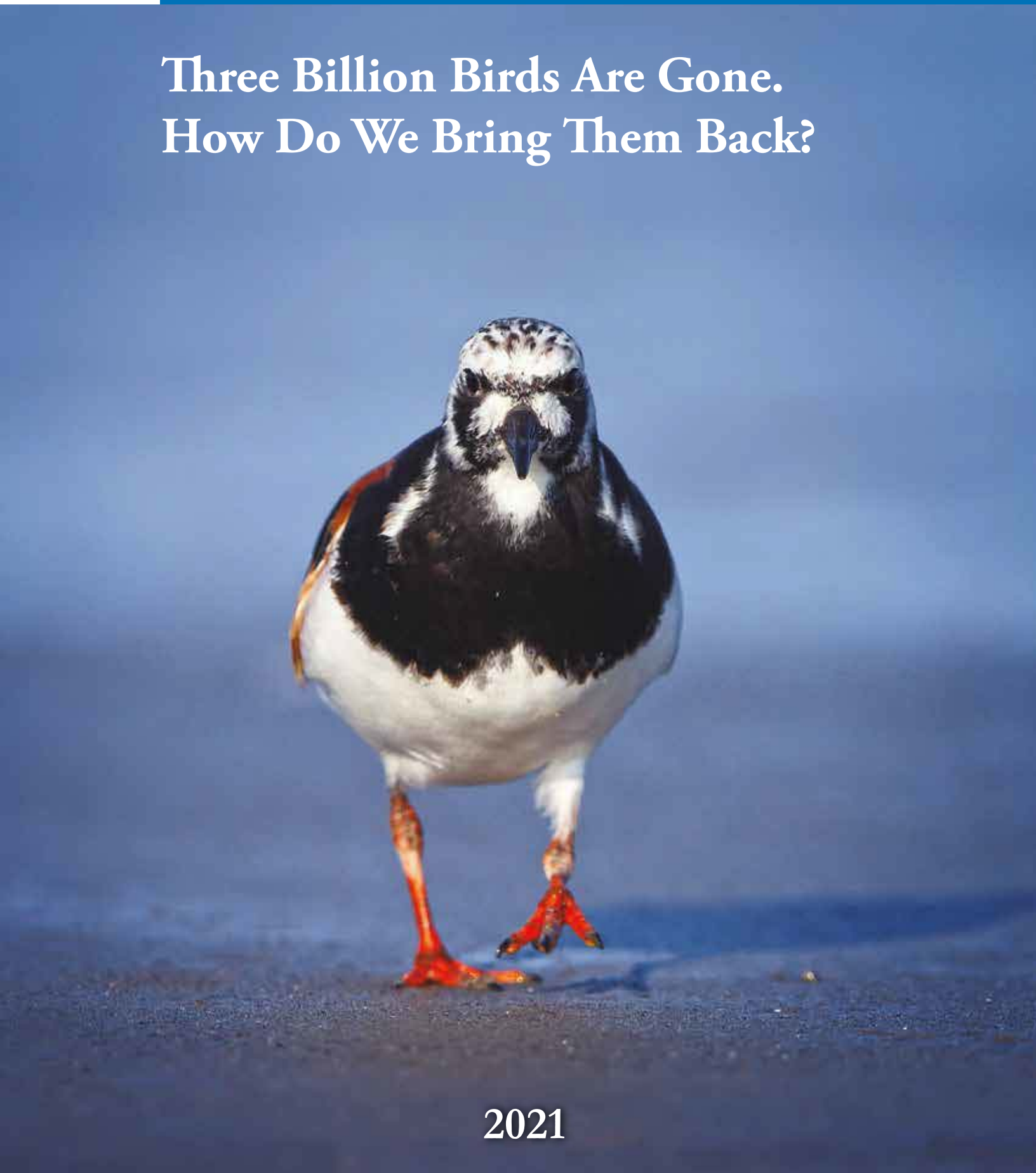
THE CONNECTICUT Audubon SOCIETY

Connecticut State of the Birds

Three Billion Birds Are Gone. How Do We Bring Them Back?



2021

CONNECTICUT STATE OF THE BIRDS

Three Billion Birds Are Gone. How Do We Bring Them Back?

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Connecticut State of the Birds

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The Stilt Sandpiper is deemed a High Urgency species.

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PHOTO: JULIAN HOUGH

Reimagining Bird Conservation in the 21st Century

by Peter P. Marra

JULIAN R. HOUGH

For species like Prairie Warbler, "We are making progress in pinpointing how to identify why, where and when the decline happens."

Slowing the loss of biodiversity across habitats on land and sea is one of the greatest environmental challenges humans face in the 21st century. Over the past 150 years, various forces of environmental change, including human-caused habitat loss, overharvesting, and invasive species, have driven extinctions. The rate is now being increased by climate change. In the Anthropocene these individual extinctions have defined the global biodiversity crisis, but they are not the only concern. Equally profound are the changes these extinctions cause in the larger ecosystem.

Using data from multiple and independent monitoring networks, I co-authored a paper in *Science* in September 2019 that reported major population losses, nearly 3 billion birds, across much of the North American avifauna, in species from every biome. And greater losses are on the horizon: Well over half of the species (331, 57 percent) that make up the North American avifauna show high vulnerability to extinction or are experiencing moderate to steep range-wide declines. This loss impacts an infinite number of ecological and evolutionary services, including pollination, seed dispersal, predator control, and scavenging.

As significant, the loss represents a major threat to the way we relate to nature, and it is indicative of impacts on other global environments that humans co-inhabit with so many other species. Birds connect people to their environment like no other organism in the natural world. We awake to their sounds, and they are usually the first wild animals we encounter when we walk out our front door.

Birds are a critical touchstone to nature, a constant reminder of the inextricable link between humans and their environment. Migratory birds also demonstrate our global interconnectedness. Like other global resources held in common, they are a part of earth's natural heritage that is shared among countries and cultures, and hopefully across generations. Their decline, given their demonstrated position as excellent indicators of ecosystem health, signals the decline of other global commons and the broader decline of ecosystem integrity itself. An ecosystem that we as humans equally depend upon.

Although the factors contributing to bird population declines remain elusive, we are making progress in pinpointing how to identify why, where, and when the decline happens. Over the past 25 years, we have worked hard to spearhead studies on migratory birds throughout their annual cycle to demonstrate the links between their geographic connections (i.e., migratory connectivity) and where and when populations are most impacted. Using cutting edge technologies, we are advancing our understanding of where individual bird species breeding in the United States migrate and spend their winters, and the conditions they face on

"Bring back 3 billion birds" has become a clarion call.

the migration route and in the non-breeding season. This information is critically important for understanding the causes of decline and for developing a path for species recovery.

We also know that today's steep population declines are a clear indication that our existing conservation tools, including domestic laws and international treaties, are not sufficient to deal with present threats to birds and need to be wholly reevaluated.

This should not be that surprising. Many of the legislative and nonlegislative measures in place to protect migratory birds and other species were adopted nearly 50 to 100 years ago—in the context of much less understanding of environmental and global interconnectedness and factors that impact species conservation. These measures often responded to specific environmental harms, such as the harvesting of egret feathers to be used in adorning hats or the impacts of a specific pesticide such as DDT on Bald Eagles, Ospreys, and other raptors. And although they protected individual and often non-migratory species, they are not effectively responding to contemporary environmental problems.

We need only look to the extinction of several bird species in North America over the last century, such as the Passenger Pigeon, the Carolina Parakeet, and the Eskimo Curlew, to remember that even abundant species can go extinct rapidly. If current rates of avian decline continue, without conservation action aligned to deeper understandings of the causes of decline causation, the losses will be enormous.

The Road to Recovery

The next several years represent a critical juncture for conservation. Estimates of biodiversity loss signal an urgent need for scientists and conservation groups to unite to set priorities, identify research needs, set a recovery agenda, and secure public support to avert additional listings under the Endangered Species Act.

In early 2020, we initiated a new path forward in the conservation of North American birds—an effort we are calling the Road to Recovery, or R2R. It's a collaboration among several of the leading bird conservation organizations and institutions in the country: Georgetown University, the Cornell Lab of Ornithology, the Bird Conservancy of the Rockies, National Audubon, and the American Bird Conservancy. Its goals are to develop recovery plans for the most vulnerable bird species; promote scientific work that will lead to action that helps the most vulnerable species; and increase the efficiency and effectiveness of current resources. Within the next several months, this coalition will be releasing its U.S. State of the Birds report, focusing on improving science, carrying out new policies, and encouraging a range of conservation actions that everyday people can take.

"Today's steep population declines are a clear indication that our existing conservation tools, including domestic laws and international treaties, are not sufficient to deal with present threats to birds and need to be wholly reevaluated."

The *Science* article and the outreach efforts accompanying it succeeded in elevating awareness, making "bring back 3 billion birds" a clarion call across the bird conservation community. Yet narrowing the gap between conservation gains and hemispheric environmental degradation and habitat loss will require a deliberate reimagining of the scope and strategies of bird conservation. Today, more species than ever are sliding toward threatened and endangered status. Not only does that mean more species are closer to extinction, it also means that, if listed, species will be subject to regulatory action and cost taxpayers hundreds of millions of dollars. The time to act on this next set of what we are calling "species on the brink" is now!

When Birds Thrive, Humans Prosper

To recover these species and avoid listing status, we need to be strategic and swift. In addition, just as the annual cycle of avian species connects multiple nations and cultures, our solutions to reverse declines must also fully engage a spectrum of collaborators, including ecological and social scientists, land managers, private industry, and policy makers throughout the hemisphere.

Birds are indeed the quintessential canaries in the coal mine, and their decline signals broadscale ecosystem decay—an ecosystem upon which humans equally depend.

Black Scoter numbers have plummeted.

When birds thrive, humans prosper. Given the recent findings of bird population declines, we must assemble the best available information and chart the path for the recovery of these remarkable species so that future generations can enjoy them as we have. Efforts to protect birds will support efforts to protect other global resources that we depend on, and, in turn, humanity's shared natural heritage.

Peter P. Marra, Ph.D., is the Laudato Si Professor of Biology and the Environment at Georgetown University and the director of the Georgetown Environment Initiative.

The Uncertain Road to Recovering 3 Billion Birds

The September 2019 report in *Science* magazine documenting the loss of 3 billion North American birds since 1970 was both sobering and galvanizing.

People who care about birds—from grassroots activists like members of Connecticut Audubon to the loftiest levels of academia—are moving into action.

This *Connecticut State of the Birds* report includes a close look at six of those species, as well as Peter D. Marra's Road to Recovery call to action, and a look at how climate change mitigation, adaptation and resilience can also help bring birds back.

The organizations working on the Road to Recovery assembled a database of avian information and then used it to create a list of birds that are close to being considered for protection under the Endangered Species Act.

The list encompasses 60 species of Very High, High, or Moderate Urgency. Another 32 have small populations and high threats but insufficient monitoring data, for a total of 92 species.

The list on this page includes 37 that can be found in Connecticut. Other organizations have compiled similar lists, with much overlap and a handful of different species. Connecticut Audubon takes all of these lists into account in framing our conservation priorities. There's no shortage of species on the brink.

Very High Urgency

Very large population loss, continued or accelerated decline

King Eider
King Rail
American Golden Plover
Ruddy Turnstone
Red Knot
Short-billed Dowitcher
Lesser Yellowlw\egs
Hudsonian Godwit
Whimbrel
Least Tern
Great Black-backed Gull

High Urgency

Large population loss, continued or accelerated decline

American Black Duck
Black-bellied Plover
Buff-breasted Sandpiper
Pectoral Sandpiper
Semipalmated Sandpiper
Stilt Sandpiper
Black Skimmer
Henslow's Sparrow
Golden-winged Warbler
Evening Grosbeak

Moderate Urgency

Large population loss, smaller recent decline or leveling off

Black Scoter
Black-billed Cuckoo
Eastern Whip-poor-will
Chimney Swift
Olive-sided Flycatcher
Wood Thrush
Bobolink
Cerulean Warbler
Prairie Warbler
Canada Warbler
Mourning Warbler

Data Deficient

Small population, high threats, insufficient monitoring

Yellow Rail
Black Rail
Bicknell's Thrush
Seaside Sparrow
Saltmarsh Sparrow

Left column top to bottom: Chimney Swift, Black-billed Cuckoo, Pectoral Sandpiper, Seaside Sparrow.
Right column top to bottom: American Black Duck, Cerulean Warbler, Evening Grosbeak, Lesser Yellowlegs, Golden-winged Warbler, Yellow Rail, Black Scoter.

PHOTOS: PAUL J FUSCO

Searching the Forests of Far Northern New Hampshire for the Key to Rusty Blackbird Declines

by Carol R. Foss

It is a cold, damp morning in early May, and patches of snow remain on the logging roads of northern New Hampshire. Aided by compass and GPS, I set off for a remote beaver pond in search of Rusty Blackbirds. Suddenly I stop dead in my tracks: a series of high-pitched "ker-glees" is coming from the wetland about 50 yards ahead. Now my pace picks up, and I head straight for the sounds. After pushing through a dense thicket of young spruce and fir, I emerge onto the shoreline and balance precariously on a log. Atop a dead tree in the beaver pond a male Rusty Blackbird is perched, sporadically delivering his "song." Careful scanning reveals his female, foraging for invertebrates on a patch of exposed mud. Another Rusty Blackbird breeding season has begun!

Rusty Blackbirds breed in boreal and Acadian forests from Alaska to Canada's Maritime Provinces, and south into northern New England and the Adirondacks. At New Hampshire Audubon, we've conducted research on them for more than a decade: Since the 1970s, the Rusty Blackbird population has plummeted. Our goal is to help find out why.

Rusty Blackbirds nest in stunted or regenerating spruce-fir stands in or near shallow wetlands. Historically, in northern New England the disturbance created by spruce bark beetle, spruce budworm, and beaver activity provided habitat for nesting and foraging. While beavers continue to be a major influence on habitat for foraging, forest management has largely replaced insect outbreaks in creating habitat for nesting.

The Rusty Blackbirds that breed in eastern Canada and northern New England winter primarily on the southeastern coastal plain. It is these birds that may pass through Connecticut during spring and fall migration, and in mild years may even winter there. Connecticut residents may encounter Rusty Blackbirds anytime from mid-September to early June.

Historical accounts suggest that the Rusty Blackbird has been declining since at least the 1920s. Although the species is not federally listed as threatened or endangered, the population has declined precipitously in recent decades; Breeding Bird Survey and Christmas Bird count data indicate more recent declines of more than 85 percent since the 1970s. In eastern Canada and the northeastern U.S., a retraction of their breeding range to the north and to higher elevations implies a climate relationship, and we hope that our research may uncover a clue to why this change has occurred.

Beginning in 2009 with a regional roadside survey, we documented a concentration of blackbird activity in northeastern New Hampshire, and in 2010 we began more widespread presence-absence surveys, nest searching and monitoring, and color-banding. Our early work centered on the Lake Umbagog area and has expanded gradually throughout the Upper Androscoggin Watershed of Coos County, New Hampshire, and Oxford County, Maine. We hope that by studying Rusty Blackbirds here, near the southeastern limit of their breeding range, we can gain insights into factors influencing the species' decline.

Surveys begin in early May, when we visit remote wetlands to watch and listen for Rusty Blackbird activity. Careful observation and lots of patience lead us to the nest. The crew checks each nest about once a week to ensure it is still active, to determine when hatch occurs, and to identify a target date for banding. Ideally, we try to band when the nestlings are 9–10 days old—large enough for bands to stay on and young enough for the birds to stay in the nest when returned after processing. The banding crew is intrepid and determined, starting off well before dawn, carrying banding equipment, net poles, and sometimes a ladder along a flagged trail on spongy ground littered with blowdowns, by light of a headlamp, while besieged with mosquitoes and blackflies. We capture the adults by setting mist nets on their route to and from the nest. Adults are easier to capture when the nets are up before daylight, as Rusty Blackbirds are adept at avoiding visible nets.

Master bird bander Patricia Wohner of New Hampshire Audubon, with a Rusty Blackbird.

PHOTO BY CAROL FOSS

Once in hand, adults and nestlings are weighed, examined for parasites, banded, and in some cases outfitted with a tracking device. The majority of our color-banded adults return to the same nesting area in consecutive years, but a few may select a new nesting area up to four miles from the previous year's nest site. The few banded nestlings that we have located in subsequent years have dispersed 2-18 miles to establish nests.

In 2015 we were surprised to find the larva of a parasitic insect, the bird blow fly, attached to a nestling. This led us to investigate bird blow fly parasitism in our population and the relationship between levels of parasitism and climate. Female bird blow flies require a minimum temperature in the 60s before emerging in spring to lay their eggs in bird nests; larvae must obtain three blood meals from nestlings to pupate and

PAUL J. FUSCO (3)

Low survival during non-breeding season might be a big cause of the Rusty Blackbird's 85 percent decline.

reach adulthood. Bird blow flies seldom kill nestlings of other species but can reduce fledgling survival. This might be a clue to how climate change could be contributing to Rusty Blackbird declines. Our analyses suggest that relationships between bird blow flies, Rusty Blackbirds, and local climate are complex, and that April precipitation and May temperatures may influence the frequency and intensity of nest infestations.

We're also collaborating in continental scale studies through the International Rusty Blackbird Working Group. One study has found that survival of adults during the non-breeding season is higher in the east, while that of juveniles is higher in the west, and that low survival during non-breeding season is likely driving the population decline.

With that possibility in mind, we began to investigate the whereabouts of our breeding population during the non-breeding season. In 2018, the Smithsonian Migratory Bird Center provided us with GPS tags, which record a bird's location at previously programmed intervals. The challenge with these tags is the necessity of recapturing the bird the following year to remove the device and download the data. The tag retrieved from the one individual we recaptured in 2019 yielded 43 locations. After the nesting season this male traveled north and moved around in New Hampshire's northernmost township until October 11 before heading south. By November 13 he had arrived in an agricultural township less than 100 miles from the coast of North Carolina, where he remained within a 250-acre area until March 10 before beginning the migration north.

Our study of migration continued in 2019 with the deployment of Motus nanotags on nine adults. These tags emit a radio signal that can be detected when the bird passes within range of special antennas throughout North America. In November 2019, the Motus antennas at Connecticut Audubon's Deer Pond Farm in Sherman detected four of these individuals. Most of our tagged birds were last detected near Chesapeake Bay, but two were detected on the South Carolina coast and one on the coast of Georgia, demonstrating that birds from our breeding population winter over a large geographic area. We found five back at their nesting areas in May 2020, including one that was never detected during spring or fall migration. We deployed 20 nanotags on breeding Rusty Blackbirds in June 2021 and look forward to following their travels in the coming months.

The work is physically challenging and time-consuming. But each data point adds valuable new information. Reversing population declines requires understanding the threats a species faces during each phase of its annual cycle. With the help of new technologies, we hope to learn more about these threats in the coming years.

* * * * *

Carol R. Foss, Ph.D., is senior advisor for science and policy at New Hampshire Audubon.

Four tagged Rusty Blackbirds have been detected at Deer Pond Farm in Sherman.

Semipalmated Sandpipers are Down by 80% —Their Plight in a Changing World

by David S. Mizrahi

The most important migration stopover areas for Semipalmated Sandpipers are Delaware Bay and the Bay of Fundy, but this species is also one of the most common migratory shorebirds in Connecticut.

Thousands of shorebirds wheeling along the shorelines is a familiar and breathtaking sight along the Atlantic Coast. But this abundance can lull us into a sense that all is well with these species. The gregarious nature of shorebirds can mask declines that are apparent only when numbers get extremely low and extinction is imminent.

We have clear examples of this process in once abundant species that are no more. Passenger Pigeon and Eskimo Curlew were hunted to extinction during the 19th and early 20th centuries. Deforestation, invasive species and hunting contributed to the demise of the Carolina Parakeet. These species once numbered in the millions, tens of millions and, even hundreds of millions.

The Semipalmated Sandpiper, one of the most common and widespread shorebirds in the Western Hemisphere, could be facing a similar plight. Many spend the non-breeding season along the northern coasts of South America, from Peru to northeastern Brazil, with some occurring in the Caribbean as well. Their breeding range is also quite extensive, with nesting from Arctic and sub-Arctic regions of western Alaska to northeastern Canada.

During the early 1980s, two biologists from the Canadian Wildlife Service, Guy Morrison and Ken Ross, undertook what seemed like an impossible task: conduct an aerial survey of the entire South America coast to enumerate wintering populations of shorebirds over a five year period. The data collected represented our best understanding of the state of shorebird populations during that period, especially for species that migrate to North America to breed.

They served as the basis for evaluating apparent population declines in the Red Knot, now listed as threatened under the Endangered Species Act, when surveys in the Tierra del Fuego and Patagonia regions of Argentina and Chile were resumed by Morrison and Ross in 2000.

Key Habitats

The 1980s surveys also revealed valuable information about Semipalmated Sandpipers. The Canadians encountered nearly 2.4 million individuals during their surveys, and 86 percent of them were wintering in the northeastern quadrant of South America, primarily Suriname (1.35 million), French Guiana (400,000) and northern Brazil (250,000).

In 2008, New Jersey Audubon partnered with Morrison and Ross to reconstitute surveys to determine if Semipalmated Sandpipers experienced declines in the core of their winter range. The impetus was a 75 percent reduction in the number of Semipalmated Sandpipers counted during aerial surveys in Delaware Bay during spring migration since the early '90s, and a 50 percent decline in the Bay of Fundy. Delaware Bay and the Bay of Fundy are the most important staging areas for the species during spring and fall migration, respectively.

The results of our South America surveys were alarming. Across the three countries, Semipalmated Sandpiper had declined to about 450,000 or almost 80 percent since the 1980s. Subsequent surveys in 2011, 2013, 2017, and 2019 strengthened our certainty about the accuracy of the results and revealed a small, continuing decline in the species.

Horseshoe crab eggs are an essential food for shorebirds.

The Red Knot is now listed as a threatened species

ALL PHOTOS: JULIAN R. HOUGH

The obvious questions were: What caused these precipitous declines? And are the apparent declines in South America and Delaware Bay related?

To address these, we needed to understand the connections between populations wintering in northeastern South America, migrant populations staging in Delaware Bay, and breeding populations across their range. We used several techniques, like sightings of birds marked with coded, field-readable leg flags. Since 2004 over 40,000 Semipalmated Sandpipers have been marked in Delaware Bay, the Gulf of Mexico, Puerto Rico, Suriname, French Guiana, and Brazil, and we now have 7,500 sightings of these birds from around the hemisphere.

Causes of Decline

We have also linked populations through chemical signatures in feathers collected on the wintering grounds, in Delaware Bay, and in the Arctic. One of the most valuable methods has been the use of tracking devices like radio transmitters and geolocators. The latter determines a bird's location based on light intensity recorded at sunrise and sunset and was used during a project conducted by the Arctic Shorebird Demographic Network.

The data suggest that birds wintering in northeastern South America stop at Delaware Bay during spring migration and then breed in the Eastern Canadian Arctic. However, these are not exclusive connections, as some birds we marked with coded leg flags in South America have been sighted during migration along the Mid-Continental Flyway, on the North Slope of Alaska, and nesting in the western Canadian Arctic.

With a solid understanding of the connections among populations, we were able to start to tackle the causes of the declines. One of those causes is related to horseshoe crabs. From 1995–2002, between one and two million of these crabs were caught in Delaware Bay as bait, primarily for whelk and eels. This catch significantly reduced the density of the crabs' eggs, a critical food source for shorebirds. Although the bait harvest has since been cut, horseshoe crabs and their eggs have been slow to recover.

Horseshoe crab blood is also essential for human health. It helps detect bacterial endotoxins in intravenous drugs, the needles and syringes that administer them, and devices implanted or inserted into the body, like replacement joints or pacemakers. The harvest of crabs for their blood (as opposed to for bait) has more than doubled over the last decade to about 750,000 annually.

Much of what we know about declines in Red Knots centers on diminished availability of horseshoe crab eggs during spring migration stopovers in Delaware Bay and the consequent inability of birds to gain sufficient weight to complete migration to the breeding grounds. We have documented similar relationships in Semipalmated Sandpipers. Before the period of peak horseshoe crab harvest in the late 1990s, the Delaware Bay stopover population was gaining an average of 0.60 grams of fat mass per

As many as 250,000 Semipalmated Sandpipers are killed by hunters in South America each year.

day. From 2002 to 2012, the average fell to 0.38 grams per day, a decrease of almost 40 percent. Weight gain potential has slowly improved to an average 0.48 grams per day, but this may still be below the energy reserves birds need once they arrive on the breeding grounds. Food becomes available in the Arctic only after snow melt, which can be 7–10 days after birds arrive. Data on Red Knots suggest that birds leaving Delaware Bay with suboptimal fat reserves have lower survival than birds with sufficient reserves, and this is likely true for Semipalmated Sandpipers as well.

Although Delaware Bay is a linchpin for Semipalmated Sandpipers, it is only a part of the story. For 6–7 months of the year, they are on the wintering grounds. In 2006, Arie Spaans, a waterbird ecologist from the Netherlands, conducted a survey along Suriname's coast to ascertain the number and species of birds shot or trapped. The study revealed that a wide variety of protected waterbirds were being killed and sold illegally each year, among which were several tens of thousands of shorebirds.

In 2016, with Spaans's help, we repeated this survey. Our results, and a reanalysis of the 2006 survey data, suggest that 150,000–250,000 shorebirds may be taken each year. Although larger shorebirds like Lesser Yellowlegs and Short-billed Dowitchers, which also occur in high densities in Suriname, are likely the primary targets, Semipalmated Sandpipers are most often killed because they are by far the most abundant. Hunting wildlife is illegal in Brazil and regulated in French Guiana. Recent evidence, however, suggests that shorebirds are subjected to significant hunting pressure in these countries.

Semipalmated Sandpipers might also be affected by climate change. When lemmings, the preferred prey of Arctic fox, are not present, the foxes prey on the eggs and young shorebirds and other nesting birds. Warming temperatures in the Arctic appear to be causing Arctic fox to switch to shorebird eggs and young more frequently than in the past. Further negative impacts have occurred from an overabundance of nesting Snow Geese. The damage they cause to sedge meadows and wetland habitats reduces the amount of habitat preferred by nesting Semipalmated Sandpipers.

PAUL J. FUSCO

An overabundance of Snow Geese has reduced nesting habitat for Semipalmated Sandpipers.

So how do we stem the tide of population declines in Semipalmated Sandpipers?

Work has started to reduce the horseshoe crab harvest (see sidebar). New Jersey Audubon and its partners in northern South America are also working with regulatory agencies to reduce the illegal or poorly regulated take of migratory shorebirds. Our work helps to provide resources that support game warden activities, like fuel, vehicle maintenance, and field camp upgrades. Partners are also doing outreach in primary and secondary schools and among hunters to raise awareness of the importance of protecting migratory species and the key roles they play in that effort.

Although we believe these actions will help Semipalmated Sandpipers, only time will tell if we can prevent the species from joining the Passenger Pigeons, Eskimo Curlews, and Carolina Parakeets that once filled our skies but are now gone forever.

* * * *

David S. Mizrahi, Ph.D, is vice president, research and monitoring, for New Jersey Audubon.

JULIAN R. HOUGH

It's likely that Semipalmated Sandpipers with suboptimal fat reserves gained during migration have a lower survival rate than birds with sufficient reserves.

The Horseshoe Crab Recovery Coalition

Since 2019, New Jersey Audubon has co-led 45 partner organizations, including the Connecticut Audubon Society, in an effort to restore horseshoe crab populations along the Atlantic coast.

The Horseshoe Crab Recovery Coalition has four primary objectives:

1. Manage horseshoe crab bait fisheries to ensure that populations are large enough to support the needs of migratory shorebirds and other marine species that consume their eggs;

2. Encourage biomedical and pharmaceutical companies to adopt the use of rFC (recombinant Factor C), a synthetic alternative to Limulus Amoebocyte Lysate (LAL, derived from horseshoe crab blood) for use in bacterial endotoxin testing procedures;

3. Institute policies that reform the biomedical bleeding industry to reduce mortality and other impacts to horseshoe crab populations;

4. Raise awareness of the importance of the horseshoe crab by engaging volunteers in efforts to conserve crabs across the Atlantic Coast.

Coalition partners have been successful in influencing regulations limiting the bait harvests in several states, working with the pharmaceutical industry to transition to rFC, and implementing a coastwide program to monitor spawning horseshoe crabs.

More information about the Coalition can be found at: *www.hscrabrecovery.org*

Researchers along the East Coast, including in Connecticut, are trying to determine why horseshoe crab numbers have fallen so drastically, and what can be done to restore the populations.

ALL PHOTOS: JULIAN R. HOUGH

Food-rich Shoals Provide Refuge For Collapsing Sea Duck Populations

by Timothy White

Abundant and dependable food supplies in winter increase the survival chances of Long-tailed Ducks and White-winged Scoters.

In fall and winter, Long-tailed Ducks and White-winged Scoters migrate to the southern New England coast to find and feed on clams, mussels, crustaceans, and fish. Yet only a tiny fraction of the coastal zone attracts large segments of the wintering population. The highest concentrations of Long-tailed Ducks on the eastern seaboard compress into feeding aggregations in the waters near Nantucket Island. In some years, nearly half a million of them use Nantucket Sound as a nighttime roost. At sunrise, these birds commute south past Nantucket's west end to forage on Nantucket Shoals, extending 1,800 square nautical miles to the east and south of Nantucket. This spectacular flight occurs twice each day—from roost to food and then back to roost at sunset.

Sea duck populations in general are in decline. And while half a million Long-tailed Ducks on Nantucket Shoals sounds like a lot, fewer of these birds show up in southern New England, including on Long Island Sound, than in years past, for reasons we are not entirely sure of. Federal wildlife agencies report that the North American Long-tailed Duck population status is in long-term decline with low confidence in a stable to increasing trend. A limited number of Long-tailed Ducks captured off Nantucket were tracked to breeding locations in eastern Canada. However, it is possible that Iceland and Greenland Long-tailed Ducks also forage in the vicinity of Nantucket.

My research partner, Richard Veit of the City University of New York, and I have been studying sea ducks in this part of the world for about 20 years. When we conducted aerial surveys by flying low-and-slow at 200 feet over Nantucket Shoals, we discovered dense aggregations of Long-tailed Ducks and White-winged Scoters on its western fringes. This colossal feeding raft of varying duck densities extended for roughly 30 nautical miles from north to south! The core feeding aggregation encompassed approximately 160 square nautical miles of ocean (16 nautical miles north-south x 10 nautical miles east-west).

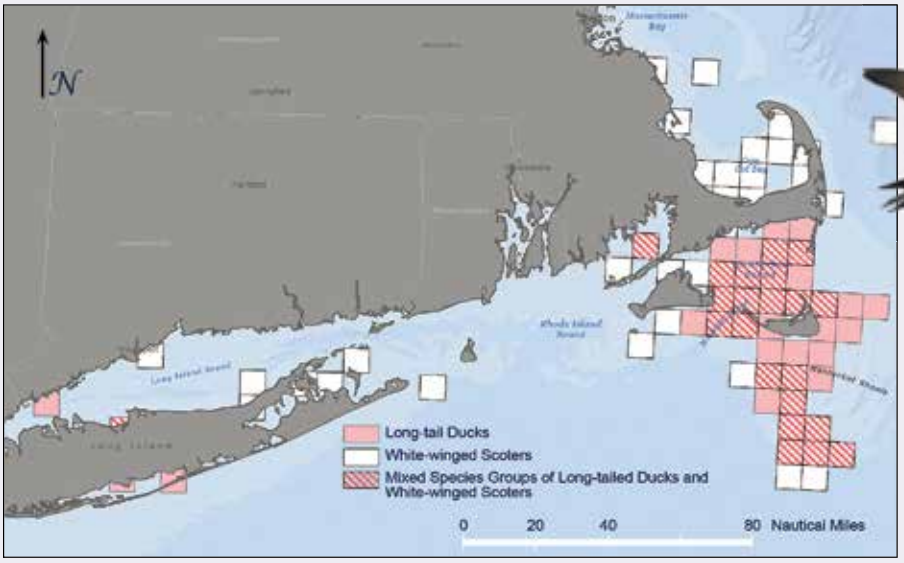
Some groups of Long-tailed Ducks stay on Nantucket Sound to feed; others feed off the eastern shore of Nantucket.

The rafts on Nantucket Shoals vary in size from year to year, but during the peak years a half a million ducks on Nantucket Shoals was a reasonable estimate. No longer. Long-tailed Ducks numbers in the commute have declined substantially from the half million peak to the many tens of thousands recently.

Richard Veit and I examined the stomachs of Long-tailed Ducks from Nantucket Shoals and found them packed with pelagic amphipods, a shrimp-like crustacean. Long-tailed Ducks often opportunistically select soft-bodied crustaceans and fish. White-winged Scoters specialize in eating bivalves such as mussels and clams. We find that their diets overlap, however, and that White-winged Scoters are relatively flexible with fish and crustacean prey. In Long Island Sound, for example, White-winged Scoters consumed a large proportion of sand lance, a sand-burrowing forage fish preyed on by seabirds and marine mammals.

Prey mapping of Nantucket Shoals revealed massive swarms of amphipods and enormous clam beds aligned with the sea duck aggregations. Satellite oceanography and drifter buoys showed how tidal currents concentrate and enhance prey abundance on its western slope. Long-tailed Ducks and White-winged Scoters might use each other's distribution as cues to prey patches at the

Long-tailed Ducks winter off Nantucket in the tens of thousands.



The squares show where significant numbers of Long-tailed Ducks (pink squares) and White-winged Scoters (white squares) spend the winter. The cross-hatched squares show where both species are abundant.

ALL PHOTOS: JULIAN R. HOUGH

bottom. This behavioral mechanism, termed local enhancement, is a form of publicly available social information that marine birds use to get themselves closer to prey.

Diving ducks swim to the bottom, using their feet and wings to overcome buoyancy. Nantucket Shoals' Long-tailed Ducks and White-winged Scoters feed in water depths between 20 and 120 feet. Diving to these limits in frigid water and ripping tides consumes substantial body reserves during winter's short days. Locating highly abundant and dependable winter resources increases the probability of winter survival and perhaps translates to body reserves needed for spring migration and the onset of reproduction.

In Long Island Sound and vicinity, broad-scale aerial surveys detect more White-winged Scoters than Long-tailed Ducks. The surveys were part of the Atlantic Marine Assessment Program for Protected Species, a joint project of the Bureau of Ocean Energy Management and the U.S. Fish and Wildlife Service. The assessment program more frequently detects White-winged Scoter aggregations near Montauk Point, Gardiners Bay, Middle Shoal, Shelter Island, Smithtown Bay, and Charles Island, off Milford. Smaller and less frequent flocks of Long-tailed Ducks occur in Stamford Harbor and Smithtown Bay, but large flocks are often reported off the shore of Stratford and around the Norwalk Islands.

The intense tidal fluxes that influence Long Island Sound are similar to those of Nantucket Shoals, Nantucket Sound, and Muskeget Channel, a hotspot between Nantucket and Martha's Vineyard. Tidal flow areas are a type of habitat favored by filter feeders such as clams, which extend their siphons into the sea to extract nutrients, and where forage fish such as sand lance feed on zooplankton forced past them on the tide. The ebb and flow of tidal energy interacts with abruptly sloping ocean bottom to enhance the high biodiversity we witness at Nantucket Shoals. In these places, abundant and reliable prey buffer sea ducks and other seabirds against severe conditions. Some of these unique areas of resilience are being recognized and protected from extreme human development.

Close to a decade ago, based on the work Richard Veit and I did, the Bureau of Ocean Energy Management removed offshore lease blocks from energy development on Nantucket Shoals to protect the Long-tailed Duck community. The bureau continues to evaluate marine bird distributions to minimize impacts from offshore energy development on the Atlantic and other regions through its Environmental Studies Program.

Sea duck populations are in decline and fewer Long-tailed Ducks show up in the Southern New England and Long Island hotspot areas, for reasons we are not entirely sure of. The waters off Stratford have been recognized as an Important Bird Area of global significance for Long-tailed Ducks. Preserving unique and resilient feeding areas for marine bird communities represents a conservation bullseye we should strive to hit.

* * * *

Timothy White, Ph.D., is an avian biologist in the Environment Studies Program of the U.S. Department of the Interior's Bureau of Ocean Energy Management.

Preserving winter feeding areas is a conservation bullseye.

In 2019, a group of ornithologists reported in *Science* that there's been a 30 percent drop in North American Bird populations over the last 50 years.

This was our question to experts around the country:

What do you think is the most important thing to do now to stabilize and restore the bird population?

Scott Weidensaul

Reversing that trend will require coordinated, concerted action on a host of fronts. But the group of birds in the most dire shape—grassland species—would also benefit most immediately and directly from a single approach: aggressive, large-scale habitat restoration. Over recent decades, we changed the trajectory for waterfowl and marshland birds when we got serious about protecting and restoring wetlands. Those species have largely recovered. We can do the same for grassland species if we apply the same political will, ample funding, creative approaches to working with private landowners, and dramatically scaled-up government programs like the Conservation Reserve Program.

Scott Weidensaul is the author of nearly 30 books on natural history, including the 2021 New York Times bestseller, A World on the Wing. *A Fellow of the American Ornithological Society, he is a field researcher specializing in migration, and co-founded the Northeast Motus Collaboration.*

Drew Lanham

For us to mitigate the losses, science and conservation action are critical, but we must feel the losses in order to move most effectively against them. Yes, some of us feel these losses, but it's critical now to enlarge the efforts. We must give serious consideration to what inclusion in the field of bird conservation entails. That means taking down our binoculars to truly see the wider field of view so that people of all hues and identities who've been ignored see common plight with the 'canaries in the coal mine.' Winged and feathered or human being, we must find empathy between birds and ourselves.

J. Drew Lanham, Ph.D., is the Alumni Distinguished Professor of Wildlife Ecology at Clemson University's Forestry and Environmental Conservation Department.

Leslie Carothers

I would like to see the northeastern state governors and their environmental agencies work together with private landowners to develop plans to conserve and connect habitat on the scale needed to secure the future for birds and other wildlife in the region. They have collaborated effectively on regional greenhouse gas emission control programs. I think addressing the challenge of biodiversity protection is another environmental issue where a regional approach could make a difference.

Leslie Carothers is a visiting scholar at the Environmental Law Institute in Washington D.C. She is a former commissioner of the Connecticut Department of Environmental Protection, and a former chair of the Connecticut Audubon Society's Board of Directors.

Morgan Tingley

To stabilize, we need to eliminate or lessen the forces that are currently reducing bird populations, primarily the loss and degradation of habitat and the increase in a built environment that is not bird-friendly. To restore populations, we need to radically make this world more hospitable to birds, such as by vastly reducing wild-roaming cats, transitioning to bird-friendly windows, and restoring and recreating vital habitats. And we have a tidal wave of future impacts bearing down on us in the form of climate change—impacts so numerous and diverse that we as ecologists have barely scratched the surface of understanding.

Morgan Tingley, Ph.D., is co-organizer of the Connecticut Bird Atlas. He is an Associate Professor of Ecology and Evolutionary Biology at UCLA and formerly of the University of Connecticut.

Arvind Panjabi

Start addressing climate change in a significant way. We already know it will take many years to reverse the buildup of greenhouse gases in our atmosphere, so it is critical we start addressing this immediately. Most importantly, we need to quickly move toward a low-carbon economy and energy grid, and develop those in ways that minimize impacts to birds and other biodiversity. At the same time, we need to protect key areas for birds while minimizing negative impacts to them in our working landscapes, like our forests, grasslands and farmlands, where many bird-friendly practices have already been identified. Now we need to bring those practices to scale by incentivizing them economically.

Arvind Panjabi, is an Avian Conservation Scientist for the Bird Conservancy of the Rockies and is based in Fort Collins, Colorado. He was a co-author of the 2019 Science *article that documented the loss of three billion North American birds.*

Deborah Cramer

Big problems require overarching solutions, but sometimes a single act can make a huge difference. To stanch the dramatic decline of millions of shorebirds, people in Connecticut can require their legislators and regulators to ban the take of horseshoe crabs for bait. It deprives shorebirds of the energy-rich horseshoe crab eggs, essential to their migration. This one act could make a huge difference.

Deborah Cramer is a visiting scholar at the Environmental Solutions Initiative at MIT. Her books include The Narrow Edge: A Tiny Bird, An Ancient Crab, And An Epic Journey.

Desirée L. Narango

The best thing we can do for birds is to get people to learn and care about their local species and encourage a new ethos of stewardship for local wildlife. Right now, habitat loss is the #1 cause of bird population declines. Managing yards, farms, forestry, and energy with bird-friendly features is a huge step toward creating sustainable landscapes that can support people and birds.

Desirée L. Narango, Ph.D., is the 2020-2022 David H. Smith Conservation Research Fellow, a Postdoctoral Researcher at the University of Massachusetts Amherst and an Early Career Fellow of the Ecological Society of America.

One Good Tern Deserves Another: Common and Roseate Terns in Long Island Sound

By Peter Paton and Pamela Loring

Among the most charismatic birds found in the Long Island Sound area are the Common Tern and the Roseate Tern. Both are long-distance migrants, with some individuals traveling over 7,000 miles between their breeding grounds in southern New England and wintering sites that extend south to Argentina. They occur in Connecticut from early May through mid-September. Both species were abundant 150 years ago but were hunted relentlessly for the millinery and egg collecting trades, sending their populations plummeting before a rebound in the 20th century. The Common Tern is listed as a species of special concern in Connecticut and its population appears stable. The Roseate Tern population has fallen since its early 20th century recovery, and it is on the federal and Connecticut endangered species lists. And yet in recent years at Great Gull Island, on the eastern end of Long Island Sound, diligent work by field biologists has resulted in a 37 percent increase in the number of Roseate Tern nests. It is perhaps a glimmer of hope for a species that needs help.

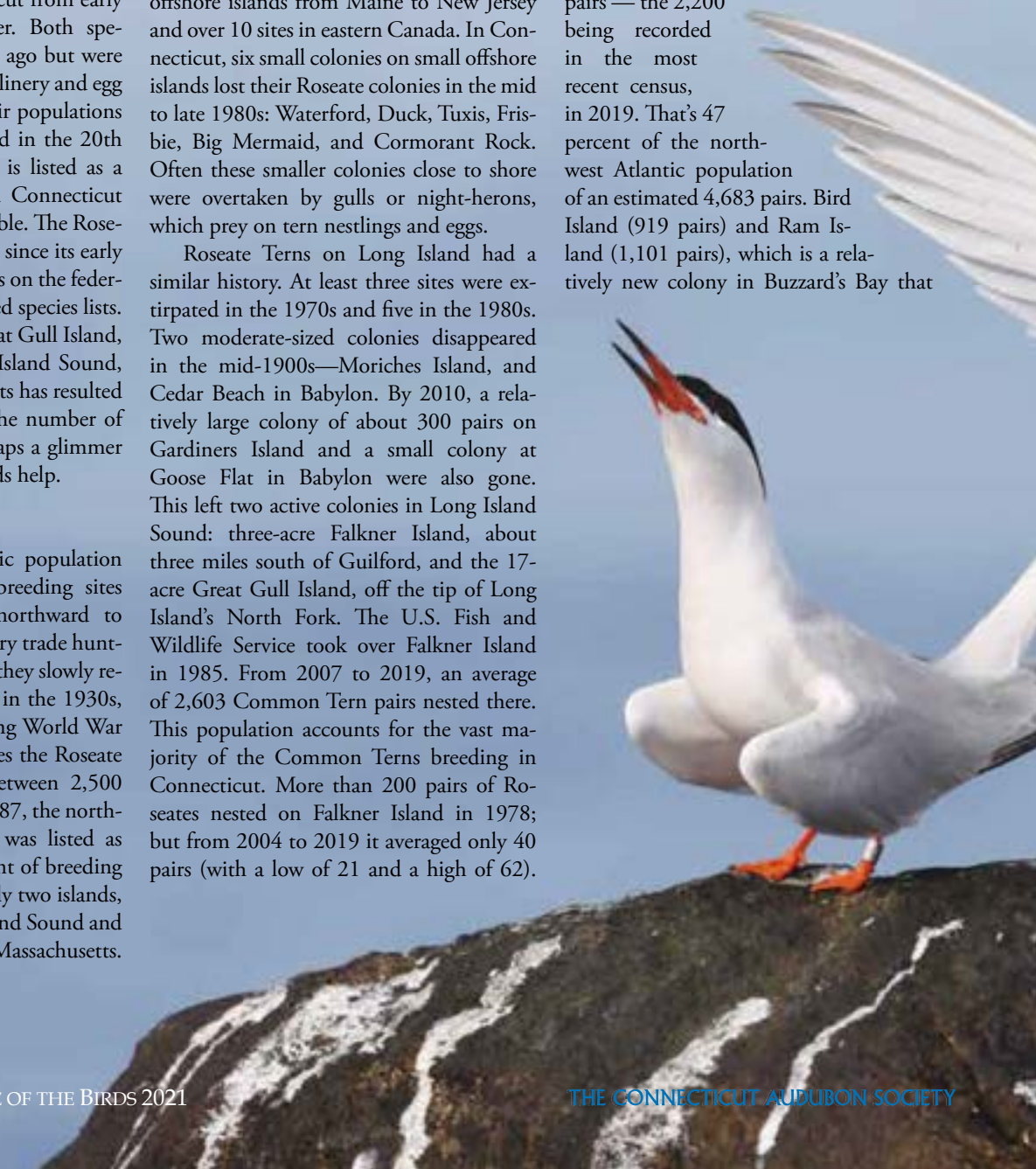
The Basics

The northwestern Atlantic population of Roseate Terns occupies breeding sites from Long Island Sound northward to Nova Scotia. After the millinery trade hunting and egg collecting ended, they slowly recovered to about 8,500 pairs in the 1930s, and then declined again during World War II. Over the past three decades the Roseate population has fluctuated between 2,500 and 4,000 nesting pairs. In 1987, the northwestern Atlantic population was listed as endangered because 85 percent of breeding pairs were concentrated at only two islands, Great Gull Island in Long Island Sound and Bird Island in Buzzard's Bay, Massachusetts.

Musical Chairs

Remember the old adage, "Don't put all your eggs in one basket"? Unfortunately this adage is applicable to the nesting islands of Roseate and Common Terns in the northeastern U.S. and in Canada. From the 1970s through the early 2000s, biologists documented extirpation on at least 54 offshore islands from Maine to New Jersey and over 10 sites in eastern Canada. In Connecticut, six small colonies on small offshore islands lost their Roseate colonies in the mid to late 1980s: Waterford, Duck, Tuxis, Frisbie, Big Mermaid, and Cormorant Rock. Often these smaller colonies close to shore were overtaken by gulls or night-herons, which prey on tern nestlings and eggs.

Roseate Terns on Long Island had a similar history. At least three sites were extirpated in the 1970s and five in the 1980s. Two moderate-sized colonies disappeared in the mid-1900s—Moriches Island, and Cedar Beach in Babylon. By 2010, a relatively large colony of about 300 pairs on Gardiners Island and a small colony at Goose Flat in Babylon were also gone. This left two active colonies in Long Island Sound: three-acre Falkner Island, about three miles south of Guilford, and the 17-acre Great Gull Island, off the tip of Long Island's North Fork. The U.S. Fish and Wildlife Service took over Falkner Island in 1985. From 2007 to 2019, an average of 2,603 Common Tern pairs nested there. This population accounts for the vast majority of the Common Terns breeding in Connecticut. More than 200 pairs of Roseates nested on Falkner Island in 1978; but from 2004 to 2019 it averaged only 40 pairs (with a low of 21 and a high of 62). Great Gull Island, owned and managed since 1948 by the American Museum of Natural History, has averaged 8,000 to 10,000 breeding pairs of Common Terns. The Roseate Tern population is smaller but still significant. An average of 1,650 pairs of Roseate Terns nested there from 2004 to 2019, with a range of 1,273 to 2,200 pairs — the 2,200 being recorded in the most recent census, in 2019. That's 47 percent of the northwest Atlantic population of an estimated 4,683 pairs. Bird Island (919 pairs) and Ram Island (1,101 pairs), which is a relatively new colony in Buzzard's Bay that



formed in 1992 after being extirpated in the early 1970s, accounted for much of the balance for this endangered population.

Threats and Long Term Protection

Given that terns are primarily fish eaters, their guano is a highly effective fertilizer that enables rapid and widespread growth of plants in nesting areas. Invasives and succession have overtaken much of Great Gull and Falkner, and biologists are constantly trying to control them at both sites, which are critical to long-term management.

Common Terns are much more widespread, abundant, and stable than Roseate Terns, and prefer to nest in patches with little surrounding vegetation, so creating open areas is critical for them. Roseate Terns tend to nest in overhead cover, including in crevices between boulders and underneath vegetation such as seaside goldenrod. Colony managers and volunteers have constructed artificial nesting boxes to provide additional shelter for Roseate Terns and to increase the available nesting sites. Researchers in Ireland and England found nest boxes could protect Roseate

PAUL J. FUSCO (3)

An average of 8,000 to 10,000 pairs of Common Terns nest on Great Gull Island.

Common Tern fledgling begging for food.

PAUL J. FUSCO (2)

Common and Roseate Terns make daily trips of 25 miles or more from their colonies in search of food.

Improvements in Roseate Tern nesting success on Great Gull Island offer a glimmer of hope.

Roseate Tern with sandlance.

Terns from nest predators. In recent years, about 50 percent of the Roseate Terns on Falkner and over 20 percent on Great Gull have used nest boxes. Since 2014 we've worked with managers on Great Gull to construct additional boxes to create more potential nest sites. These additions seem to have helped to increase the nesting population from about 1,600 pairs in 2014 to 2,200 pairs in 2020.

The availability of nesting habitat is also affected by climate change, including sea level rise and the increasing intensity of storms. Erosion has reduced Falkner Island from eight acres in the mid-1600s to 5.7 acres in 1818 and 2.9 acres now. This constant erosion is a threat to Falkner's Roseate Terns, most of which nest on an eroding spit at the northern tip of the island and a revetment on the eastern side. On Great Gull, where many of the breeding Roseate Terns nest among boulders surrounding the island, they may be vulnerable to inundation by sea level rise. Maintaining suitable nesting habitat will require management actions that address these effects of climate change.

One of the most pressing issues for nesting Common and Roseate terns is prey availability. Both species depend on small forage fish. Roseate Terns tend to specialize in one type, sand lance (Ammodytes spp.), with over 90 percent of their diet in some years dominated by these long, slender fish that are relatively easy for their chicks to swallow. Common Terns tend to forage on a broader variety of fish. Since both species will prey on herring (Clupeidae), recent efforts to remove dams in Connecticut to increase the anadromous herring runs may be beneficial for

terns. Improvements to the conservation and management of forage fish will help ensure a sustainable food base for seabirds and other predators.

Recent advances in wildlife tracking technology have provided new information on foraging movements of Common and Roseate Terns. From 2013 to 2019, we tracked terns with Motus transmitters, which emit radio signals every five seconds for approximately three to four months. Signals from the tags were monitored by stations within the Motus Wildlife Tracking System, the international automated radio telemetry network that includes an array of stations along the Atlantic coast. This research revealed that Common and Roseate terns take daily trips to feeding areas up to 25 miles or more from their nesting colonies. We often detected Roseate and Common terns from Great Gull flying off Napatree Point, about 14 miles away, and near Block Island, 26 miles away, in addition to flights near Montauk, 16 miles away. Results from this study provided new information on regional movements during the post-breeding period, including timing and weather conditions of offshore flights to staging areas on Cape Cod. This information is being used for various management activities, including assessments of proposed wind energy facilities off the coast of southern New England and the Mid-Atlantic.

After shelters like these were introduced on Great Gull Island, Roseate Tern numbers rose by 37 percent.

PHOTO BY PETER PATON

PAUL J. FUSCO

Both species of tern depend on small forage fish for food.

Maintaining a nesting population of Common and Roseate terns in Long Island Sound will be a continuing challenge. Actions identified by the U.S. Fish and Wildlife Service's Roseate Tern Recovery Plan include population monitoring at breeding colonies; management of nesting habitat, including use of shelters and control of invasive vegetation and succession; assessments of vulnerability of nesting areas to sea level rise and tidal erosion and evaluations of alternative nesting sites; and conducting research to better understand the distribution and ecology of terns during migration and wintering. Continued efforts to manage nesting areas on Falkner and Great Gull islands will be important for maintaining tern populations in Long Island Sound into the future.

* * * * *

Peter Paton, Ph.D., is Professor and Chair, Department. of Natural Resources Science, University of Rhode Island. Pamela Loring, Ph.D., is a wildlife biologist with the U.S. Fish and Wildlife Service, Division of Migratory Birds, North Atlantic-Appalachian Region, in Hadley, Mass.

Birds are Telling Us It's Time to Act on Climate Change

Natural Climate Solutions Show the Way

by Brooke Bateman

As one of the most beloved and ubiquitous forms of wildlife, birds are our connector to nature. Birds are also messengers, and if we pay attention, they're showing us that our world is changing. Over the last 50 years North America has lost about 30 percent of its birds—that's nearly 3 billion fewer birds to fill our skies today than in 1970. We are altering nature at an unprecedented rate, and we are in the midst of a biodiversity crisis that is threatening the well-being of our world. We are also facing a climate crisis. Given that climate change amplifies existing threats, it is the biggest issue that birds and people will face over the next 50 years. Climate change and biodiversity loss are intertwined, and we can no longer afford to look at them as separate issues.

There is a scientific consensus that we need to limit global temperatures to 2°C (or preferably 1.5°C) above pre-industrial levels to avoid a climate tipping point—a critical threshold beyond which we would see dramatic, detrimental, and irreversible system-level changes to our planet. One consequence of crossing this threshold is potentially losing billions more birds. Audubon's 2019 report, *Survival by Degrees: 389 Bird Species on the Brink*, shows that two-thirds of North American bird species are at risk of extreme range loss and potential extinction from unmitigated climate change. In Connecticut, over 80 species are climate vulnerable, including Scarlet Tanager, Wood Thrush, American Woodcock, and Saltmarsh Sparrow. The federally threatened Piping Plover could be completely lost from Connecticut's shores. Forest birds are particularly at risk, with 65 percent of the species in Connecticut vulnerable to climate change. The birds of our eastern forests have already seen a loss of 170 million birds, a decline of 17 percent, since 1970. If forest specialists like the Ovenbird no longer find suitable conditions under a no-mitigation climate future—which is what models indicate might well happen—the familiar "teacher, teacher, teacher" call will be lost forever from the soundscape of Connecticut's forests.

Quick action saves birds

However, there is hope. If we act now to reduce greenhouse gas emissions and stabilize the climate below the tipping point, the science from *Survival by Degrees* shows that 76 percent of birds in North America will suffer less range loss, experience fewer extreme events, and be less vulnerable to climate change. We already have a lot of the tools we need to reduce the effects of global warming. A range of policy strategies and conservation actions can be used together as a climate change toolkit.

First, we must focus on climate mitigation—drawing down greenhouse gases from the atmosphere, to help stabilize the climate below the 2°C tipping point. We also need to focus on climate adaptation, through protecting, managing, and restoring habitats that benefit biodiversity and provide for better climate resilience. Providing better habitats and natural infrastructure helps both birds and people better withstand climate change threats. These changes include creating living shorelines, preserving habitat to protect water quality, and implementing heat island cooling strategies such as increasing tree and ground vegetation cover.

85% of Connecticut is in a priority area to maintain or restore habitat for the double benefit of carbon sequestration and bird protection.

Natural climate solutions, a nature-based solution pathway, provide a promising strategy to simultaneously address the biodiversity and climate crises. Natural climate solutions harness the ability of plants and soils

to store carbon for climate mitigation. It is achieved through maintaining and restoring—protection and sustainable management, restoration, and conservation practices—natural and modified habitats that benefit biodiversity and promote adaptation and resilience. To achieve "net-zero" emissions by mid-century—the goal set forth by the Paris Agreement—we need major investments in natural climate solutions today. These solutions cost-effectively provide roughly a third of the climate action needed by 2030 and are available and proven now and will have the added effect of helping to protect the important ecological services that our natural infrastructure provides, e.g. water quality protection, oxygen production and buffering from natural disasters.

Audubon's *Natural Climate Solutions Report: Maintaining and Restoring Natural Habitats to Help Mitigate Climate Change* (2021) identifies areas that are important for carbon storage and sequestration. It also identifies areas that support birds under climate change, areas called Climate Strongholds. The places where these two kinds of areas overlap are key. They include forests, wetlands, coasts, grasslands, aridlands, and green spaces in cities and suburbs. They offer an opportunity to help solve the biodiversity crisis and the climate crisis simultaneously.

Some of these areas are prime candidates for sustainable management and conservation actions; we've identified these as priority areas to maintain. Others have been modified by human actions or disturbances. We've identified these as priority areas to restore. With targeted conservation, management, and restoration actions, these areas can have increased value for birds and draw down considerably more carbon than they do now. Combined, these priority areas already store over 100 billion tons of carbon. If human disturbance is minimized, they have the potential to sequester up to twice as much carbon per year as they do currently while also improving bird habitat. That gets us to 23.2 percent of the country's 2016 commitment to the Paris Agreement while also helping to build resilience for birds.

Locking up carbon

In Connecticut, there are more than 1.5 million acres of priority areas to maintain and restore. Collectively they store over 500 million tons of carbon. Forests keep large stores of carbon locked in plants and soils, providing the best opportunity for total carbon storage. In Connecticut, these include landscape-scale Important Bird Areas such as the Lyme Forest Block along the east side of the lower Connecticut River, and the Macedonia Forest Block, in Litchfield County. The keys are to preserve, protect, and restore large forests and to restore native plants and forests in suburbs and cities. These actions will also benefit forest birds such the climate-vulnerable Wood Thrush.

PAUL J. FUSCO (2)

Forest species such as Ovenbird will benefit from natural climate solutions.

Coastal wetlands, a priority area to restore, also pack a big carbon mitigation punch, storing more carbon per acre than any other ecosystem across the state. These coastal areas have undergone extensive change as a result of human activities and urbanization. Restoration of these areas in Connecticut can lead to 2.5 times more carbon drawdown per year, improving the habitats for coastal birds. These include Saltmarsh Sparrow, a species at risk of extinction because of sea level rise, as well as rising temperatures, and urbanization. Restoring these

wetlands not only leads to increased carbon absorption, but also helps alleviate flooding and storm surges associated with sea level rise and more intense storms and hurricanes.

These solutions cost-effectively provide roughly a third of the climate action needed by 2030 and are available and proven now.

The bottom line: what's good for birds is also good for stabilizing climate change. Natural Climate Solutions tackle the dual biodiversity and climate change crises together. Working strategically across ecosystems will provide a healthy future for both people and nature. We know what we need to do. We need to plan for a better future, working on mitigation and adaptation, and pursuing Natural Climate Solutions—to benefit all living things. That way, 50 years from now, we won't be lamenting billions more birds lost from the skies but instead will be celebrating the more resilient world we helped build.

Birds are telling us, the time to act on climate change is now. We can do this.

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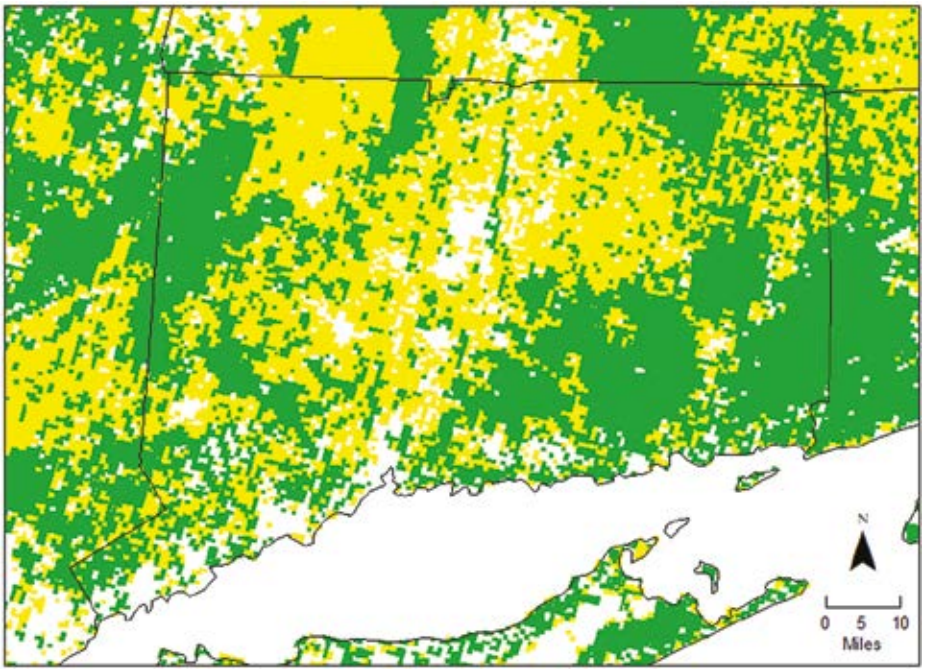
Brooke Bateman, Ph.D., is Director of Climate Science for the National Audubon Society.

Priorities for Bird Habitat and Carbon Storage in Connecticut



This map shows priority areas to maintain for bird habitat and carbon storage, in green. It also shows priority areas to restore for bird habitat and carbon storage, in yellow. It's based on data from National Audubon's Natural Climate Solutions *report.*

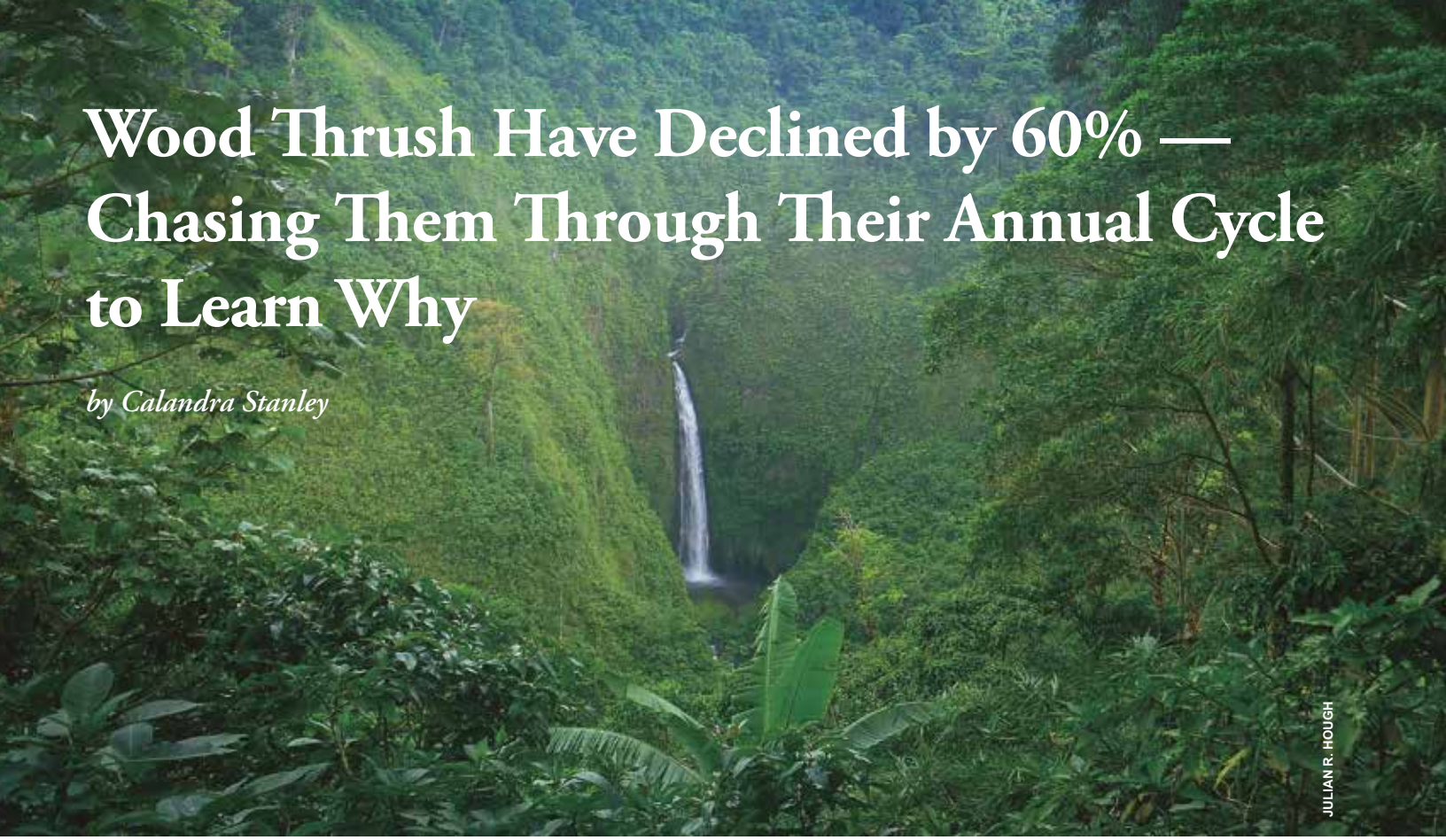
MAP BY: NATIONAL AUDUBON & JIM ARRIGONI / CONNECTICUT AUDUBON

PAUL J. FUSCO (2)

Coastal marshes store carbon and are habitat for birds such as this saltmarsh sparrow.

Wood Thrush Have Declined by 60% — Chasing Them Through Their Annual Cycle to Learn Why

by Calandra Stanley



Understanding what's causing the Wood Thrush population decline will require examining conditions on their Costa Rican winter grounds as well as on migratory pathways.

In a wet forest along the Caribbean coast of Costa Rica, I wait patiently between heavy bouts of rain to try to recapture a Wood Thrush with a little backpack that I had placed on it the previous winter. It was my first day in the field, and although the dry season was supposed to start imminently, the rain has not subsided since our arrival, so we have no choice but to set up our mist nets and wait for breaks. The little backpack I am hoping to retrieve is a light-level geolocator, a simple data logger that records ambient light levels and tracks the migration route, cleverly using daylength and sunrise to pinpoint location. This is not the first time light-level geolocators had been used to track a migratory songbird. In 2008, my master's supervisor at the time, Dr. Bridget Stutchbury, had successfully retrieved tags from a population of Wood Thrush and Purple Martin in Pennsylvania. It was, however, the first time they had been deployed on the wintering grounds. We had no idea if Wood Thrush had any fidelity to its wintering territory, which, as a master's student, made me very nervous. What if none of the birds come back with their valuable backpack?

My fears were quickly assuaged, as the first Wood Thrush captured that afternoon was carrying one of our light-level geolocators. Huddled under a giant umbrella, soaking wet, I carefully removed it, took measurements, and released the thrush back to the wet and dark understory. Later, when analyzing the data downloaded from that geolocator, I discovered he was a fellow Canadian, spending his summer in the province of Quebec. After breeding, he had migrated to the exact same winter territory in southern Costa Rica and amazingly was captured in the same mist net as the previous winter. Just two years prior, uncovering this information about migration pathways and where individual migratory songbirds are found throughout the year would have been almost impossible.

Fast forward a little over a decade: tracking devices such as light-level geolocators along with other techniques like stable isotopes or genetic analysis have unlocked the mystery of migration for an ever-increasing number of migratory birds. Learning about the magnificent feats of endurance undertaken by migratory songbirds is fascinating in its own right, but this information is also crucial for helping scientists decipher the factors driving declines in migratory songbirds. To pinpoint the causes, we need to understand the threats faced by populations across every season.

Calandra Stanley holds a Wood Thrush fitted with a geolocator

ALL PHOTOS: JULIAN R. HOUGH

Forest loss on breeding and wintering grounds, including in Connecticut, are contributing to Wood Thrush population declines.

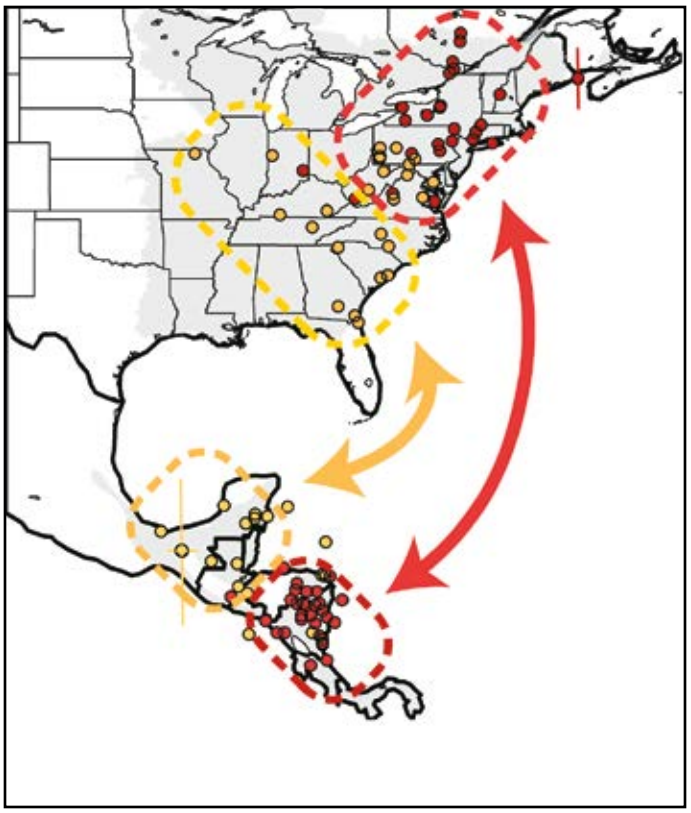
Central to this approach is the ability to connect populations across their breeding and non-breeding periods—something known as migration connectivity. Making these connections would not have been possible without the emergence of new miniaturized tracking technologies over the last decade, leading to what has been termed the golden age of tracking. I have been lucky enough to take advantage of this surge in new technologies, and over the last decade my research has focused on chasing Wood Thrush through the tropical forest of Costa Rica and Belize and the temperate forest of eastern United States to better understand its ecology across the full annual cycle.

The Migration Connection

Despite being a summer fixture of the forests of eastern North America, Wood Thrush has the unwelcome status of being the poster child for declining forest songbirds. Since the 1970s its populations have declined by 60 percent across its range. Research has suggested that forest loss, degradation (e.g., from acid rain, forest management practices), and fragmentation are key threats driving its population declines. However, deciphering where and when specific threats are having the most impact has remained challenging. Using the light-level geolocators collected in Costa Rica, as well as geolocators collected by colleagues on populations across their breeding and wintering range, we constructed a map linking populations across the annual cycle—a migratory connectivity map.

We discovered that Wood Thrush populations that bred in the northeast of their range tended to migrate the farthest, wintering in the most southern extent of their range. By contrast, birds from the southern and midwestern portions of their breeding range wintered at the northern end of their range. In Connecticut, where Wood Thrush populations have declined at an average rate of 2.4 percent per year over the last 50 years (73 percent overall), understanding the threats driving population declines will require examining conditions on their wintering grounds in Nicaragua and Costa Rica but also along their migratory pathways.

Taking this holistic approach to understanding declines, researchers have used the migratory connectivity map to develop models to assess the impact of forest loss in the breeding and wintering grounds. These studies confirm that forest loss is occurring across those Wood Thrush ranges and is driving declines. But whether forest loss on the breeding ground versus the wintering ground is having the largest impact varies across populations. Such findings indicate that Wood Thrush



Geolocators show that Wood Thrush that nest further north tend to winter farther south, and vice versa. Connecticut birds are often found in Nicaragua and Costa Rica.

populations should not be treated as a monolith. It will be important to tailor conservation plans to specific populations.

Big Knowledge Gaps

Unfortunately, even for a well-studied species like Wood Thrush, how individuals respond to forest loss and degradation outside the breeding season remains poorly understood. Most research has historically focused on the study of birds during breeding season, when they are in our own backyards. This bias has left large gaps in our knowledge of the biology of species outside the breeding season. Increasingly, we are discovering that migratory species behave differently than we might have expected.

By tracking Wood Thrush using GPS transmitters that are accurate to within 10 meters, we discovered that Wood Thrush changes its habitat preferences during the migratory period. Although thought of as forest birds, they become less picky when selecting stopover locations and are often found in non-forested habitat such as agricultural fields and savannahs. Do these non-forested habitats represent good quality migration stopovers? That remains unclear. What is clear is that Wood Thrush populations are currently using these habitats during migration, and therefore they need to be considered when developing management plans during migration.

Tracking Wood Thrush with GPS transmitters also led us to discover that a large proportion do not settle in a single territory during the winter period. While we often consider the winter a stationary period for migratory birds, we found that individual thrushes can move up to 150 kilometers to settle in a new territory. Such fascinating discoveries continue to emerge, and these results raise important questions about how best to manage landscapes outside the breeding period.

The path forward for the recovery of Wood Thrush populations remains murky. What is clear is that research has provided a strong foundation that we can build upon. This research suggests the importance of protecting intact forest during the breeding and winter period. However, where and when conservation efforts should be focused will vary across the population's range. Importantly, we are still lacking information about the impacts of threats to Wood Thrush outside of the breeding season, particularly during migratory periods. New initiatives like the Road to Recovery, spurred on by the documented loss of 3 billion birds from the North America avifauna, are creating a pathway that can be used to guide the species recovery efforts. By bringing together researchers, conservation practitioners, social scientists, and other relevant stakeholders, and even with imperfect information, we can begin moving Wood Thrush towards population recovery.

Calandra Stanley, Ph.D. is a post-doctoral researcher at Georgetown University.

New initiatives like the Road to Recovery are creating a pathway to guide the recovery efforts for Wood Thrush and other species.

Working for Better Conservation

by Patrick Comins

Conservation of birds, other wildlife and their habitats is the foundation of our work at the Connecticut Audubon Society. The 2019 *Science* article documenting the loss of 3 billion birds over 50 years sharpened our focus and made that work more urgent. Let me give several examples of how our volunteers, members, and staff are helping species highlighted in this *Connecticut State of the Birds* report.

Most if not all of Connecticut Audubon's sanctuaries lie within the Climate Strongholds identified in the National Audubon Society's *Natural Climate Solutions Report* (page 18). These include the 2,200-plus acres of the Croft, Bafflin, and Deer Pond Farm Sanctuaries in Goshen, Pomfret, and Sherman, which are being actively maintained, enhanced and restored. We have also added more than 100 acres to our sanctuaries in the past year. .

With grassland and shrubland birds among those in the greatest decline, Connecticut Audubon is working on habitat creation and restoration projects throughout the state's Climate Stronghold areas. Connecticut Audubon has been a leading advocate of land preservation investment, through the state's Open Space and Watershed Land Acquisition Grant Program and Recreation and Natural Heritage Trust Program. We advocated for funding that in 2021 allowed the state to permanently protect 600 acres in Goshen near Croft Preserve.

Connecticut Audubon has been working with National Audubon and other partners to study the effects of disturbance on roosting and feeding Semipalmated Sandpipers and other shorebirds. In 2020 we began to focus on reducing disturbance to shorebird flocks at Sandy Point in West Haven, Stratford Point in Stratford and Milford Point.

Improved signage and tweaking of string fencing areas to offer more undisturbed roosting habitat seems to have had a dramatic positive impact on reducing disturbance.

Horseshoe crabs, the eggs of which are a critical food for migrating shorebirds, are harvested commercially for bait in the eel and whelk/conch fisheries. But all horseshoe crab fishing is banned in Milford, Stratford, West Haven, and Westbrook. Connecticut Audubon has been a leading advocate for establishing and will continue to press for the cessation of harvest elsewhere.

Regarding Roseate and Common Terns, Connecticut Audubon Society works with the American Museum of Natural History to recruit volunteers for its Great Gull Island tern colony. We've advocated effectively as part of a coalition for the conservation of the forage fish that the terns rely on.

Other bird conservation projects include the Audubon Alliance for Coastal Waterbirds. The Alliance relies on staff and volunteers to protect and increase the number of Piping Plovers, Least Terns and American Oystercatchers nesting on Connecticut's shoreline.

The Osprey Nation project, propelled by 700 volunteers, has established a map of roughly 600 nest sites and a database of information about nesting success and fledglings. This information helps conservationists monitor the success of the burgeoning Osprey population.

All of these projects and much more happen only because of the financial support and volunteer support from Connecticut Audubon members.

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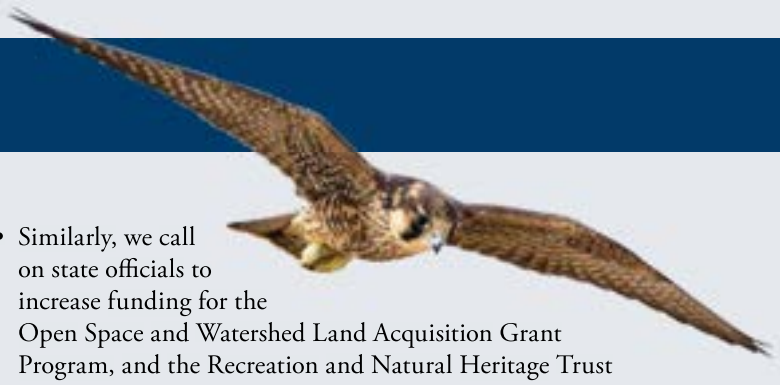
Patrick Comins is Executive Director of the Connecticut Audubon Society.

PAUL J. FUSCO

RECOMMENDATIONS



- Congress should pass the Recovering America's Wildlife Act. This bill, introduced in Congress for each of the last several years, would direct some $1.3 billion of existing revenue annually to state-led wildlife conservation efforts, allowing states like Connecticut to fully implement their Congressionally mandated Wildlife Action Plans.

  Connecticut would receive about $11.8 million annually from the fund—an almost 10-fold increase in what it spends on the plan now. It would be a game-changer for habitat protection in the priority climate stronghold areas.

Reasons for hope: Bald Eagles and Peregrine Falcons, top, are no longer endangered.

- Congress should also pass the Migratory Bird Protection Act of 2021 (H.R. 4833) to replace the Migratory Bird Treaty Act of 1918.

- Land acquisition remains the best way to protect habitat. The state has not come close to its official goal of protecting 21 percent of the land in Connecticut by 2023. Focus on areas identified as "climate strongholds" in the *Natural Climate Solutions Report*. With literally hundreds of conservation organizations, governments, and agencies able to work on this, Connecticut has the ability to make a big difference quickly.

  Governor Lamont and the Connecticut General Assembly must restore, fully fund, and protect the Community Investment Act as a source of open space funding.

- Similarly, we call on state officials to increase funding for the Open Space and Watershed Land Acquisition Grant Program, and the Recreation and Natural Heritage Trust Program and look for new and innovative ways to fund land conservation and stewardship.

- Analyze the Connecticut Bird Atlas results to prioritize areas for species of greatest conservation need. Work with partners to identify protection opportunities within those areas and strategies to protect and improve habitat utilizing a proactive approach to identify the most important places for each species of concern.

- Equally essential are actions that individual residents can take to reduce the number of birds that die from well-known and preventable causes. Outdoor cats, for example, kill an estimated 1.3 billion to 4 billion birds in North America every year. Windows kill approximately 1 billion birds each year. Keep cats indoors. Work on preventing window strikes. Eliminate or reduce the use of pesticides on your property. Plant native.

ALL PHOTOS: JULIAN R. HOUGH

Keep cats indoors. They kill up to 4 billion birds a year.

A more extensive list of what you can do to help can be found at: ctaudubon.org/helpbirds.

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“Narrowing the gap between conservation gains and hemispheric environmental degradation and habitat loss will require a deliberate reimagining of the scope and strategies of bird conservation.”

—Peter P. Marra