Black-bellied Plover (*Pluvialis squatarola*) with leg flag and <5g solar satellite tag; Ryan Askren, USGS/Smithsonian

Connecting people and places across the Western Hemisphere with shorebird migrations

Conservation Contribution #04

Conservation Action: Education and Awareness

WHSRN

Smithsonian *Migratory Bird Center*

Prepared by the Shorebird Science & Conservation Collective:
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Project Background

Conservation Request

The Western Hemisphere Shorebird Reserve Network (WHSRN) proposed a project showing how shorebird movements connect key sites across the Western Hemisphere into networks of "sister sites". To fulfill this request, the Shorebird Science and Conservation Collective (hereafter "Shorebird Collective") created a multilingual online outreach exhibit via ArcGIS StoryMaps--interactive digital experiences that allow organizations to tell stories with maps, **Figure 1.** The ArcGIS StoryMap series, "Cultural Connections across Migratory Flyways," follows the movements of three individual shorebirds tracked with electronic tracking devices (see page 10 for more information on tracking data) as they migrate across the Americas. Each StoryMap features a shorebird migratory flyway (i.e., a common route taken by many species, named the Pacific, Midcontinent, and Atlantic Flyways) and cultural theme (i.e., foods, music, crafts) while showcasing the many people, places, and cultures each shorebird might encounter along their migrations. Explore the multi-lingual ArcGIS StoryMap series in English, Spanish, or Portuguese by clicking on any of the links in the text box below!

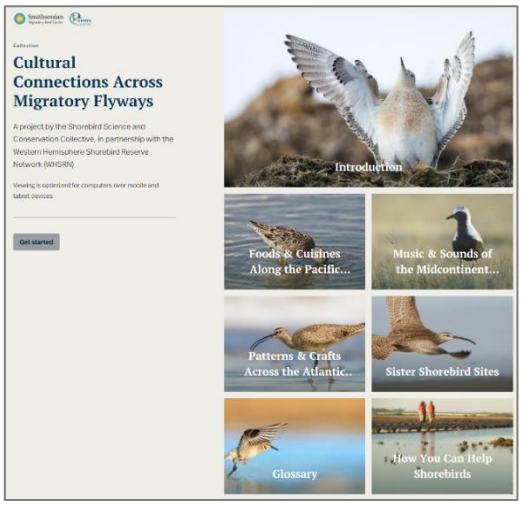

Figure 1. ArcGIS StoryMap series cover page.

Web Links for the ArcGIS StoryMap Series

- English version
- Spanish version
- Portuguese version

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 Western Hemisphere Shorebird Reserve Network

WHSRN is a voluntary, non-regulatory network of public and private partners working to protect shorebirds and their habitats 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 on WHSRN's website: web link for WHSRN's website.

About Shorebird Flyways

The term "flyway" refers to a broad flight path used by a large number of birds migrating between their breeding and wintering grounds. The three primary shorebird flyways in the Americas include the Pacific, Midcontinent, and Atlantic flyways (**Figure 2**). The Pacific (**Figure 2a**) and Atlantic flyways (**Figure 2c**) contain a larger proportion of coastal landscapes, while the Midcontinent flyway (**Figure 2b**) provides interior habitats, such as grasslands, fields, and inland wetlands, as well as coastal habitat along the Gulf of Mexico.

During migration, shorebirds stop at several key sites along a flyway to rest and refuel, otherwise known as "stopover sites". These stops can last from less than a day to multiple weeks. Many shorebirds (and other migratory birds) depend on the same stopover sites year after year, highlighting the importance of protecting these key places so that migrating birds obtain the resources they need to complete their migrations.

Shorebirds encounter a range of threats on migration. While some threats occur across all three flyways (e.g., habitat loss and alteration, human disturbance, predation, and climate change), others are more specific to a region. For example, shorebirds that migrate through the midcontinent of North America may encounter wind turbines and/or face unpredictable water resources across years (Niemuth et al. 2013, Steen et al. 2018), while those that use the Atlantic flyway may face increased hunting pressures in parts of the Caribbean and northeastern South America (ASFI 2016). Recognizing these different threats across regions is critical for developing strategic and targeted conservation actions.

The recent development of three flyway-scale shorebird conservation initiatives aim to address these threats and reverse the decline of shorebird populations. These initiatives are a collaborative effort across different sectors and include multiple stakeholders and partnering organizations along each flyway. Learn more on the Shorebird Conservation Initiatives of the Americas website: [web link for the Shorebird Conservation Initiatives website].

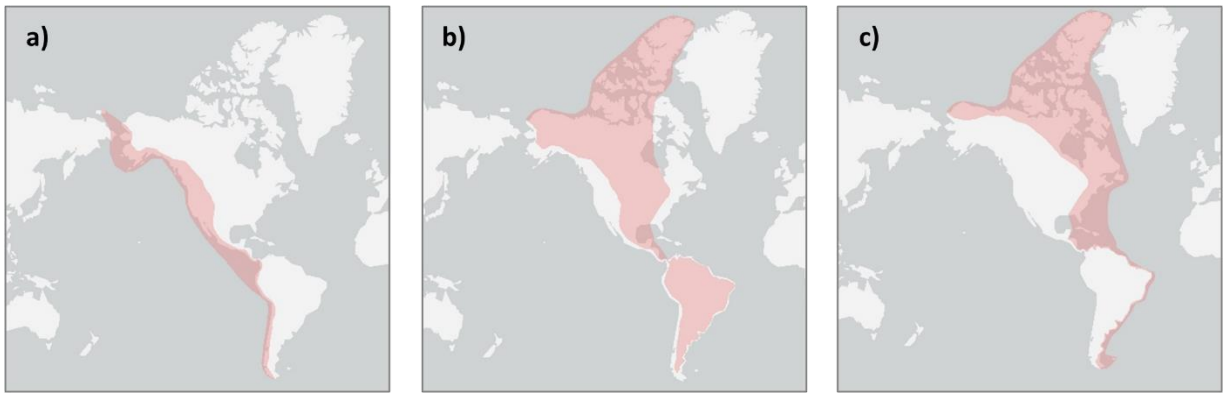

Figure 2. The a) Pacific, b) Midcontinent, and c) Atlantic shorebird flyways of the Americas (adapted from USFWS 2023).

About the Birds

The ArcGIS StoryMap series is designed to connect people and places through the migratory movements of individual shorebirds as they migrate across the Americas. Each StoryMap chapter follows an individual Dowitcher (*Limnodromus sp.*), Black-bellied Plover (*Pluvialis squatarola*), or Whimbrel (*Numenius phaeopus*) tracked with a satellite tag (**Figure 3**) as they make stops to rest and refuel in local communities along their migrations. At each of the birds' stops, we highlight what they might eat, hear, or see, while also illustrating unique corresponding cultural elements of the local communities they visit, including foods, music, or crafts. The series features cultural elements of Latin American, African American, and Native American communities across the Western Hemisphere, connected to each other by the migratory movements of the shorebirds featured in the series. Explore the ArcGIS StoryMap series in English, Spanish, or Portuguese: web link for the English version; web link for the Spanish version; web link for the Portuguese version.

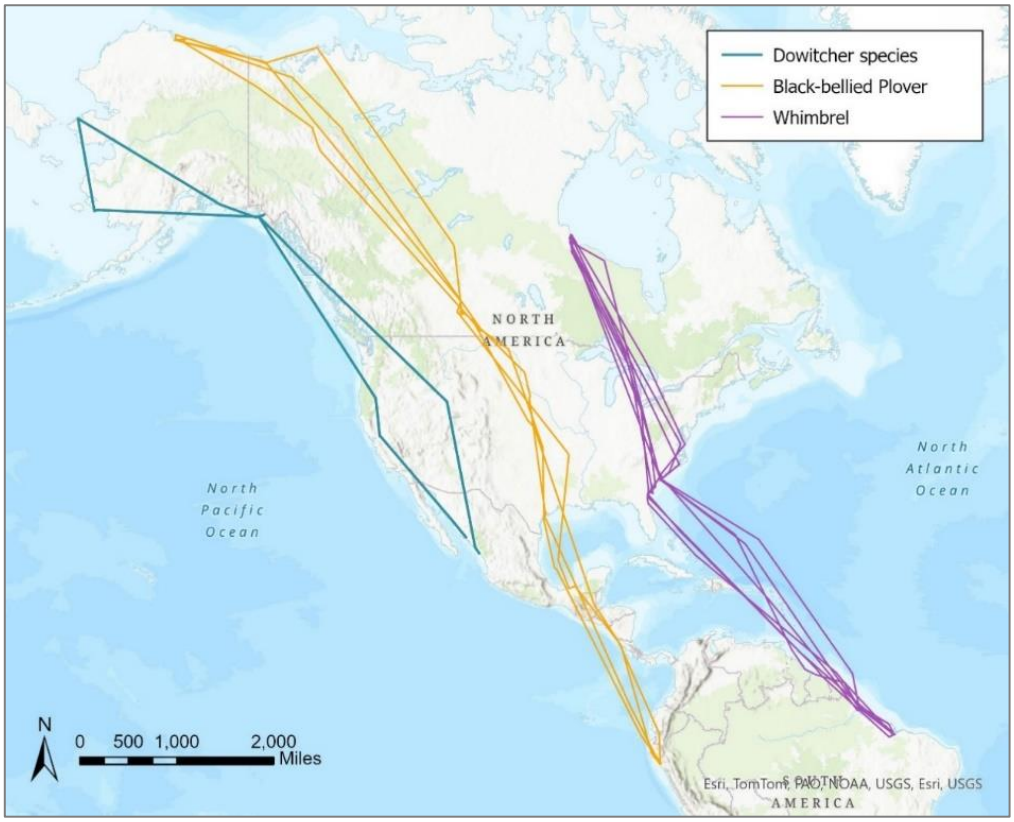

Figure 3. Annual cycle movements of the three individual shorebirds featured in the ArcGIS StoryMap series: Dowitcher (*Limnodromus sp.,* Pacific Flyway), Black-bellied Plover (*Pluvialis squatarola*, Midcontinent Flyway), and Whimbrel (*Numenius phaeopus*, Atlantic Flyway). See page 12 for data contributor information.

Dowitcher

Dowitchers are chunky, medium-sized shorebirds with a long, straight bill (Takekawa et al. 2020). Two species occur in the Western Hemisphere (i.e., Long-billed and Short-billed), both of which are similar in appearance though Long-billed are slightly larger and can have longer-bills (Jehl et al. 2020, Takekawa et al. 2020). Breeding adults have mottled brown upperparts with cinnamon underparts; nonbreeding individuals are brownish gray with pale underparts (Jehl et al. 2020, Takekawa et al. 2020).

Images: 1) Long-billed Dowitcher, Andy Boyce, Smithsonian; 2) Klamath Basin, Oregon, USFWS (CC); 3) Herring, Smithsonian; 4) Marionberry harvesting, Oregon Dept. of Agriculture (CC)

Long-billed Dowitchers breed on the tundra from northeastern Russia to northwestern Canada and winter along the Pacific and Gulf coasts of the southern United States and Mexico (Takekawa et al. 2020). Short-billed Dowitchers breed across the subarctic and boreal regions of Alaska and Canada and winter along the Pacific, Gulf, and Atlantic coasts of the southern United States and Central and South America (Jehl et al. 2020).

The dowitcher featured in the Pacific Flyway StoryMap was tagged on its wintering grounds in Playa Ceuta, a WHSRN site in Sinaloa, Mexico and data contributed by Scott Flemming, Canadian Wildlife Service, Environment and Climate Change Canada. Given the many similarities and range overlaps between the two species, the scientists who tagged this bird were uncertain whether he or she was a Long-billed or Short-billed species; future DNA analyses will confirm species. Following a full year of its movements, the bird flew approximately 7,600 miles round-trip and stopped in nine different areas across the United States and Mexico (**Figure 4**).

The Pacific Flyway/Dowitcher StoryMap centers around foods and cuisines. As the dowitcher stops at each site, we highlight what the dowitcher might eat or find in the surrounding area while showcasing traditional dishes and/or common foods found in nearby human communities (examples in images above).

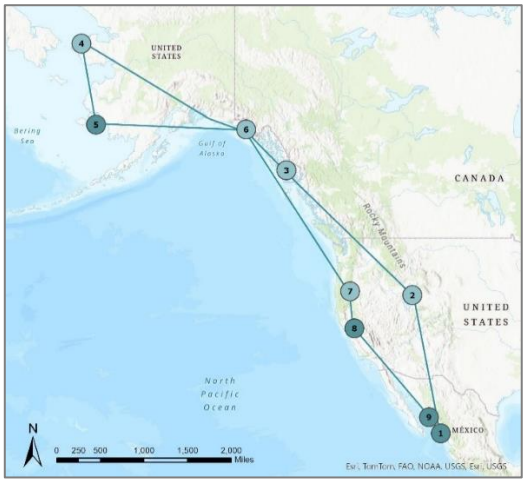

Figure 4. Annual movements of the Dowitcher highlighted in the story map with labeled breeding, wintering, and stopover locations. Darker circles indicate a WHSRN site. Dowitcher tracking data contributed by Scott Flemming, Canadian Wildlife Service, Environment and Climate Change Canada. See page 12 for additional data contributor information.

1. Playa Ceuta* - Sinaloa, Mexico (**W**)
2. Bear Lake National Wildlife Refuge - Idaho, USA
3. Tsimpsean Peninsula - British Columbia, Canada
4. Bering Land Bridge National Preserve - Alaska, USA (**B**)
5. Yukon Delta National Wildlife Refuge* - Alaska, USA (**B**)
6. NEAR Yakutat Forelands - Alaska, USA
7. Upper Klamath National Wildlife Refuge - Oregon, USA
8. NEAR Sacramento Valley* - California, USA
9. NEAR Bahía de Santa María* - Sinaloa, Mexico (**W**)

B: Breeding Site; **W**: Wintering Site; *: WHSRN Site

Black-bellied Plover

Black-bellied Plovers are medium-sized shorebirds with a thick, short neck and stocky body (Poole et al. 2020). Breeding males are known for their striking black-and-white tuxedo appearance; juveniles and females, in comparison, have a speckled, silver-grey pattern (Poole et al. 2020). The species has an extensive range, occuring on six of the seven continents, excluding Antarctica (Poole et al. 2020). Within the Americas, they breed in the high Arctic of Alaska and Canada and winter along the coasts from southern Canada to South America (Poole et al. 2020).

Images: 1) Female Black-bellied Plover, Ryan Askren, USGS/Smithsonian; 2) Traditional Costa Rican folk dancers, Mehgan Murphy, Smithsonian; 3) Shorebirds along Chaplin Lake, Saskatchewan, Canada, Jessica Howell; 4) Traditional powwow, Walter Larrimore/ Smithsonian

The Black-bellied Plover featured in the Midcontinent Flyway StoryMap was tagged on her breeding grounds along the Colville River Delta in Alaska by Autumn-Lynn Harrison, Smithsonian Institution. Following a full year of her movements, she flew 12,000+ miles round-trip and stopped in seven different areas across five countries (**Figure 5**).

The Midcontinent Flyway/Black-bellied Plover StoryMap centers around music and sounds. As the plover stops at each site, we highlight what she might hear in the surrounding landscape while showcasing traditional music in nearby human communities (examples in images above).

Figure 5. Annual movements of the Black-bellied Plover highlighted in the story map with labeled breeding, wintering, and stopover locations. Darker circles indicate a WHSRN site. Black-bellied Plover tracking data contributed by Autumn-Lynn Harrison, Smithsonian Migratory Bird Center. See page 12 for additional data contributor information.

1. Colville River Delta – Alaska, USA (**B**)
2. NEAR Chaplin/Old Wives/Reed Lakes* - Saskatchewan, Canada
3. Laguna de Términos - Campeche, Mexico
4. NEAR Gulfo de Nicoya* - Guanacaste, Costa Rica
5. Pacasmayo – La Libertad, Peru (**W**)
6. Aransas National Wildlife Refuge – Texas, USA
7. Southern Saskatchewan, Canada
8. Colville River Delta – Alaska, USA (**B**)

B: Breeding Site; **W**: Wintering Site; *: WHSRN Site

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Whimbrel

Whimbrels are large shorebirds with a long neck, legs, and downward curved bill (Skeel and Mallory 2020). Their most prominent features are their small striped heads and downward curved bills (Skeel and Mallory 2020). The species has an extensive range, occuring on six of seven continents, excluding Antarctica (Skeel and Mallory 2020). Within the Americas, they breed on the tundra in Alaska and Canada and along the western coast of the Hudson Bay (Skeel and Mallory 2020). Wintering sites occur along the coasts of the southern United States, Mexico, and Central and South America (Skeel and Mallory 2020).

Images: 1) Whimbrel, Rachel Richardson, USGS Alaska Science Center (CC); 2) Blooming purple saxifrage, Denali National Park (CC); 3) Loggerhead sea turtle tracks, Keenan Adams, USFWS (CC); 4) James Bay Cree hood, Florence C. Quinby/ Smithsonian

The Whimbrel featured in the Atlantic Flyway StoryMap was tagged at a stopover site on northbound migration along the Georgia Barrier Islands in Georgia and data contributed by Jennie Rausch, Canadian Wildlife Service. Following a full year of his movements, he flew approximately 10,500 miles round-trip and stopped in six different areas across five countries (**Figure 6**).

The Atlantic Flyway/Whimbrel StoryMap centers around patterns and crafts. , As the Whimbrel stops at each site, we highlight what colors and natural patterns might occur in the surrounding landscape while showcasing traditional crafts in nearby human communities (examples in images above).

Figure 6. Annual movements of the Whimbrel highlighted in the story map with labeled breeding, wintering, and stopover locations. Darker circles indicate a WHSRN site. Whimbrel tracking data contributed by Jennie Rausch, Canadian Wildlife Service, Environment and Climate Change Canada. See page 12 for additional data contributor information.

1. Wapusk National Park - Manitoba, Canada (**B**)
2. Cape Romain National Wildlife Refuge***** - South Carolina, USA
3. Georgetown - Demerara-Mahaica, Guyana
4. Marais De Kaw - Cayenne, French Guiana
5. Baixada Maranhense - Maranhão, Brazil (**W**)
6. Georgia Barrier Islands***** - Georgia, USA
7. Wapusk National Park - Manitoba, Canada (**B**)

B: Breeding Site; **W**: Wintering Site; *****: WHSRN Site

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 (*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 insights into where shorebirds move and are located throughout the year (**Figure 7**). 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. The three birds featured in the ArcGIS StoryMap series were tracked with satellite tags.

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 three birds featured in the ArcGIS StoryMaps were tracked with either Argos or GPS satellite tags. Click here 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.

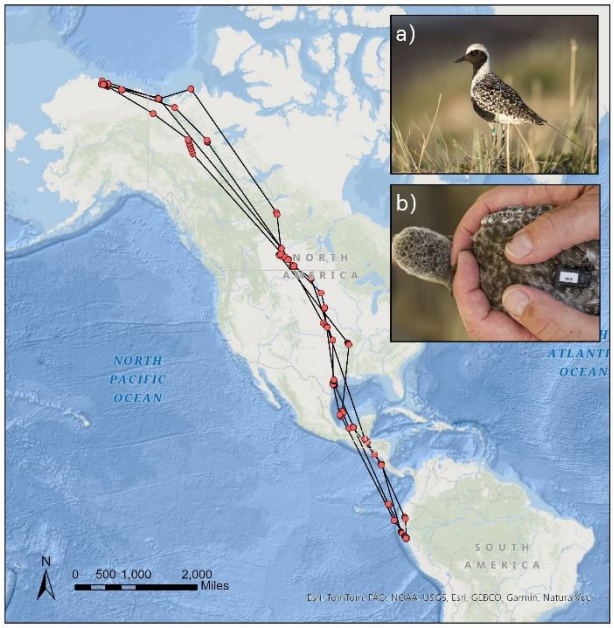

Figure 7. Full cycle track line across two years for an individual Black-bellied Plover (*Pluvialis squatarola*); contributed by Autumn-Lynn Harrison, Smithsonian Migratory Bird Center; David Newstead, Coastal Bend Bays & Estuaries Program; and Lee Tibbitts, U.S. Geological Survey, Alaska Science Center. Photos: **a)** Breeding male Black-bellied Plover with leg flag and <5 g solar satellite tag, Ryan Askren, USGS/Smithsonian; **b)** Satellite tag attached to the back of a Black-bellied Plover; Tim Romano, Smithsonian.

WHSRN

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Using Education for Conservation Action

Education and outreach programs like the online StoryMap we created, 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).

Picking up trash on a beach; Tim Romano, Smithsonian

The ArcGIS StoryMap series is one example of an educational outreach product designed to raise awareness about shorebirds and their incredible migrations. 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. Additionally, by covering several different geographic regions in the StoryMaps, the series allows readers to explore other cultures while recognizing that a single shorebird can connect several disparate communities across the Western Hemisphere.

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, the StoryMap series showcases individual shorebird movements and connections to different sites across the Western Hemisphere, allowing readers to better understand how coordinated conservation efforts are needed across a whole flyway to ensure a shorebird's survival. 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 anyone can take or recommend to others.

Shorebird-Friendly Actions

1. **Avoid closed areas** – Avoid walking through roped or blocked off areas on beaches where shorebirds may be nesting.
2. **Keep dogs leashed** – Keeping dogs leashed at beaches will prevent them from rushing towards areas where shorebirds nest, rest, and feed.
3. **Don't get too close** – While it's exciting to get close to wildlife, being too close can disturb the birds. It's better to grab a pair of binoculars and observe from afar!
4. **Pick up trash** – Keeping beaches and other natural landscapes clean will prevent birds from choking or becoming entangled in trash. Garbage can also attract predators, which prey on shorebird eggs.
5. **Avoid pesticides** – Limit pesticide use around the home and yard as many are toxic to birds and other wildlife.
6. **Turn lights out** – Turning off excess lighting during the migration months will help shorebirds (and other migratory birds) become less disoriented while migrating.
7. **Protect wetlands** – Support the protection of your local wetlands, which provide important habitat for shorebirds.
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.

Black-bellied Plover Track

Autumn-Lynn Harrison*[1], David Newstead[2], Lee Tibbitts[3]

Unpublished data: Migratory Connectivity Project

Dowitcher Track

Scott Flemming*[4], Pam Sinclair[4], Benoit Laliberte[4], Juanita Fonseca[5], Medardo Cruz[6]

Unpublished data: Canadian Wildlife Service, Environment and Climate Change Canada, Manomet, Universidad Autónoma Metropolitana de Mexico

Whimbrel Track

Jennie Rausch*[1], Fletcher Smith[7,8], Bryan Watts[7], Brad Winn[9]; Julie Paquet[1]

Associated Citation: Watts, B. D., Smith, F. M., Hamilton, D. J., Keyes, T., Paquet, J., Pirie-Dominix, L., Truitt, B., and Woodard, P. 2019. Seasonal variation in mortality rates for Whimbrels (*Numenius phaeopus*) using the Western Atlantic Flyway. *The Condor: Ornithological Applications*, 121(1), duy001.

Contributor Organizations

[1] Smithsonian Migratory Bird Center, [2] Coastal Bend Bays & Estuaries Program, [3] U.S. Geological Survey, Alaska Science Center, [4] Canadian Wildlife Service, Environment and Climate Change Canada, [5] Manomet, [6] Universidad Autónoma Metropolitana de Mexico, [7] College of William & Mary, [8] Georgia Department of Natural Resources, [9] Manomet

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