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**Stellwagen Sanctuary Seabirds,
Deer Winter Survival,
Crappie Tactics**

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On the Cover: Skittering over the waves to take flight, Great Shearwaters (*Ardenna gravis*) migrate north to New England coastal waters each summer to feed. Shearwaters are currently being studied in Stellwagen Bank National Marine Sanctuary in Cape Cod Bay, and elsewhere in the Gulf of Maine as part of a broader project to survey bird life numbers and their food supply in the sanctuary. Photo © Mark Wilson

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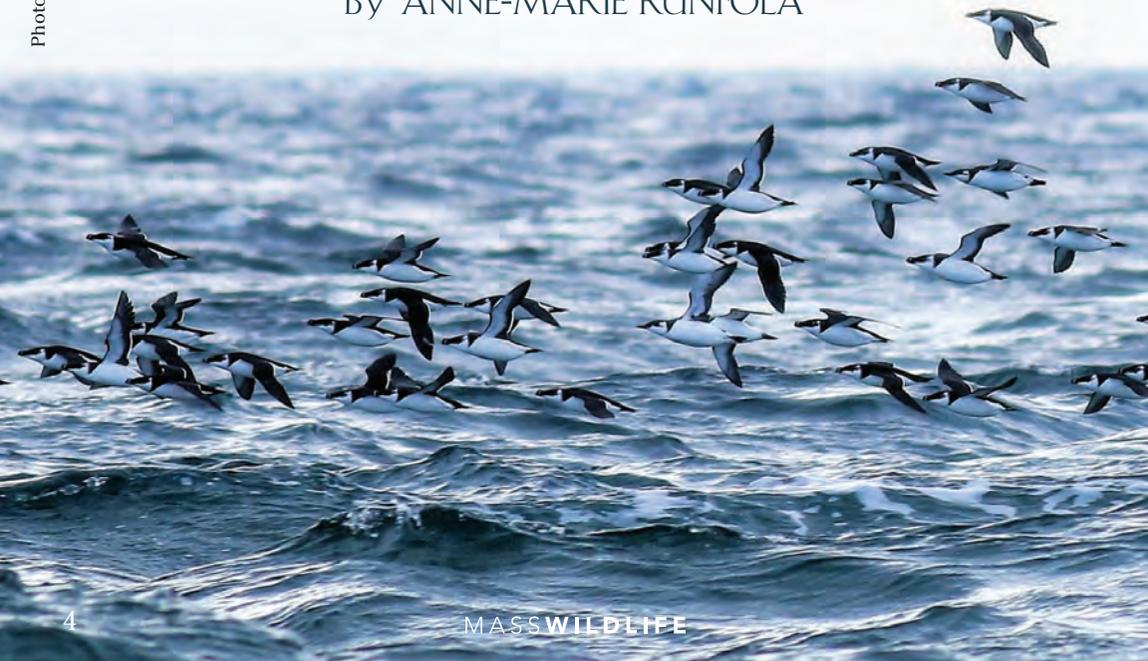


STELLWAGEN SEABIRDS



LIFE IN THE OPEN OCEAN

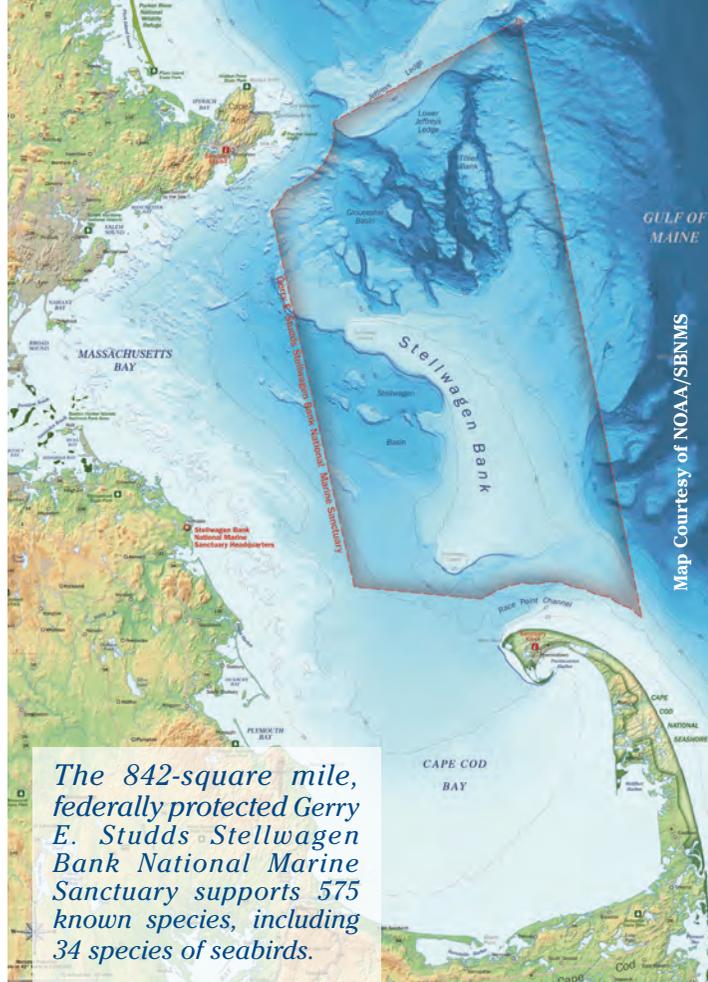
BY ANNE-MARIE RUNFOLA



Winter on the open ocean can be brutal. Frigid winds and big, rolling waves are the norm and the salty sea spray freezes to everything it hits. It is not an ideal time for a wildlife cruise—unless you are a diehard birder—because winter is a great time to track seabirds off the coast of Massachusetts. So despite below-freezing temperatures and a steady northwest wind, a team of nine volunteers, bundled up in snow suits, lugged their gear aboard the *Auk*, a 50-foot research vessel, before the sun made its appearance on the horizon last December. Even with the prospect of a long, cold day ahead, no one complained and several started birding in the parking lot. They all saw the trip as a rare opportunity that was not to be missed, even though it was occurring in the middle of the busy holiday season. This was one of five research trips conducted annually on the *Auk* in Stellwagen Bank National Marine Sanctuary by the Stellwagen Sanctuary Seabird Stewards (S4) Program. Vol-

unteers make as many as 50 additional trips each year on boats operated by our whale watch industry partners. The sanctuary created the S4 Program in 2011 in partnership with Mass Audubon. The program is building a database of bird sightings and associated information that will help sanctuary managers identify long-term population trends in seabirds and provide information on the health of the ecosystem as a whole.

What attracts birders is the same thing that attracts their quarry and other, larger animals like Humpback and North Atlantic Right Whales: the waters between Cape Ann and Cape Cod are teeming with life, even in winter. The nearshore geology, currents, and water chemistry create ideal habitat for foods such as phytoplankton and zooplankton



to thrive within sight of Boston. Marine mammals, seabirds and fish travel here from around the globe to feed off the outsized buffet on Stellwagen Bank, a sandy plateau submerged just offshore. These conditions have produced some of the best fishing, whale watching, and seabird viewing in the world and led to the establishment of the sanctuary in 1992. Today, the region also offers a unique opportunity to study ocean-going species close to shore, including seabirds, which has been the focus of our team's work for the past seven years.

Because seabirds travel above water and react quickly to changing conditions, we can learn a lot from them by studying their numbers and behaviors. As a result, seabirds are a means for biologists to peer beneath the waves to answer a wide range of questions. It has also become

Volunteers with the Stellwagen Sanctuary Seabird Stewards (S4) Program receive an orientation prior to heading out to Stellwagen Bank National Marine Sanctuary to observe and record seabirds and other wildlife.



Photo courtesy of Michael Thompson, NOAA/SBNMS

one of several ways for a group of citizen scientists to contribute to the broader understanding of the Stellwagen Bank ecosystem and beyond.

On the *Auk*, anticipation built as the captain gave his safety talk. Afterward, I briefed our team on the science mission and announced that my husband and chief cookie baker had come through again with two batches of oatmeal chocolate chip cookies to keep us going for the day. Then, as the *Auk* slowly pulled away from the dock, the volunteers took their positions on the flying bridge; a data recorder and observer pair on each side of the vessel, and marine mammal observers and a photographer at the center.

We stopped briefly at the harbor entrance to practice judging distance from the vessel to a nearby buoy. I took my position on a raised platform so I could see and hear all of the activity, and we were off and running with birds already in view. The observers immediately started calling out observations as their warm

breath formed wispy O's in the chilly air. At least this year, no icicles hung from the captain's pilot house.

"Sighting! 14:25:10. Black-legged Kittiwake. One. Flying. No association. 200 meters. 0 degrees. Flight height three. Flight direction seven o'clock."

"Got it."

"Sighting! Atlantic Puffin! One immature. Sitting. 100 meters. 10 degrees."

For nine hours, our observers called out sightings as we "mowed the lawn" across the sanctuary, recording all wildlife, vessel traffic, and marine debris encountered along our 114-mile route. We traverse the bank in east-west segments, two and a half nautical miles apart. I rotated team members to give them a chance to play different roles and ostensibly for them to take breaks, although telling a birder to go below to rest when a puffin, jaeger or, rarely, a skua might appear at any moment is usually a losing proposition.

Stellwagen Bank: An Important Bird Area

We have long known that the shallow banks and shelves of the Gulf of Maine (GoM), including Stellwagen Bank, support large congregations of seabirds. Shearwaters, storm-petrels, gannets, phalaropes, gulls, terns, jaegers, alcids and a variety of sea ducks frequent the region. The Wilson's Storm-Petrel, a regular austral winter visitor, is thought by some ornithologists to be the most abundant bird in the world, with a global population numbering in the hundreds of millions.

In 2002, Stellwagen Bank was designated as an Important Bird Area (IBA). Administered in our state by Mass Audubon, the IBA program is part of BirdLife International's global bird habitat conservation work. An IBA is a region that provides essential habitat to one or more species of breeding, wintering or migrating birds. It must support high-priority species, large concentrations of birds, exceptional bird habitat, and/or have substantial research or educational value—criteria easily met by the sanctuary.

New England communities also recognized the area for its natural productivity and diversity, long history of human use, and cultural significance when they nominated the site for special protection. In 1992, with the support of Congressman Gerry E. Studds and Senator John Kerry, 842-square miles of the ocean and seafloor were added to the National Marine Sanctuary system managed by the National Oceanic and Atmospheric Administration. We know the Gerry E. Studds Stellwagen Bank National Marine Sanctuary supports 575 known species, including 34 species of seabirds, but we also know the list is far from complete. In order to responsibly manage the sanctuary for future generations, researchers at the sanctuary and our many partner organizations work to understand the distribution, behavior, interrelationships and needs of the wildlife above and below the surface. That's where the seabirds—and our boat full of volunteers—comes in.



Photo © Peter Flood

S4 volunteers record data on seabirds, like the Black-legged Kittiwake (above) and a wide variety of marine mammals and food resources to help scientists better understand the Stellwagen ecosystem.



Photo © Bill Byrne

A Cory's Shearwater snatches a sand lance from an open ocean swell in Stellwagen Bank National Marine Sanctuary.



Photo © Peter Flood

What is a Seabird?

Seabirds spend much of their lives in the open ocean, coming ashore only to breed or occasionally to rest. They have unique physiological and behavioral adaptations making it possible for them to survive remarkably harsh conditions. Some seabirds, such as the sparrow-sized Wilson's Storm-Petrels, are pelagic and almost never fly near shore unless blown by storms. Others, like gulls and terns, spend most of their time on the coastline.

Some of the seabirds we see in Massachusetts waters nest and hatch locally. For instance, the Roseate Tern—a federal and state endangered species—nests in a handful of coastal locations. The state's largest colonies are located on two islands in Buzzards Bay. In September, Roseates migrate to Brazil for the winter. In contrast, the Great Shearwater breeds on the island of Tristan da Cunha between southern South America and Africa and makes a 12,000-mile round-trip to feed in the sanctuary and other northwest Atlantic waters.

Open Ocean Adaptations

Feeding behaviors make for some spectacular wildlife displays. The Northern Gannet dives from heights of up to 130 feet using its wings to swim under water and catch fish. Wilson's Storm-Petrels dip their feet into the water in flight, stirring plankton and krill up to the surface. Using their wings, Common Murres dive up to several hundred feet underwater to catch and swallow their prey, and Pomarine Jaegers harass terns until they drop their food and then swoop down to steal it in midair. Tiny sea-going sandpiper relatives called phalaropes nest on the Arctic tundra and migrate over sanctuary waters, where we occasionally see them spinning in quick, tight circles on the water's surface to stir up meals of plankton, which they draw up like a straw through their needle-like beaks.

These behaviors and the equally unique physical features listed below make for a seemingly endless variety of ornithological details to note or consider during our long days on the water.

Continued on page 12

GREAT SHEARWATER TAGGING

Great Shearwaters (*Ardenna gravis*) are one of more than 30 species of seabirds that spend at least part of their life in the waters of Stellwagen Bank National Marine Sanctuary. Great Shearwaters nest in the Southern Hemisphere and usually appear in the Gulf of Maine (GoM) in June to feed during the austral winter, but little is known about how they spend their time in these northern waters. For that reason, researchers at the sanctuary office in Scituate, are using satellite technology to learn more about the movements, life cycle, and feeding and foraging habits of Great Shearwaters in the GoM region.

Seabirds are excellent indicators of ecosystem health, and they help us track changes to the environment over time as a result of climate change, by-catch, marine debris, and other impacts. They can be affected by the local condition of their habitat, as well as the condition of regions through which they migrate, which, for shearwaters, spans the globe.

The Great Shearwater is a true seabird, spending the majority of its life at sea, and is one of the larger members of the family Procellariidae. It is dark above and white below, with a dark cap and dark coloring on the trailing part of its tail (see cover photo). They can be seen in the sanctuary gliding over the wave tops on stiff, outstretched wings or feeding in large groups on schools of small fish, often in the company of whales and other birds. They breed in large colonies during the northern winter on the island complex of Tristan da Cunha, where the female lays one egg on open grass or in a small burrow. Their winter feeding grounds range from Florida to the Labrador Sea (south of Greenland). To get between their breeding and feeding grounds, they follow a “Great Circle” migratory route that can span 6,000 miles or more each way.

The Stellwagen research team uses miniature satellite tags manufactured by Microwave Technology to track the movements of 10 birds in the sanctuary each year and, in the case of one bird,



(Above, L to R) Dr. David Wiley (SBNMS) and Linda Welch (USF&WS) attach a solar satellite transmitter to one of the 10 Great Shearwaters tagged for the project in 2016; (Below) A solar satellite tag.



well beyond. Researchers attach the tags to the back of each bird with fine thread that eventually dissolves, releasing the tag. At the same time, the team collects body weight data as an indicator of the bird's health, and takes blood and feather samples to study food habits.

Signals from the tags allow scientists to plot bird movements throughout their summer range. One tagged bird named Everglade, kept its tag on for nearly a full year, providing data well into its winter habitat. Using this tracking data, scientists can relate the movements of the tagged birds to oceanographic conditions such as water temperature, bathymetry (water depth), chlorophyll concentration, and ocean weather fronts, and other factors that might affect the birds themselves, as well as critical forage species such as sand lance (see page 11).



NOAA Fisheries Permit #605-1904

Clockwise: Anne-Marie Runfola watches for marine mammals from the observer platform (Photo © Evelyn Ganson); Shearwaters feed alongside two Humpback Whales (Photo courtesy of Jeremy Winn, NOAA); A Wilson's Storm-Petrel flutter dances (Photo © Mark Wilson); and Mass Audubon's Wayne Petersen with the S4 team (Photo courtesy Anne-Marie Runfola, NOAA).



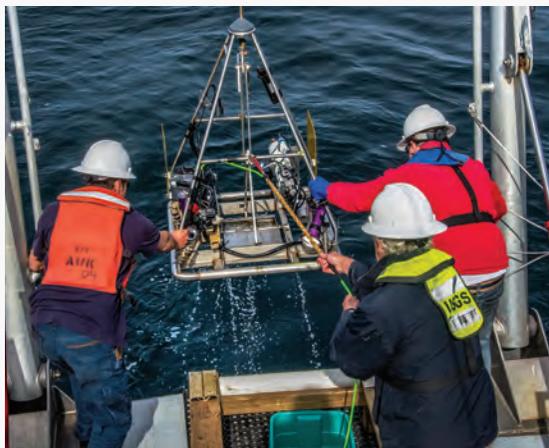
SAND LANCE STUDY

In the southern Gulf of Maine, the unassuming Northern Sand Lance (*Ammodytes dubius*) is the primary forage fish for most large predators, including whales, seabirds, Bluefin Tuna, and other important commercial and recreational fishes. But the numbers of this critical fish fluctuate significantly, and in recent years have been quite low. At the sanctuary, we want to learn more about how seabirds react to changes in their primary food source and what factors cause changes in forage fish abundance.

Sand lance are a small (three- to six-inch), eel-like fish that spend their days feeding on zooplankton in the water column and at night, thanks to having no swim bladders, they can bury themselves in the shallow, sandy seafloor of Stellwagen Bank.

Despite their importance to large, charismatic marine animals such as whales, little is known about sand lance and the conditions that affect their abundance. This mystery is why scientists at the sanctuary office and partner organizations have begun turning their attention to this seemingly small but critical part of the local ecosystem. Since 2013, researchers have been using the Seabed Observation and Sampling System (SEABOSS), a technology created by researchers at U.S. Geological Survey, to record and sample sand lance and their associated sediment type at 44 sites throughout the sanctuary.

Video captured while sampling provides a record of sand lance numbers, but SEABOSS also measures CTD (conductivity, temperature, and depth) data that



Photos © Rob MacDonald

help researchers understand how basic oceanographic variables impact abundance and distribution. At each station, the various teams, including volunteer observers, record sightings of seabirds and whales to correlate predators and prey in the waters of the sanctuary. The team is also using S4 and satellite tag data from the 40 shearwaters tagged to date to help understand these populations and their relationships (see page 9).

In 2016, the research team added collaborators from the Woods Hole Oceanographic Institution, who will study the relationship between larval sand lance and their key food source: phytoplankton and zooplankton. This study will provide a more complete picture of how energy moves from the base of the food chain throughout the ecosystem.

Because sand lance prefer very specific habitat types (sandy bottoms no deeper than 90 to 100 meters), they are potentially vulnerable to environmental change in the sanctuary. If warming waters move preferred phytoplankton blooms away from their sediment-based habitat, for example, the sand lance could go hungry, and in turn impact the larger food web. To that end, the team is also collaborating with scientists from the University of Connecticut who are conducting experiments on a range of possible future environmental conditions on sand lance larva.



Continued from page 8

Extra-long wings: For soaring instead of flapping, which enables seabirds to conserve energy while migrating long distances over open ocean.

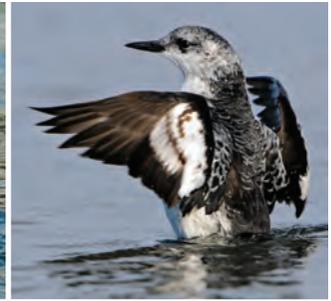
Countershading: Being dark on top helps seabirds blend into the cliff faces where they nest and dark ocean waters where they feed; a white underbelly allows them to be less conspicuous to their fish prey below the surface.

Stereoscopic vision: Most terrestrial birds' eyes are located on either side of their head. The eyes of some seabirds are positioned close together on the front of their head, an adaptation that seems to be linked with foraging efficiency.

Salt glands: To remain hydrated at sea, one group of seabirds—the tubenoses—have special glands that remove salt from seawater. Located above or within their eye sockets, these glands work much like the human kidney, removing excess salt from the bloodstream and enabling the bird to expel it by shaking their heads or “sneezing” water from tubes on the top of their bills.

Threats & Research

Adaptations such as having a low reproductive rate and lengthy maturation period may also put some species at greater risk, especially when confronted with changes caused by human activity. Some of these threats include over-hunting, egg harvesting, nesting area destruction, oil spills, fish net entanglement, and ocean trash ingestion. Seabirds are also affected indirectly and less visibly by changes and activities that often occur over hundreds or thousands of miles. Overfishing, declining water quality, rising sea surface temperatures, and ocean acidification affect prey availability, diminish habitat quality, and create added resource competition with other animals. Large-scale changes like global warming are also pushing seabirds into places beyond their established range. This is a phenomenon expert observers have noted anecdotally in the increased number of southern species reported in and around the sanctuary in recent years. However, it is not yet clear if or how individual species will be affected by any or all of these changes.



Clockwise: A bull Gray Seal surfaces and a Black Guillemot wing flaps (Photos © Mark Wilson); A hovering juvenile Long-tailed Jaeger (Photo © Peter Flood); a young Loggerhead sea turtle basks in calm seas (Photo © Rob MacDonald).



Photo © Mark Wilson

Jaegers and skuas are true pirates of the sea. Here a juvenile Parasitic Jaeger aggressively chases a Common Tern in an attempt to get the tern to regurgitate a fish it just caught.

Back on the Bank

This past December, our S4 team counted three times the number of Common Murres (48) and four times the number of Razorbills (64) over the numbers tallied in 2015. Unlike the previous winter's cruise, we did not see any Northern Fulmars or Great Shearwaters. Mass Audubon's Director of Important Bird Areas, Wayne Petersen, suggested that in 2015, the combination of warmer-than-usual ocean temperatures and a super-abundance of the small bait fish called the Northern Sand Lance (see page 11), delayed the departure of Great Shearwaters headed to the Southern Hemisphere for the austral summer.

Also, to the surprise of the *Auk* team, we recorded an adult Atlantic Puffin. Juvenile puffins, with smaller, less colorful beaks than their iconic parents, are sometimes seen in the sanctuary, but adult puffins are unusual, making it one of the highlights of the cruise.

The S4 team also spotted a number of marine mammals, including Humpback Whales, Common Dolphins, Harbor Porpoises, and Harbor Seals. But at its heart, the cruise was about seabirds, their phenomenal adaptations to their

environment, and their deep connection to the ecosystem of Stellwagen Bank National Marine Sanctuary.

Seabirds are animals without borders. What happens to them on their breeding and feeding grounds has a ripple effect across the globe. They are under tremendous pressure and are struggling worldwide. The S4 Program plays a crucial role in monitoring seabird populations off the coast of Massachusetts, to measure the health of the birds and through them, the Gulf of Maine ecosystem and far beyond. As each S4 volunteer witnesses the beauty and resilience of these animals and returns to shore to share stories, we move one step closer to reaching a level of public awareness that will ensure the birds' protection for us and for future generations.

For more information on Stellwagen Bank National Marine Sanctuary, its seabirds, and volunteer opportunities visit, <http://stellwagen.noaa.gov>.

About the Author



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