



Prairie Potholes in North Dakota, USA;
Jim Brandenburg, USFWS (CC)

Using shorebird tracking data as an outreach tool for local stakeholders in North Dakota

Conservation Contribution #13

Conservation Action: Education and Awareness



Smithsonian
Migratory Bird Center

Prepared by the Shorebird Science & Conservation Collective:

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Project Background

Conservation Request

The North Dakota Naturel Resource Trust (ND NRT) requested shorebird tracking data from the Shorebird Science and Conservation Collective (hereafter, "Shorebird Collective") to help raise awareness about shorebirds in North Dakota. Specifically, they requested movement maps and summary information of electronically tracked shorebirds ([see page 9 for more information on shorebird tracking data](#)) in North Dakota to use as examples at local stakeholder meetings to demonstrate the value of North Dakota lands for shorebirds. The Shorebird Collective compiled relevant movement paths for individuals tracked in the state and created maps of their local and full cycle movements to support ND NRT's outreach efforts.

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 the North Dakota Natural Resources Trust

The ND NRT promotes the restoration, creation, and management of wetlands, grasslands, and riparian areas throughout the state of North Dakota. Since 1986, ND NRT has worked with federal, state, and private partners to support working lands cost-share programs, long-term protection, and outreach efforts across the state. Learn more on ND NRT's website: [web link for ND NRT's website](#).

Example Maps Provided to ND NRT

Below we present maps shared with ND NRT depicting local and full cycle movement paths of individual birds tracked in the state of North Dakota (Figure 1-Figure 4). ND NRT intends to share these maps at local stakeholder meetings to demonstrate the value of North Dakota lands for shorebirds.

Buff-breasted Sandpiper (*Calidris subruficollis*)

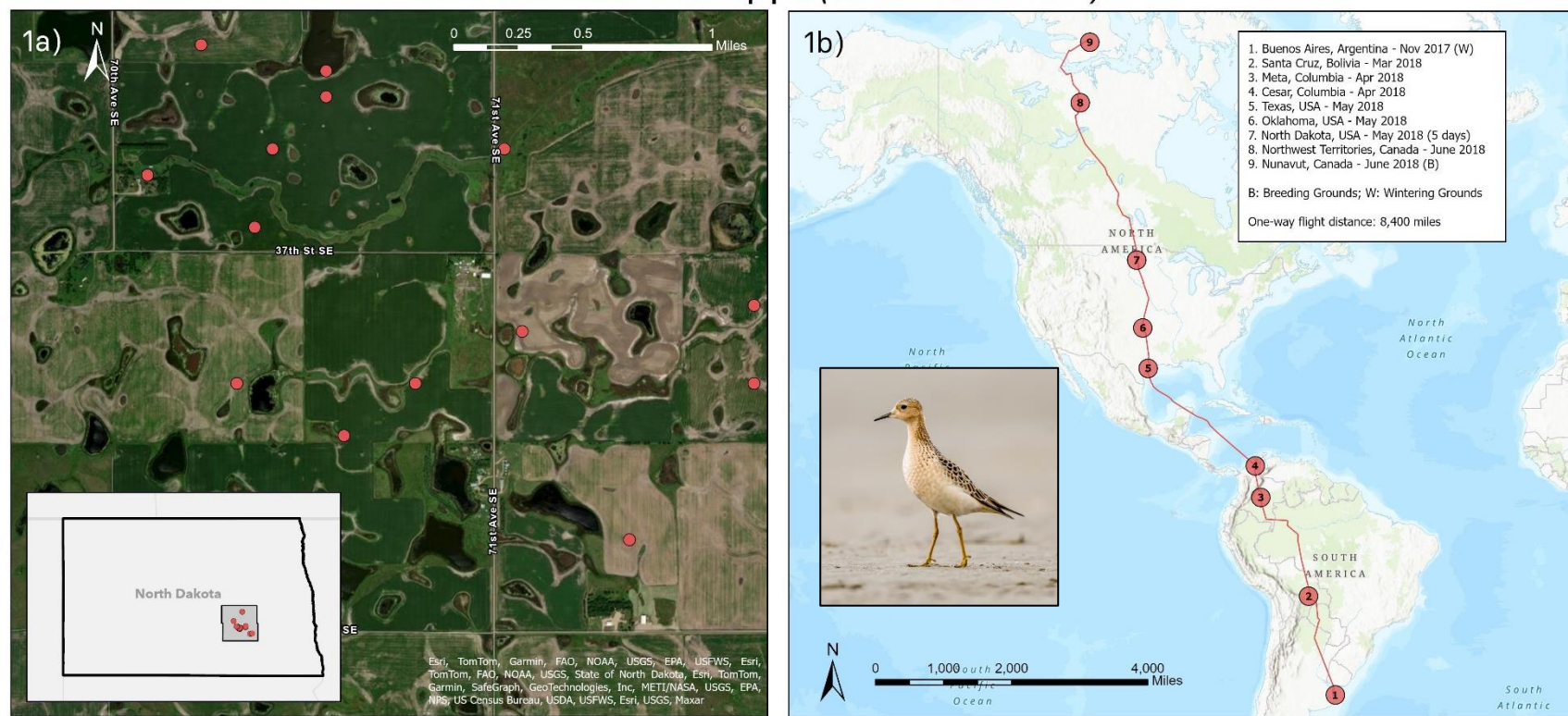


Figure 1. An example of tracked GPS and Argos satellite locations of a Buff-breasted Sandpiper (*Calidris subruficollis*) along wetlands and agricultural fields in (a) Stutsman County, North Dakota. The bird stopped in the state for five days in May 2018 (i.e., during spring migration) before flying approximately 1,300 miles north to its next stopover location in Northwest Territories, Canada. (b) Northbound migration movements of the Buff-breasted Sandpiper with labeled wintering, stopover, and breeding areas. The bird was equipped with a tracking device on its wintering grounds in Buenos Aires, Argentina by a team of scientists in November 2017 and tracked for ten months. During this time, the bird flew approximately 8,400 miles north between its nonbreeding and breeding grounds. Buff-breasted Sandpiper tracking data were contributed by Lee Tibbitts, U.S. Geological Survey, Alaska Science Center. See page 12 for additional data contributor information. Buff-breasted Sandpiper photo: Jake Bonello, USFWS (CC).

Long-billed Curlew (*Numenius americanus*)

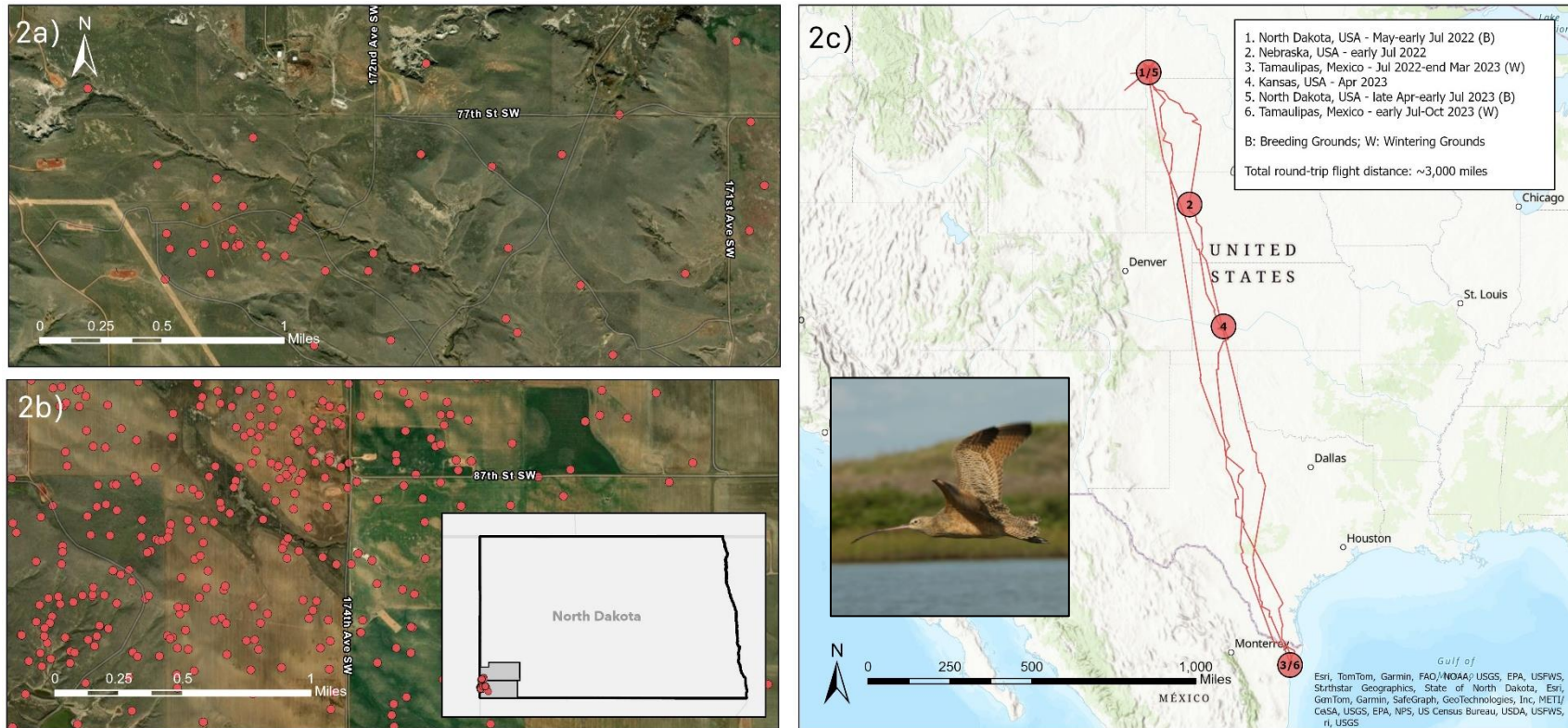


Figure 2. An example of tracked Argos satellite locations of a Long-billed Curlew (*Numenius americanus*) along grasslands and agricultural fields in **a)** Slope and **b)** Bowman Counties, North Dakota. The bird spent the breeding season in the state (May-early July) before flying approximately 1,500 miles south to its nonbreeding grounds in Tamaulipas, Mexico. **c)** Annual movements of the Long-billed Curlew with labeled breeding, stopover, and wintering locations. The bird was equipped with a tracking device on its breeding grounds in North Dakota by a team of scientists in May 2022 and tracked for a year-and-a-half. During this time, the bird flew approximately 3,000 miles round-trip between its breeding and nonbreeding grounds. Long-billed Curlew tracking data were contributed by Jay Carlisle, Intermountain Bird Observatory, Boise State University. See page 12 for additional data contributor information. Long-billed Curlew photo: Tim Romano, Smithsonian.

Marbled Godwit (*Limosa fedoa*)

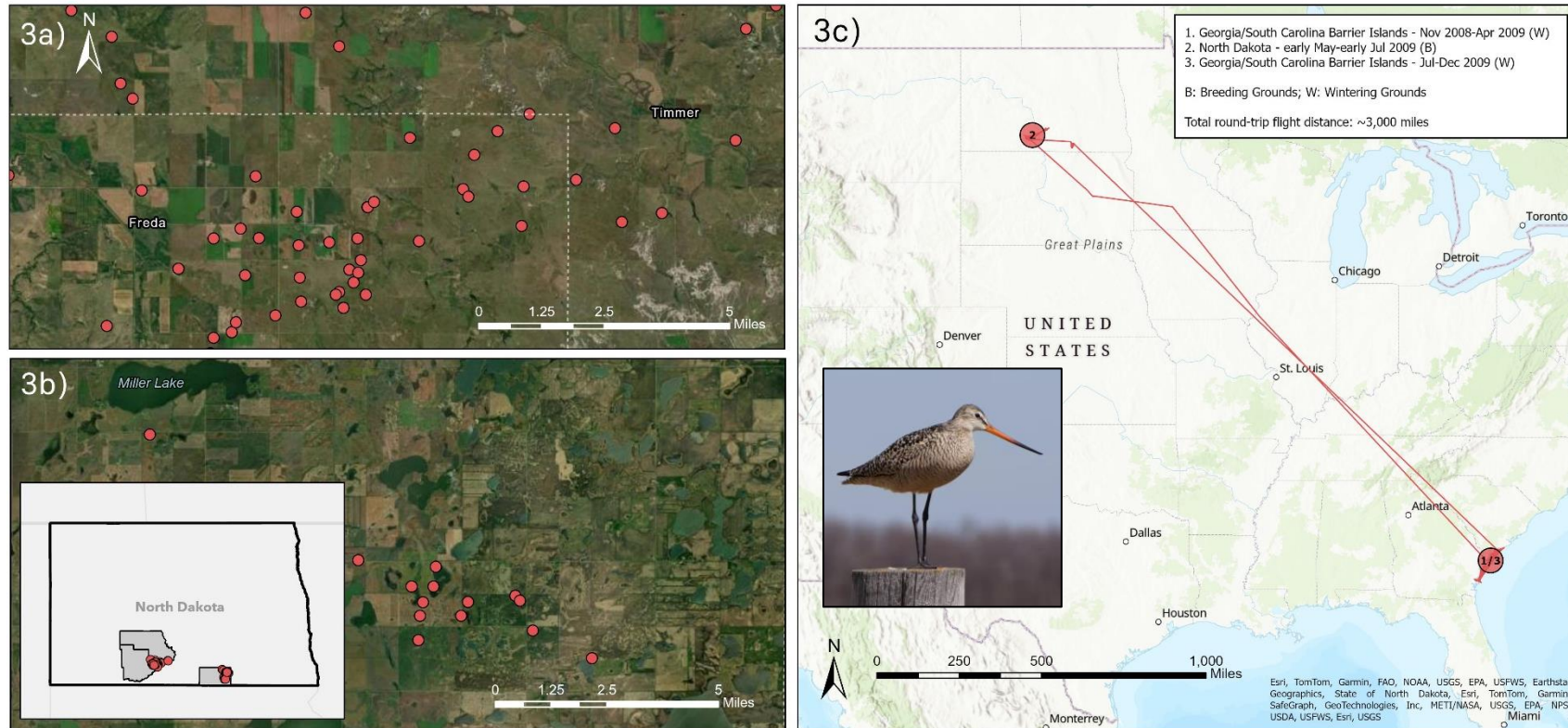


Figure 3. An example of tracked Argos satellite locations of a Marbled Godwit (*Limosa fedoa*) along wetlands and agricultural fields in **a)** Grant and Morton and **b)** McIntosh Counties, North Dakota. The bird spent the breeding season in the state (early May-early July) before flying approximately 1,500 miles southeast to its nonbreeding grounds in Georgia and South Carolina, USA. **c)** Annual movements of the Marbled Godwit with labeled breeding and wintering locations. The bird was equipped with a tracking device on its nonbreeding grounds in Georgia by a team of scientists in November 2008 and tracked for one full year. During this time, the bird flew approximately 3,000 miles round-trip between its breeding and nonbreeding grounds. Marbled Godwit tracking data were contributed by Bridget Olson, U.S. Fish and Wildlife Service. Marbled Godwit photo: Corey Enger, USDA (CC).

About the Prairie Potholes

The Prairie Pothole Region (PPR) spans over 300,000 square miles in the upper Midwest, covering portions of five U.S. states and three Canadian provinces (**Figure 5**). The vast landscape contains millions of depressional wetlands, known as “potholes”, which collectively form one of the richest and most diverse wetland systems on the planet (Doherty et al. 2018). These seasonal wetlands, in conjunction with the surrounding grasslands, provide critical stopover habitat for 36 shorebird species during spring and fall migration¹, in addition to serving as an important breeding area for 13 shorebird species (Skagen and Thompson 2013). In fact, the region currently hosts nine Western Hemisphere Shorebird Reserve Network (WHSRN) sites², three of which are located in the state of North Dakota, emphasizing the importance of North Dakota lands for shorebirds.



Over 90% of the land within the PPR is privately owned (Ross and McKenna 2023), positioning private landowners as key partners for successful shorebird conservation. However, the region faces major conservation challenges due to the rapid conversion of natural habitats into agriculture, coupled with the dynamic and unpredictable fluctuations of water levels and wetland conditions across years (Skagen and Thompson 2013). As such, many shorebird populations are opportunistic and may move between seasons and years to find needed habitats in the PPR (Skagen and Thompson 2013).

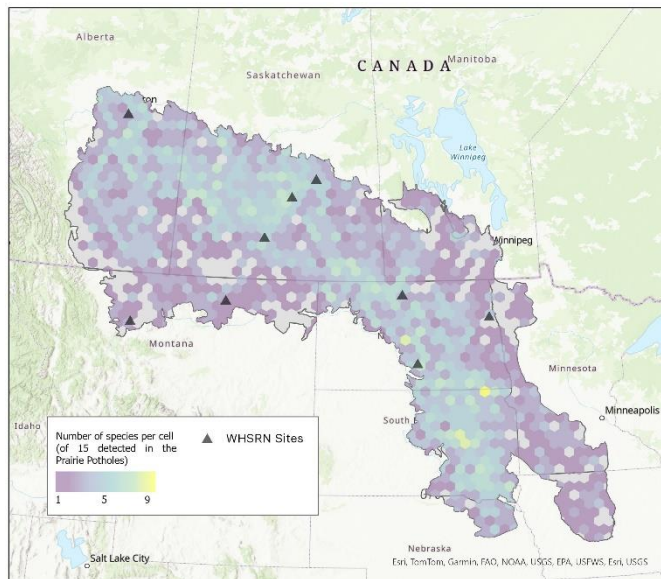


Figure 5. Density of tracked shorebird species ($n = 15$) in the PPR, based on Argos and GPS satellite data contributed to the Shorebird Collective. Each cell is a 30 x 30 km hexagon and counts per cell are summed from the number of species with an estimated location in the cell at the original sampling interval of the tag across all years.

¹ It is estimated that over 7.3 million shorebirds stop in the PPR during spring migration (Steen et al. 2018).

² WHSRN is a voluntary, non-regulatory network of public and private partners working to protect shorebirds through a network of key sites throughout the Americas. There are currently 125 WHSRN sites in 20 countries covering over 39.1 million acres of shorebird habitat across the Americas. Learn more at on WHSRN's website: [web link for WHSRN's website](https://www.whsrn.org/).

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 et 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.

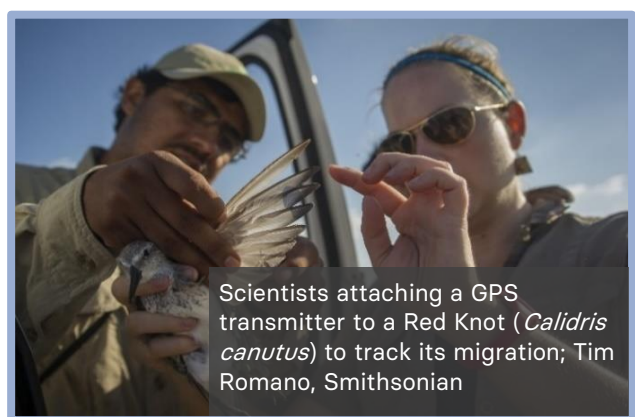


Long-billed Curlew
(*Numenius americanus*);
Tim Romano, Smithsonian

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 (*Limosa fedoa*) next to a shorebird scientist;
Tim Romano, Smithsonian



Scientists attaching a GPS transmitter to a Red Knot (*Calidris canutus*) 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 6). 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 ND NRT.



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 ND NRT. [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.

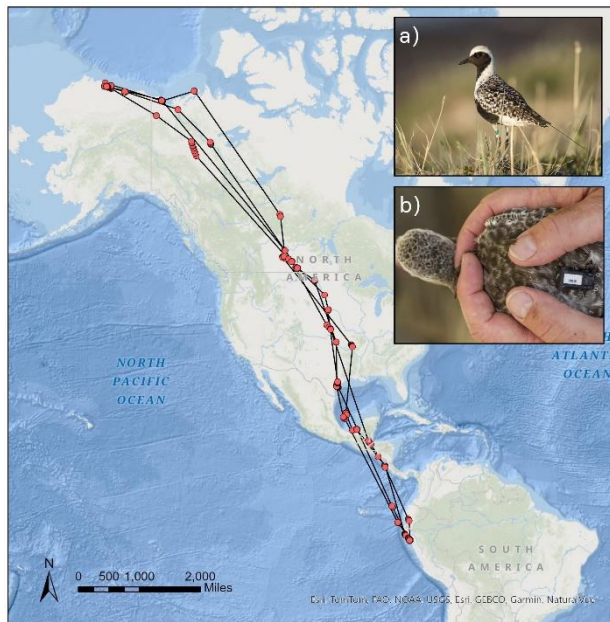


Figure 6. Full cycle track line across two years for an individual Black-bellied Plover (*Pluvialis squatarola*); contributed by Autumn-Lynn Harrison, Smithsonian Migratory Bird Center and Lee Tibbitts, U.S. Geological Survey, Alaska Science Center. Photos: **a)** Breeding male Black-bellied Plover with leg flag and <5 g solar satellite tag, Ryan Askren, USGS/Smithsonian; **b)** Satellite tag attached to the back of a Black-bellied Plover; Tim Romano, Smithsonian.

Using Education for Conservation Action

Education and outreach programs offer a unique opportunity to raise awareness about, and action towards, specific conservation concerns. Its application can increase knowledge, shape attitudes and values, build skills that prepare individuals to take positive conservation action, and foster engagement between community members, scientists, practitioners, and decision-makers (Ardoin et al. 2020).

ND NRT's shorebird outreach efforts are one example of a local effort designed to raise awareness about shorebirds and their conservation. With many shorebird populations in decline (NABCI 2022, Rosenberg et al. 2019, Smith et al. 2023), it is now more important than ever to spread knowledge about these birds. ND NRT plans to share these example maps at local stakeholder meetings to raise awareness about shorebirds in the state and the role that local conservation projects have in protecting their populations.



Picking up trash on a beach;
Tim Romano, Smithsonian

When planning any conservation education program, lesson, or activity, efforts must be designed in a way that align with the participants' attitudes and values and framed in way that makes them care (Lakoff 2010). For example, as part of a phase II, ND NRT could work with the Shorebird Collective to provide landowners with tailored maps of shorebird tracks in their property to encourage interest in shorebirds. Additionally, encouraging simple and manageable actions is often a first step to motivate change and initiate greater conservation action (Mengak et al. 2019, Schultz 2002). Relevant to helping shorebirds, there are several examples of simple and manageable "shorebird-friendly" actions that ND NRT could recommend to private landowners participating in ND NRT programs.

Shorebird-Friendly Actions

1. **Reduce or time the use of pesticides** near aquatic and grassland habitats so applications do not limit invertebrate availability and/or degrade shorebird habitat.
2. **Limit disturbance** (e.g., vehicles, humans/pets) in areas with high shorebird concentrations.
3. **Control tall/dense vegetation** in grassland and aquatic habitats through brush management or prescribed burning.
4. **Protect on-site wetlands** from livestock by installing fencing around the site and/or placing livestock watering facilities away from the wetlands to prevent erosion and habitat degradation.
5. For managed wetlands, **maintain shallow water levels** when shorebirds are present.
6. **Maintain a mosaic of different habitats** to provide resources for multiple shorebird species.
7. **Incorporate prescribed grazing systems** on rangelands by providing shorter grass during spring and fall migration.
8. **Share sightings on eBird** – Report your shorebird observations on eBird to help scientists better understand where shorebirds are and when, allowing for more effective conservation and land management efforts ([web link for eBird](#)).

Data Contributors

Tracking data for this project were contributed to the Shorebird Collective by the following people and organizations. Individuals with an asterisk (*) indicates the technical point of contact for the dataset. A full list of data contributors to the Shorebird Collective can be found on our webpage: [web link for the Shorebird Collective's webpage](#).

Buff-breasted Sandpiper Track

Lee Tibbitts^{*1}, Bob Gill¹, Dave Douglas¹, Gabriel Castresana², Joaquín Aldabe^{3,4,5}, Juliana Almeida^{3,6}, Rebecca McGuire⁷, Rick Lanctot⁸

Long-billed Curlew Track

Jay Carlisle^{*9}, Stephanie Coates⁹

Marbled Godwit Track

Bridget Olson^{*8}

Contributor Organizations

¹ U.S. Geological Survey, Alaska Science Center, ² Ministerio de Ambiente de la Provincia de Buenos Aires, ³ Manomet Conservation Sciences, ⁴ Aves de Uruguay, ⁵ Universidad de la Republica Uruguay, ⁶ SAVE Brasil, ⁷ Wildlife Conservation Society, ⁸ U.S. Fish and Wildlife Service, ⁹ Intermountain Bird Observatory, Boise State University,

References

- Ardoyn, N. M., Bowers, A. W., and Gaillard, E. 2020. Environmental education outcomes for conservation: a systematic review. *Biological Conservation*, 241: 108224.
- Doherty, K. E., Howerter, D. W., Devries, J. H., and Walker, J. 2018. Prairie Potholes Region of North America. In: Finlayson, C., Milton, G., Prentice, R., Davidson, N. (eds), *The Wetland Book*. Springer, Dordrecht.
- Lakoff, G. 2010. Why it matters how we frame the environment. *Environmental Communication*, 4: 70–81.
- Lesterhuis, A. J., and R. P. Clay. 2019. Conservation status of shorebird species resident to Latin America and the Caribbean, v1. WHSRN Executive Office and Manomet, Inc., Manomet, MA.
- Mengak, L., Dayer, A. A., Longenecker, R., and Spiegel, C. S. 2019. Guidance and best practices for evaluating and managing human disturbances to migrating shorebirds on coastal lands in the northeastern United States. U.S. Fish and Wildlife Service.
- Morrison, R. I. G., Gill, R. E., Harrington, B.A., Skagen, S., Page, G.W., Gratto-Trevor, C.L., and Haig, S.M. 2000. Population estimates of Nearctic shorebirds. *Waterbirds*, 23: 337–352.
- [NABCI] North American Bird Conservation Initiative. 2022. The State of the Birds, USA, 2022.
- O'Brien, M., Crossley, R., and Karlson, K. 2006. The shorebird guide. Houghton Mifflin Company, New York, NY.
- Rosenberg, K. V., Dokter, A. M., Blancher, P. J., Sauer, J. R., Smith, A. C., Smith, P. A., Stanton, J. C., Panjabi, A., Helft, L., Parr, M., and Marra, P. 2019. Decline of the North American avifauna. *Science*, 366(6461):120–124.
- Ross, C. D., and O. P., McKenna. 2023. The potential of Prairie Pothole wetlands as an agricultural conservation practice: A synthesis of empirical data. *Ecosystem Services of Wetlands*, 43:5.
- Schultz, P. W. 2002. Knowledge, information, and household recycling: examining the knowledge deficit model of behavior Change. In *New tools for environmental protection: education, information and voluntary measures* (T. Dietz and P. C. Stern, Eds.), National Academy Press, Washington D.C., 67–82.
- Skagen, S. K., and G., Thompson. 2013. Northern Plains/Prairie Potholes regional shorebird conservation plan, Version 1.0. U.S. Shorebird Conservation Plan, Lakewood, CO.
- 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.
- Steen, V., Skagen, S. K., and Noon, B. R., 2018. Preparing for an uncertain future: migrating shorebird response. *Ecosphere*, 9(2):e02095.