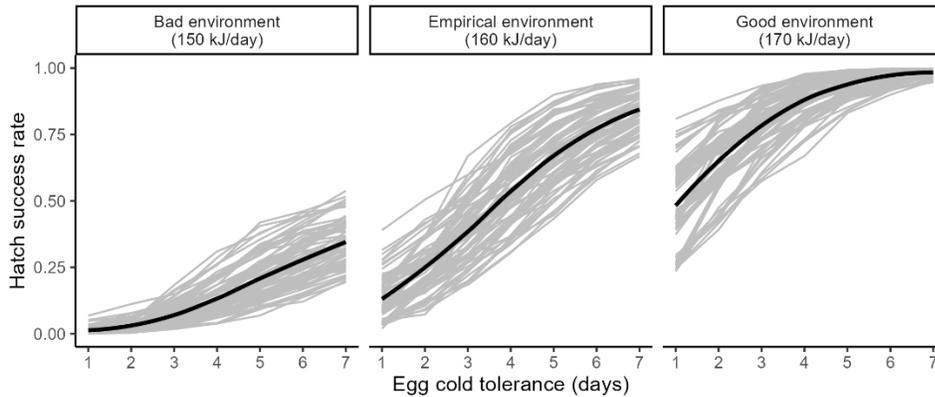


Figure 3. Computer simulations highlight the importance of the egg in seabird reproduction. Storm-petrel eggs have evolved to withstand exceptionally long periods of neglect (7+ days in a row) and still hatch successfully. The model suggests that even attentive parents in favorable environments will experience reproductive failure if eggs are not extremely cold tolerant.

Restoration of New York’s Common Loons Lost in the 2003 Buzzards Bay Oil Spill

Primary Contact: Lizz Schuyler, Senior Director of Conservation and Science, Adirondack Center for Loon Conservation, email: research@adkloon.org

Collaborators: SUNY-ESF’s Adirondack Ecological Center, New York State Department of Environmental Conservation, fishing outfitters, and lake associations in NY’s Adirondack Park

Project Summary: The goal of this project is to restore breeding Common Loons in New York’s Adirondack Park that were killed by the 2003 Bouchard Barge 120 oil spill in Buzzards Bay, Massachusetts and Rhode Island. This project is conducted by the Adirondack Center for Loon Conservation in collaboration with SUNY-ESF’s Adirondack Ecological Center, New York State Department of Environmental Conservation, fishing outfitters, and lake associations in NY’s Adirondack Park, a six-million-acre mosaic of private and public lands and waters.

In the last two decades, Adirondack loon reproductive success has shown a steady decline, with fewer nesting pairs and fewer chicks hatching and surviving to fledging. There has also been an increase in the morbidity and mortality of adult loons due to fishing line entanglement, lead poisoning, human disturbance, conspecific interactions, and predation by Bald Eagles.

Thus, to restore the loons lost in the B-120 spill and address the current concerns of reduced loon productivity and increased morbidity and mortality, the objectives of this project are to:

1. **Increase the reproductive success of Common Loons breeding in NY’s Adirondack Park.** A variety of management efforts including deployment of loon nest rafts, avian guards, and signage/buoys around loon nest sites, as well as collaboration with Adirondack lake associations to inspire community-based environmental stewardship, will be implemented over the five years of the project.
2. **Reduce the morbidity and mortality of Adirondack loons.** We will use a combination of community outreach programs, loon rescues, and rehabilitation to reduce exposure of loons to fishing-related threats, morbidity, and mortality, including:

- a. A Lead Tackle Buy-Back Program implemented with Adirondack fishing tackle outfitters
- b. Fishing line recycling containers distributed throughout the Park
- c. Training of loon rescue volunteers across the Park
- d. Collaborating with wildlife rehabilitation professionals to diagnose and treat loons in need of additional care

The expected outcome of this project is to restore the loon-years lost in the Buzzards Bay oil spill by:

1. Increasing loon reproductive success on managed nest sites compared to unmanaged sites and historical productivity
2. Reducing loon morbidity and mortality through:
 - a. Increased utilization of non-toxic fishing tackle by Adirondack anglers and removal of lead fishing tackle from use
 - b. Increased response time, efficiency, and success of capturing distressed Adirondack loons
 - c. Veterinary-supervised diagnosis, treatment, and rehabilitation of distressed loons
3. Expanding public awareness of conservation concerns affecting Adirondack loons
4. Establishing an Adirondack lake community stewardship program to increase community activities to protect loons

The effectiveness of this project at restoring loon-years lost in NY's Adirondack Park as a result of the B-120 oil spill will be assessed through annual and five-year statistical analyses of loon reproductive success, rescue attempts, health, and by monitoring the survival and productivity of released banded birds. The following parameters will be tracked:

1. Monitoring Adirondack Loon Reproductive Success
2. Implementing the Lead Tackle Buy-Back, Fishing Line Recycling, and Loon-Friendly Lake Certification Programs
3. Quantifying Loon Rescue Effort and Success

This project is funded through an award from the US Fish and Wildlife Service on behalf of the Bouchard Barge 120 Buzzards Bay Oil Spill Trustees.

Monitoring the Impacts of Climate Change and Environmental Pollutants on Common Loons and Aquatic Ecosystems in New York's Adirondack Park

Primary Contact: Lizz Schuyler, Senior Director of Science and Conservation, Adirondack Center for Loon Conservation, email: research@adkloon.org

Collaborators: New York State Energy Research and Development Authority (NYSERDA), SUNY-ESF, New York State Department of Environmental Conservation, Calvin College, Wildlife Conservation Society (WCS), University of Vermont

Project Summary: In this project, the Adirondack Center for Loon Conservation (ACLC) utilizes the Common Loon (*Gavia immer*) as a sentinel species of the impacts of climate change and airborne pollutants on aquatic ecosystems in New York's six-million acre Adirondack Park. Since 1998, the ACLC and its collaborators have been monitoring the Adirondack loon population to assess its exposure to environmental mercury pollution, and the risk mercury exposure poses to the reproductive success of Adirondack loons.

Results from our first decade of study on Adirondack loons indicated that birds with elevated mercury levels had reduced reproductive success compared to loons with low mercury exposure. The resulting drop in airborne emissions as a result of regulations (e.g., Clean Air Act Amendments of 1990, Mercury and Air Toxics Standards rule) has led to chemical recovery of many formerly acidic Adirondack lakes, and to significant reductions in mercury deposition across the Northeast. Correspondingly, mercury levels in Adirondack loons plateaued after 2010, and loon reproductive success was no longer as significantly impacted by mercury exposure compared to other factors.

Our monitoring and analyses indicate that climate change, among other factors, is now a significant threat to loon survival and productivity. Climate change-related torrential rain events reduce loon nesting success through nest flooding. A phenomenon increasing in frequency is the “molt-migration mismatch,” in which lakes now freeze later with warmer winters, loons fail to migrate prior to “ice-up” and their catastrophic winter wing molt, and they are subsequently “iced-in.” Additionally, climate change could lead to increased exposure of loons to avian diseases, such as avian malaria, with the range expansion of disease vectors and cause loon breeding ranges to retract northward due to temperature tolerance limitations. Thus, the Adirondack loon population could become an ecological sink, as the Park is currently at the southern limit of the species’ breeding range.

Continued monitoring and rescue efforts contribute to our understanding of the threats mercury and climate change pose to the Adirondack loon population and the aquatic ecosystems they inhabit. The nesting success of breeding loons on approximately 100 Adirondack study lakes is monitored annually to determine causes of nest failure, and to assess if nest flooding related to heavy and consistent rainfall during the loon incubation period continues to be a significant factor impacting the hatching of loon eggs. Breeding loons are captured, banded, and non-lethally sampled to collect blood and feathers to estimate total mercury body burden and to conduct complete blood counts and analyses for exposure to hemoparasites. Inviolate loon eggs are collected for contaminant testing from failed nest attempts. In addition, any rescued iced-in loons are examined to determine the status of their molt and document if a lack of flight feathers contributed to their inability to migrate prior to ice-in. Results from this project will contribute to a broader scientific understanding and increased public awareness of the threats environmental pollutants and climate change pose to loons and the aquatic ecosystems they inhabit.

This project is funded by the New York State Energy Research and Development Authority (NYSERDA).

Ecology of the endangered Diablotin Black-capped Petrel *Pterodroma hasitata*

Primary Contacts: Yvan Satgé, Clemson University, ysatge@clemson.edu.

Collaborators: Patrick Jodice, U.S. Geological Survey South Carolina Cooperative Fish and Wildlife Research Unit, pjodice@clemson.edu; Ernst Rupp, Grupo Jaragua, Brian Patteson, Brad Keitt.

Project Summary: The Black-capped Petrel (*Pterodroma hasitata*, also known as Diablotin) is an ESA-listed gadfly petrel endemic to the Caribbean and present in the Caribbean Sea, the Gulf of Mexico, and the western North Atlantic. Two phenotypes have been described: a smaller dark

form and a heavier pale form, which are genetically distinct. The only confirmed breeding sites have been located in the mountain ranges of Hispaniola, where habitat loss and degradation are continuing threats.

This year, we built a comprehensive database of nest monitoring data collected since 2012. The database standardizes and collates individual nest metadata (i.e. nest location and, when available, measurements, substrate, etc.) and annual monitoring data. We also assessed and controlled the quality of monitoring data to ensure that endpoints (i.e. reproductive activity and reproductive success) were comparable between partner organizations. Between 2012 and 2024, more than 181 Black-capped Petrel nests were located in Hispaniola, spread out among five nesting areas. Twenty-five nests were monitored for more than 10 years, and nine nests for more than 10 consecutive years. This effort provides an overview of nest search efforts, as well as a baseline for trends in colony occupancy and reproductive success, enabling a better assessment of conservation actions. This project is a collaboration with the International black-capped Petrel Conservation Group, American Bird Conservancy, and the U.S. Fish and Wildlife Service.

In September 2025, we initiated a proof of concept to test using environmental DNA to confirm the presence of Black-capped Petrel nesting areas in the landscape. At the onset of the breeding period, we collected four 1-L water samples from a mountain stream flowing below a known petrel nesting area. eDNA was amplified using primers 12SVertF and 12SVertR, and sequenced via Illumina sequencing (performed by Jonah Ventures). No petrel DNA was identified in these first samples. We plan on testing another six samples during the rainy season (January to March 2026). Funding for this project was provided by the Seabird Group and the South Carolina Cooperative Fish and Wildlife Research Unit.

Fieldwork was planned to track petrels from at-sea capture locations off Hatteras, North Carolina in April 2025 but it was postponed due to federal issues.

During the last year, we published an article in the *Journal of Caribbean Ornithology* that supports hypotheses of breeding allochrony and allopatry between the two phenotypes:

Satgé, Y.G., J.B. Patteson, B.S. Keitt, C.P. Gaskin, and P.G.R. Jodice. 2025. Satellite tracking supports hypotheses of breeding allochrony and allopatry in the Endangered *Pterodroma hasitata* (Black-capped Petrel, Diablotin). *Journal of Caribbean Ornithology* 38:59–66.

<https://doi.org/10.55431/jco.2025.38.59-66>