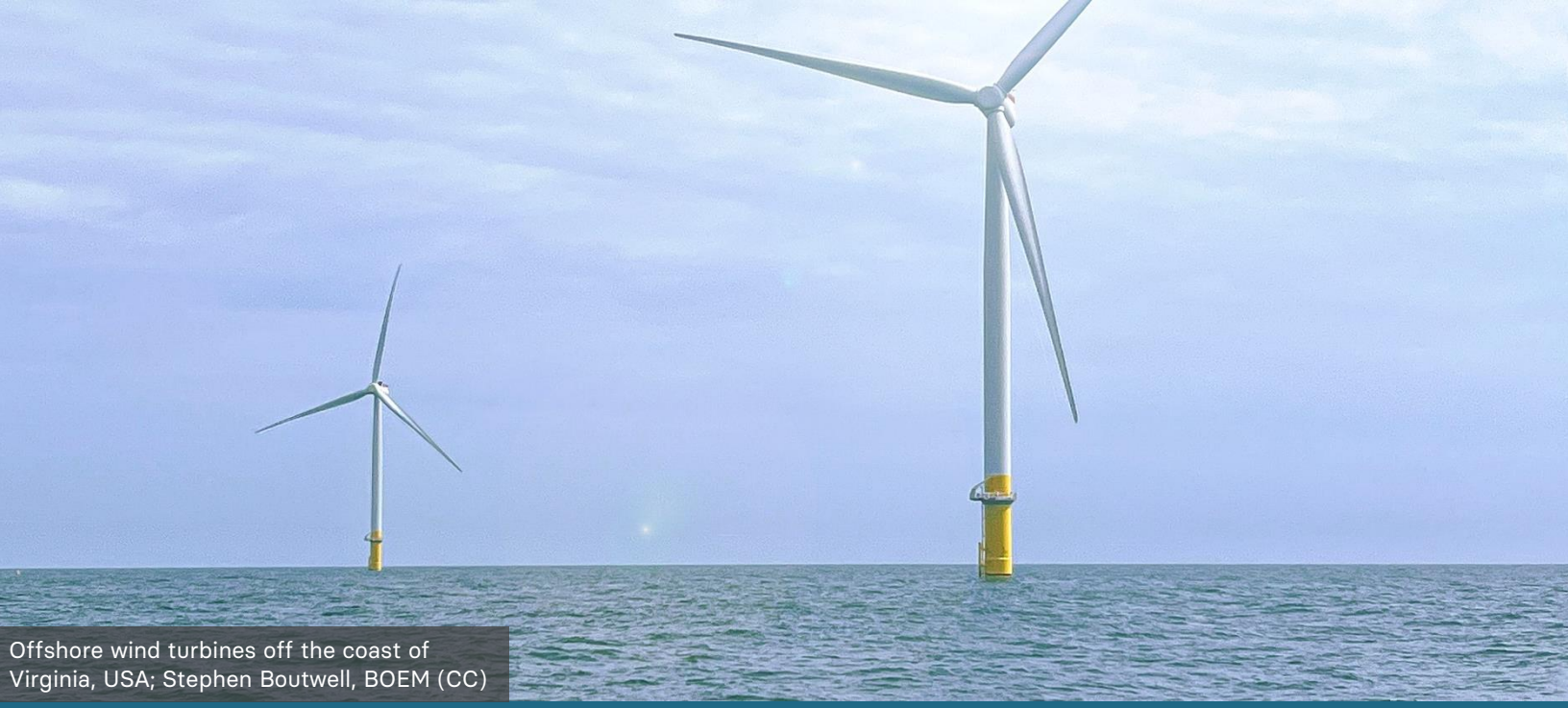

Offshore wind turbines off the coast of Virginia, USA; Stephen Boutwell, BOEM (CC)

Using shorebird tracking data to support a risk assessment related to offshore wind development along the U.S. Atlantic

Conservation Contribution #14

Conservation Action: Land/Water Management; Land/Water Protection

Smithsonian Migratory Bird Center

U.S. Fish & Wildlife Service

Prepared by the Shorebird Science & Conservation Collective:
Candace Stenzel, Allie Anderson, Autumn-Lynn Harrison

September 2024

*This report for public audiences describes how the Shorebird Collective fulfilled a conservation request, presents key findings, and due to data privacy settings, **shows only a subset of the data** used in a full report to our partner.*

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Smithsonian
Migratory Bird Center

Project Background

Conservation Request

The U.S. Fish and Wildlife Service (USFWS) requested shorebird tracking data from the Shorebird Science and Conservation Collective (hereafter, "Shorebird Collective") to support a risk mapping exercise related to offshore wind development along the U.S. Atlantic coast (Error! Reference source not found.). Specifically, USFWS requested access to tracked point locations within their area of interest (AOI) to estimate exposure risks to offshore lease areas. The Shorebird Collective provided USFWS with spatial layers of tracking points, associated timestamps, and metadata to support this request (see page 7 for more information on tracking data).

Important Note: This report describes how the Shorebird Collective fulfilled USFWS's request and presents key outputs and findings showing only a subset of the data shared. Due to the privacy settings of some datasets contributed to the Shorebird Collective, a full summary of findings provided to USFWS is for internal planning use only.

About the Shorebird Science and Conservation Collective

The Shorebird Collective is a partnership of scientists and practitioners working to translate the collective findings of shorebird tracking and community science data into effective on-the-ground actions to advance shorebird conservation in the Western Hemisphere. Learn more on our webpage: web link for the Shorebird Collective's webpage.

About U.S. Fish and Wildlife Service

USFWS is a U.S. federal government agency within the U.S. Department of the Interior which oversees the management of fish, wildlife, and natural habitats across the United States. Learn more on USFWS' website: web link for USFWS' website.

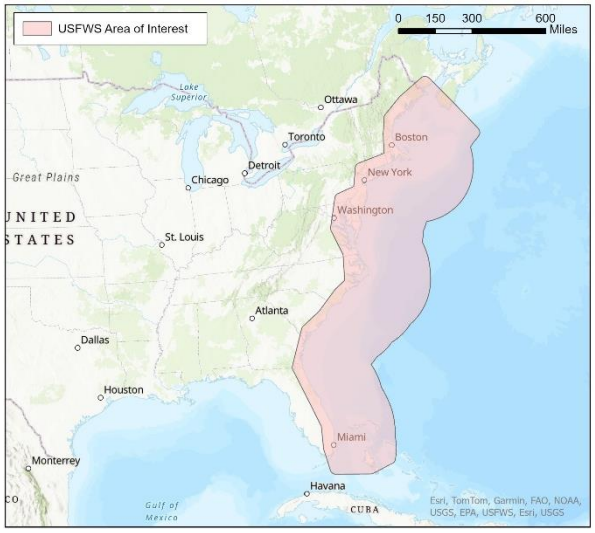


Figure 1. Map of USFWS' offshore AOI (pink polygon) along the U.S. Atlantic coast.

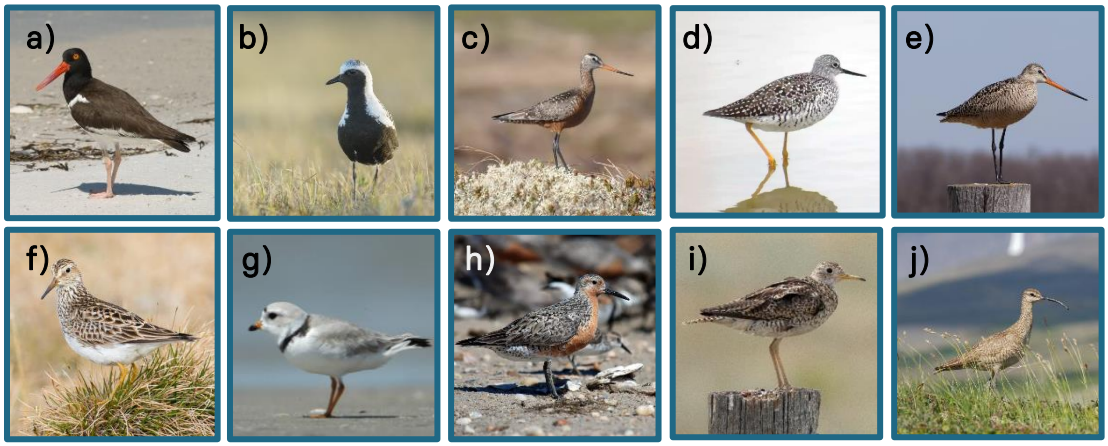
Smithsonian Migratory Bird Center

Summary of Results

Of 1,678 individuals tracked by GPS and Argos satellite technologies and contributed to the Shorebird Collective[1], **143** individuals of **13** species were estimated to have moved through USFWS' offshore AOI (see **Figure 2** as an example), with 24 individuals of nine species tracked in the region across multiple years. Tracked individuals included:

- **5** American Oystercatcher (*Haematopus palliatus*)
- **17** Black-bellied Plover (*Pluvialis squatarola*)
- **9** Hudsonian Godwit (*Limosa haemastica*)
- **1** Long-billed Curlew (*Numenius americanus*)
- **2** Long-billed Dowitcher (*Limnodromus scolopaceus*)
- **26** Lesser Yellowlegs (*Tringa flavipes*)
- **6** Marbled Godwit (*Limosa fedoa*)
- **38** Pectoral Sandpiper (*Calidris melanotos*)
- **11** Piping Plover (*Charadrius melodus*)
- **2** Red Knot (*Calidris canutus*)
- **1** Short-billed Dowitcher (*Limnodromus griseus*)
- **2** Upland Sandpiper (*Bartramia longicauda*)
- **23** Whimbrel (*Numenius phaeopus*)

Tracked locations in the AOI occurred across the whole year, with observations recorded from 2008 to 2024. A total of 123 individuals were tracked during southbound migration, 47 during northbound migration, 25 during the breeding season, and 16 while overwintering. Additional information may become available as data contributors continue to share new tracking data with the Shorebird Collective. We invited USFWS to periodically check in with the Shorebird Collective on the availability of new data to support any future risk mapping exercises related to offshore wind development.



Example species in AOI with photo credits: a) American Oystercatcher, Keith Ramos, USFWS (CC); **b)** Black-bellied Plover, USGS/Smithsonian; **c)** Hudsonian Godwit, Kristine Sowl, USFWS (CC); **d)** Lesser Yellowlegs, Jill Shannon, USFWS (CC); **e)** Marbled Godwit, Corey Enger, USDSA (CC); **f)** Pectoral Sandpiper, Lisa Hupp, USFWS (CC); **g)** Piping Plover, Gene Nieminen, USFWS (CC); **h)** Red Knot, Gregory Breese, USFWS (CC); **i)** Upland Sandpiper, Andy Boyce, Smithsonian; **j)** Whimbrel, Rachel Richardson, USGS Alaska Science Center (CC)

[1] These data come from 74 organizations, collected from 2006 to 2023. *Data version: 2024-06-01*

Methods

The Shorebird Collective used statistical models to account for spatial uncertainty and determined the most likely movement path of each bird recorded by the tracking device (example code is available on GitHub: web link for GitHub page). We then overlayed contributed GPS and Argos satellite tracking data on USFWS' AOI and removed any obvious errors. USFWS also requested original tag transmission data to enable them to apply their own filtering and location estimation methods.

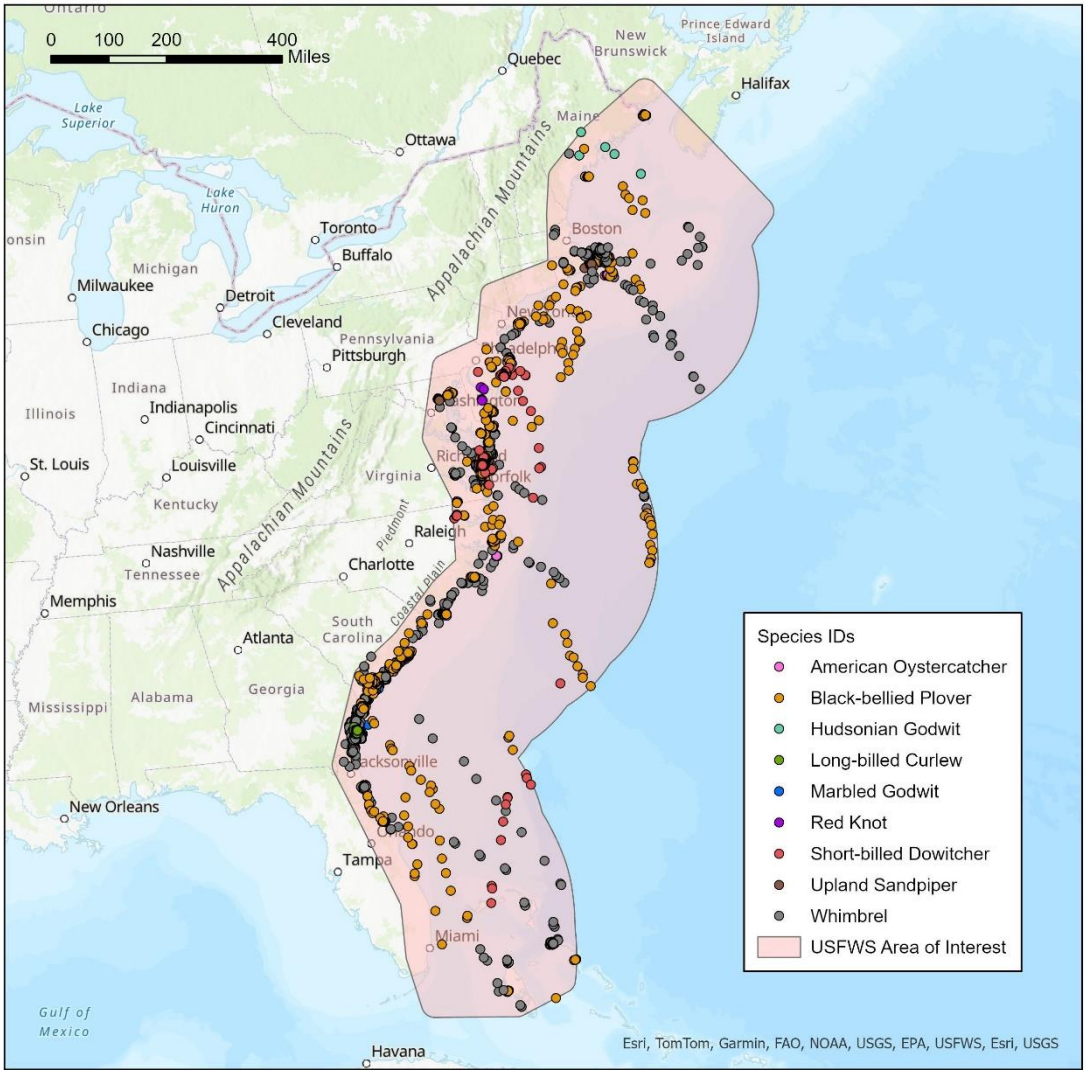


Figure 2. An example of tracked GPS and Argos satellite locations of individual shorebirds ($n = 59$) in USFWS' offshore AOI. Due to the privacy settings of some of the tracking datasets, this public-facing map contains only a subset of the tracks (41% of individuals and 69% of species) shared with USFWS. Note that this map shows tracked shorebird locations across multiple years and does not necessarily reflect the birds co-occurring in the area at the same time.

Shorebird Background

Shorebirds are a diverse group of birds in the order Charadriiformes, including sandpipers, plovers, avocets, oystercatchers, and phalaropes. There are approximately 217 shorebird species in the world (O'Brien at al. 2006), 81 of which occur in the Americas. 52 species breed in North America (Morrison et al. 2000) and 35 species breed in Latin America and the Caribbean (Lesterhuis and Clay 2019). They are among the planet's most migratory groups of animals. Many species in the Western Hemisphere, for example, travel thousands of miles every year between their breeding grounds in the Arctic and wintering grounds in the Caribbean and Central and South America, stopping at key sites along the way to rest and refuel. Across their vast range, shorebirds depend on a variety of habitats, including coastlines, shallow wetlands, mudflats, lake and pond edges, grasslands, and fields.

Long-billed Curlew; Tim Romano, Smithsonian

Although shorebirds are often seen in large flocks, it may surprise some to know that their populations are rapidly declining. Many populations have lost over 70% of their numbers in the past 50 years (NABCI 2022, Rosenberg et al. 2019, Smith et al. 2023), making them one of the most vulnerable bird groups in North America. Habitat loss and alteration, human disturbance, and climate change are just some of the major threats shorebirds face today. Effective shorebird management is even more of a challenge due to many species depending on habitats across multiple countries under different political jurisdictions. Despite these trends, many public and private groups are working to protect shorebirds and the habitats they depend on.

Flock of Marbled Godwits next to a shorebird scientist; Tim Romano, Smithsonian

Scientists attaching a GPS transmitter to a Red Knot to track its migration; Tim Romano, Smithsonian

About Shorebird Tracking Data

Tracking data provide valuable insight into where shorebirds move and are located throughout the year (**Figure 3**). These data can ultimately help biologists and practitioners make more informed conservation and land management decisions to protect shorebirds and their habitats. Tracking data are collected via tiny electronic devices (often called "tags") which are attached directly to individual birds (typically with either leg bands, harnesses, or glue) and may be carried by the birds year-round. Data from shorebirds tracked with satellite tags were shared with USFWS.

Black-bellied Plover with <5g solar satellite tag; Ryan Askren, USGS/Smithsonian

Satellite tags work by sending signals to orbiting satellites that re-transmit location data back to a receiving station which researchers can access through their computer. The two types of satellite tags commonly used to study birds include Global Positioning System (GPS) and Argos tags. GPS tags typically have high spatial accuracy (i.e., minimal location error, generally <10 meters), while Argos tags can have location error of 500-2,500 meters. The Shorebird Collective compiled both contributed GPS and Argos satellite data to support USFWS' request. Web link for more information on satellite tags.

One key benefit of tracking data compared to other data types such as survey or count data is that they give detailed information on movements and habitat use of individual animals in areas that are otherwise difficult to access, such as remote areas or private lands. Therefore, the birds themselves show us where they are, independent of the need for direct human observation.

Figure 3. Full cycle track line across two years for an individual Black-bellied Plover; contributed by Autumn-Lynn Harrison, Smithsonian Migratory Bird Center; David Newstead, Coastal Bend Bays & Estuaries Program; and Lee Tibbitts, U.S. Geological Survey, Alaska Science Center. Photos: **a)** Breeding male Black-bellied Plover with leg flag and <5g solar satellite tag, Ryan Askren, USGS/Smithsonian; **b)** Satellite tag attached to the back of a Black-bellied Plover; Tim Romano, Smithsonian.

Data Contributors

Tracking data for this project were contributed to the Shorebird Collective by the following people and organizations. A full list of data contributors to the Shorebird Collective can be found on our webpage: web link for the Shorebird Collective's webpage.

American Oystercatcher
Data contributed by Pam Loring (U.S. Fish and Wildlife Service); co-owned by Curtice Griffin and Paul Sievert (University of Massachusetts Amherst), Cabel Spiegel (U.S. Fish and Wildlife Service)

Black-bellied Plover
Data contributed by Jennie Rausch (Canadian Wildlife Service, Environment and Climate Change Canada); co-owned by Paul Woodard (Canadian Wildlife Service, Environment and Climate Change Canada)

Hudsonian Godwit
Data contributed by Jennie Rausch (Canadian Wildlife Service, Environment and Climate Change Canada), Nathan Senner (University of Massachusetts Amherst, University of South Carolina), Mitch Weegman (University of Missouri, University of Saskatchewan), Bart Ballard (Texas A&M University, Kingsville); co-owned by Fletcher Smith (College of William and Mary, Georgia Department of Natural Resources), Bryan Watts (College of William and Mary); Jennifer Linscott (University of South Carolina), Jorge Ruiz and Juan Navedo (Universidad Austral de Chile),

Long-billed Curlew
Data contributed by Autumn-Lynn Harrison (Smithsonian Migratory Bird Center); co-owned by David Newstead (Coastal Bend Bays & Estuaries Program), David Bradley (Birds Canada)

Long-billed Dowitcher
Data contributed by Bart Kempenaers (Department of Ornithology, Max Planck Institute for Biological Intelligence); co-owned by Eunbi Kwon (Department of Ornithology, Max Planck Institute for Biological Intelligence)

Lesser Yellowlegs
Data contributed by Jim Johnson and Callie Gesmundo (U.S. Fish and Wildlife Service), Katie Christie (Alaska Department of Fish and Game); co-owned by Laura McDuffie (U.S. Geological Survey, Alaska Science Center), Christian Friis, Benoit Laliberté, and Jennie Rausch (Canadian Wildlife Service, Environment and Climate Change Canada), Christopher Harwood (U.S. Fish and Wildlife Service), Erica Nol (Trent University), Audrey Taylor (University of Alaska Anchorage), Jay Wright (Ohio State University), Department of Defense - Joint Base Elmendorf-Richardson

Marbled Godwit
Data contributed by Bridget Olson (U.S. Fish and Wildlife Service)

Pectoral Sandpiper
Data contributed by Bart Kempenaers (Department of Ornithology, Max Planck Institute for Biological Intelligence); co-owned by Mihai Valcu (Department of Ornithology, Max Planck Institute for Biological Intelligence)

Piping Plover
Data contributed by Michelle Stantial (SUNY College of Environmental Science and Forestry)

Red Knot
Data contributed by Amy Scarpignato (Smithsonian Migratory Bird Center); co-owned by Migratory Connectivity Project

Short-billed Dowitcher
Data contributed by Autumn-Lynn Harrison (Smithsonian Migratory Bird Center); co-owned by David Newstead (Coastal Bend Bays & Estuaries Program)

Upland Sandpiper
Data contributed by Jason Hill (Vermont Center for Ecostudies); co-owned by Rosalind Renfrew (Vermont Center for Ecostudies, Vermont Fish and Wildlife Department)

Whimbrel
Data contributed by Jennie Rausch (Canadian Wildlife Service, Environment and Climate Change Canada), Erica Nol (Trent University); co-owned by Fletcher Smith (College of William and Mary, Georgia Department of Natural Resources), Bryan Watts (College of William and Mary), Brad Winn (Manomet), Julie Paquet (Canadian Wildlife Service, Environment and Climate Change Canada)

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Smith, P. A., Smith, A. C., Andres, B., Francis, C. M., Harrington, B., Friis, C., Guy Morrison, R. I., Paquet, J., Winn, B., and Brown, S. 2023. Accelerating declines of North America's shorebirds signal the need for urgent conservation action. *Ornithological Applications,* 125:1-14.