Long-billed Dowitcher (*Limnodromus scolopaceus*); Andy Boyce, Smithsonian

Overlap of tracked shorebirds with Texas public lands and adjacent private areas to inform a conservation easement incentive program

Conservation Contribution #02

Conservation Action: Land/Water Protection; Livelihood, Economic, and Other Incentives

Prepared by the Shorebird Science & Conservation Collective:

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January 2023

*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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Project Background

Conservation Request

The Texas Parks and Wildlife Foundation (TPWF) requested information from the Shorebird Science and Conservation Collective (hereafter, "Shorebird Collective") to inform their newly launched Buffer Lands Incentive Program (BLIP): link to BLIP webpage. BLIP provides financial assistance to new conservation easements on private lands that border Texas Park and Wildlife Department (TPWD) public lands. At least half of BLIP's funding is intended to support lands that benefit grassland birds and shorebirds. Specifically, TPWF requested information on 1) whether electronically tracked shorebirds (link to page with more information on tracking data) used 12 TPWD lands and surrounding private land parcels previously identified as priority areas for BLIP funding and 2) whether tracking data might suggest additional areas where conservation easements could support shorebirds. The Shorebird Collective compiled contributed shorebird tracking data and summary information to support this request.

Important Note: This report describes how the Shorebird Collective fulfilled TPWF's request and presents key outputs and findings showing only a subset of the data used to inform our partner. Due to the privacy settings of some datasets contributed to the Shorebird Collective, a full report of findings provided to TPWF was for their internal planning use only.

About the Shorebird Science and Conservation Collective

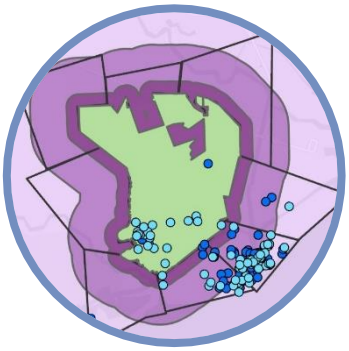
The Shorebird Collective is a partnership of scientists and practitioners working to translate the collective findings of shorebird tracking and community science data into effective on-the-ground actions to advance shorebird conservation in the Western Hemisphere. Learn more on our webpage: link to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

About Texas Parks and Wildlife Foundation

TPWF is a nonprofit organization whose mission is to support the TPWD by raising private funds to manage and conserve the state's wildlife, habitats, and natural resources. Founded in 1991, TPWF has raised more than $235 million dollars to advance conservation in the state of Texas. Learn more on TPWF's website: link to TPWF's website.

Key Outputs & Recommendations

Below we summarize key outputs, findings, and recommendations provided to TPWF to support the BLIP:



1. The Shorebird Collective provided TPWF with detailed information about shorebird land use in 12 TPWD lands and surrounding private land parcels previously identified as priority areas by TPWF for BLIP funding. In a full report to TPWF and with permission of data owners, we provided maps of electronically tracked shorebird movements in these 12 areas with additional details of stopover durations and migratory connections to other parts of the Western Hemisphere. **Nine** individuals of **six** species were tracked in the 12 BLIP priority areas. The Shorebird Collective also overlayed tracking data on maps of all TPWD lands ($n = 140$) to identify other notable areas for TPWF to consider when moving forward with the BLIP.

2. The Shorebird Collective created density maps from shorebirds tracked in Texas (**260** individuals of **12** species) to further inform TPWF's prioritization of BLIP funding outside of the 12 priority areas. Tracking data showed concentrations of shorebirds in the Gulf Prairies ecoregion of the state as well as the High Plains, Blackland Prairie, Cross Timbers, Post Oak Savanah, and South Texas Plains ecoregions. Conservation easements in these areas could extend shorebird conservation benefits outside of TPWD lands to adjacent private lands, which is a key conservation goal of the program.

3. Tracking data can provide detailed information on habitat use and seasonal timing of land use. We provided TPWF with examples of additional applications of tracking data. For example, the Shorebird Collective could work with the BLIP to develop tailored outreach products for landowners that promote targeted and shorebird-friendly land management activities.

Images: 1. Tracked Whimbrel (*Numenius phaeopus*) locations within a TPWD priority area. See methods (page 5) for more details. Tracking data contributed by Jennie Rausch, Canadian Wildlife Service, Environment and Climate Change Canada. See page 12 for additional data contributor information; **2.** Texas ecoregions of value to shorebirds based off the contributed tracking data, darker blue indicates Gulf Prairie ecoregion; **3.** Scientists surveying a Texas wetland, Tim Romano, Smithsonian

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Methods

The Shorebird Collective filtered contributed GPS and Argos satellite tracking data to remove false detections and determined the most likely movement path of each bird using mathematical models that account for spatial uncertainty of locations recorded by tracking devices. We then overlayed the modeled tracks on maps of land parcels surrounding 12 TPWD lands previously identified by TPWF as priority areas for BLIP funding (hereafter "BLIP priority areas"). Size of parcels ranged from 50 to 11,000 acres with most less than 2,000 acres.

In a full report to TPWF, we provided maps of tracked shorebirds located on the parcels (see **Figure 1a** for a hypothetical example of a Whimbrel, *Numenius phaeopus*, tracked in a BLIP priority area), with additional details of stopover durations and migratory connections to other parts of the Western Hemisphere (see **Figure 1b** for an example movement path of a Whimbrel). We also overlayed the tracking data on maps of all other TPWD lands (n = 140; available through the Land & Water Resources Conservation & Recreation Plan Statewide Inventory 2012: link to the inventory) to identify additional TPWD lands for TPWF to consider when moving forward with the BLIP (**Figure 2**).

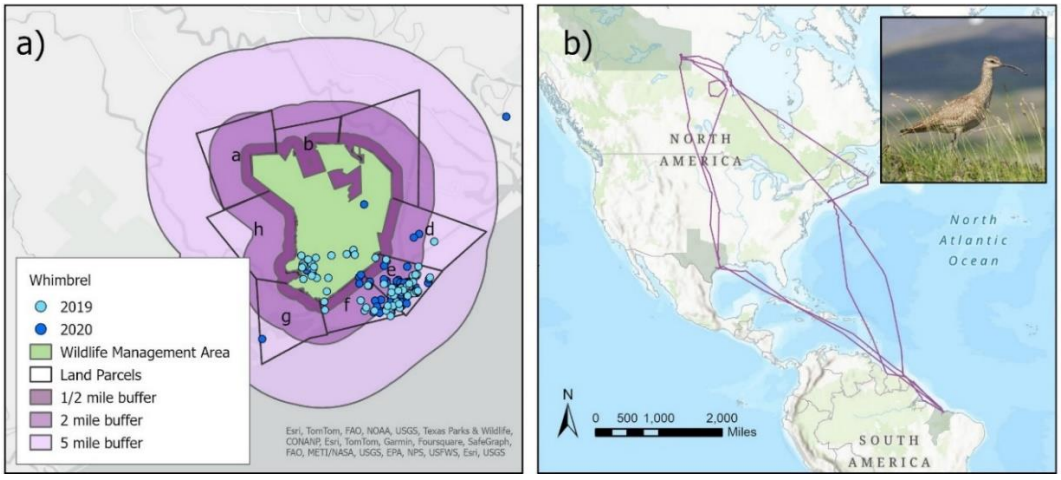


Figure 1. (a) An example of Argos satellite locations of a tracked Whimbrel (*Numenius phaeopus*) overlayed on a set of hypothetical land parcels[1] bordering a TPWD Wildlife Management Area (WMA) previously identified as priority area for BLIP funding by the TPWF. The Whimbrel was tracked within the WMA and primarily in parcels e and f during 2019 and 2020 northbound migrations. He stopped in the area for 32 and 43 days, respectively, and used both the WMA and surrounding private land parcels, demonstrating the importance of lands buffering the WMA to this individual. Other shorebirds were tracked in this area, including one Hudsonian Godwit (*Limosa haemastica*), one Lesser Yellowlegs (*Tringa flavipes*), and two Long-billed Dowitcher (*Limnodromus scolopaceus*), but are not shown in this public-facing summary report due to the privacy settings of the datasets. The Shorebird Collective provided maps of such private tracking datasets to TPWF for their internal planning use with permission of data owners. Also shown in Figure 1 are half-mile, two-mile, and five-mile buffers around the WMA. For all TPWD lands (n = 140), we counted the number of tracked shorebirds that stopped within each of these buffer areas. We considered distances up to five miles because large parcels in the 12 priority areas often extended five miles from the public land boundary. **(b)** Annual movements of the Whimbrel in Figure 1a. Tracking data revealed the bird spent the 2019 and 2020 breeding and wintering seasons in Northwest Territories, Canada and Maranhão, Brazil, respectively, logging over 10,000 miles each year he was tracked. These maps demonstrate that conservation easements in BLIP priority areas could have benefits to shorebirds throughout their extensive ranges. *Whimbrel tracking data contributed by Jennie Rausch, Canadian Wildlife Service, Environment and Climate Change Canada. See page 12 for additional data contributor information. Whimbrel photo credit: Rachel Richardson, USGS Alaska Science Center (CC).*

[1] To respect TPWF's privacy concerns, land parcels shown are hypothetical and do not represent real boundaries.

Summary of Results

Of 1,480 individuals tracked by GPS and Argos satellite technologies and contributed to the Shorebird Collective[1] (**Box 1**), **18%** (*n* = 260) moved through the state of Texas during their annual cycle.

Fifty-two individuals of **nine** species stopped within five miles of a TPWD land (**Figure 2**); nine of these individuals stopped directly within two of the 12 TPWD lands or surrounding land parcels previously identified as priorities for BLIP funding, including:

- **1** Hudsonian Godwit (*Limosa haemastica*)
- **2** Lesser Yellowlegs (*Tringa flavipes*)
- **1** Long-billed Curlew (*Numenius americanus*)
- **3** Long-billed Dowitcher (*Limnodromus scolopaceus*)
- **1** Pectoral Sandpiper (*Calidris melanotos*)
- **1** Whimbrel (*N. phaeopus*)

Box 1. Summary of shorebird tracks in areas of interest

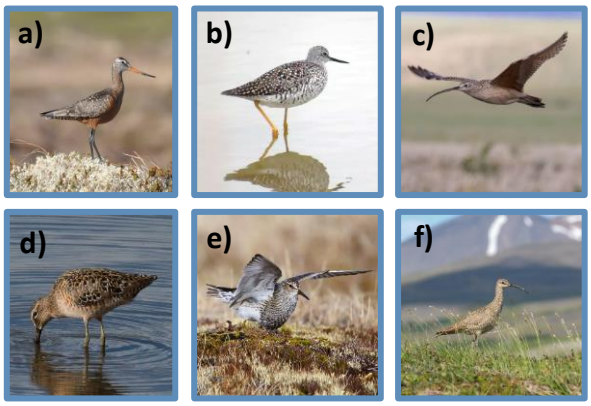
1,480 individuals of 17 species contributed to the Shorebird Collective

260 individuals of 12 species tracked in Texas

9 individuals of 6 species within 2 priority TPWD lands and/or surrounding private land parcels

Five of these individuals used BLIP priority areas as stopover habitat during their northward migrations in the spring (staying from 4-43 days), and four used priority areas during the winter (staying from 54-188 days). Collectively, these nine shorebirds were tracked in 24 countries during their annual cycles. Note that while the number of tagged individuals is limited, because many shorebird species group together in flocks, these birds likely act as sentinels that might highlight where many more birds are present. Thus, the Shorebird Collective suggested on-the-ground surveys to confirm the importance of sites used by tracked birds.

When considering all tracking data in the state, the highest concentrations of shorebirds occurred in the Gulf Prairies ecoregion of the state, with other notable concentrations in the High Plains, Blackland Prairie, Cross Timbers, Post Oak Savanah, and South Texas Plains ecoregions (**Figure 3**). Additional information may become available as data contributors continue to share new tracking data with the Shorebird Collective. We invited TPWF to periodically check in with the Shorebird Collective on the availability of new data to support their effort.



Images: a) Hudsonian Godwit (*Limosa haemastica*), Kristine Sowl, USFWS (CC); **b)** Lesser Yellowlegs (*Tringa flavipes*), Jill Shannon, USFWS (CC); **c)** Long-billed Curlew (*Numenius americanus*), Andy Boyce,Smithsonian; **d)** Long-billed Dowitcher (*Limnodromus scolopaceus*), Andy Boyce, Smithsonian; **e)** Pectoral Sandpiper (*Calidris melanotos*), Peter Pearsall, USFWS (CC); **f)** Whimbrel (*N. phaeopus*), Rachel Richardson, USGS Alaska Science Center (CC)

[1] These data were contributed by 52 organizations, collected from 2006 to 2022.

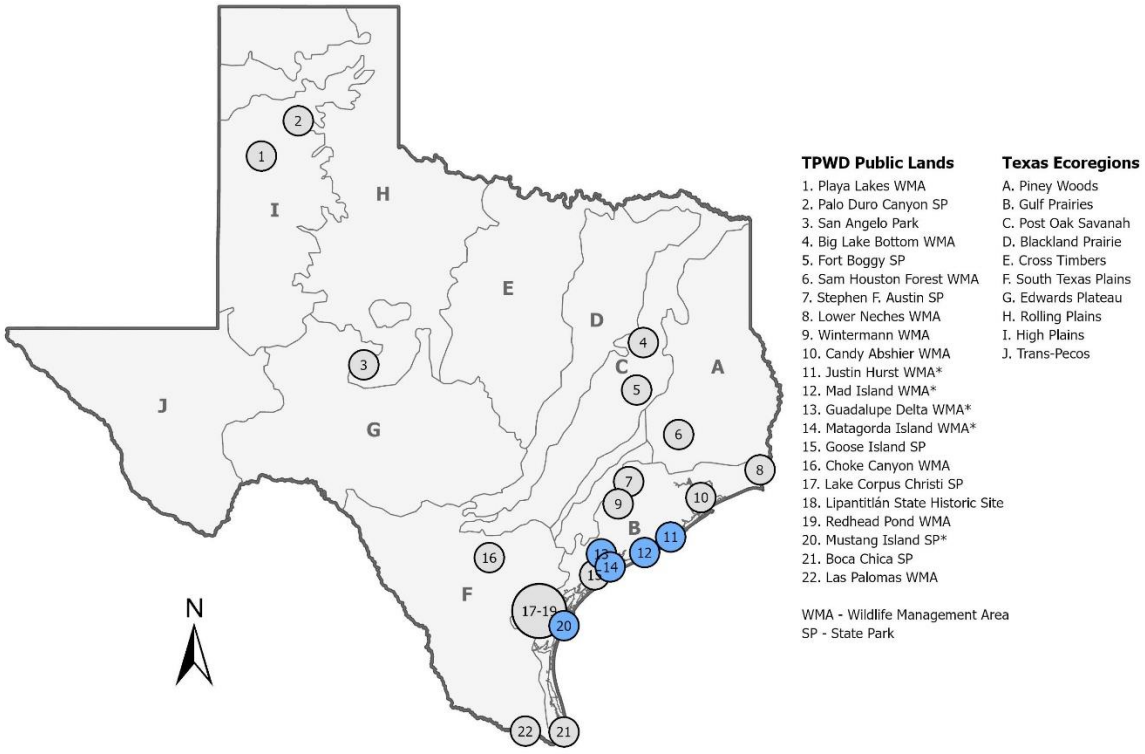


Figure 2. Texas ecoregions overlayed with important TPWD lands based on the number of tracked shorebird species that stopped or overwintered within five miles of the land. Blue sites indicate more than one tracked species stopped or overwintered within two miles of the TPWD land; larger circles indicate multiple TPWD lands in close proximity. Some TPWD lands are not shown because no tracked shorebirds stopped within five miles of the land.

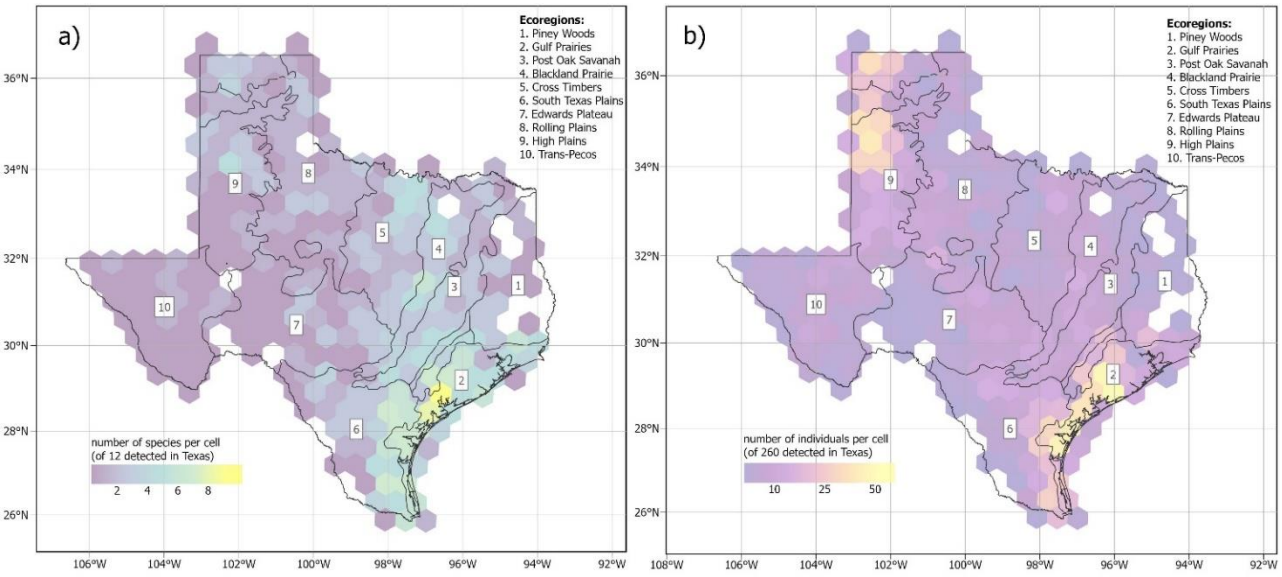


Figure 3. Density of shorebird (**a**) species and (**b**) individuals tracked in Texas with GPS and Argos satellite tracking technologies and overlayed with Texas ecoregions. Grid cells are 2,620 km^2. Summarized data are for 12 species and 260 tracked individuals tracked in Texas.

About Conservation Easements

With approximately 60% of land in the United States privately owned (Hilty and Merenlender 2003), private lands play a critical role in environmental stewardship and land protection. Conservation easements are just one of the many tools landowners can use to safeguard their lands well into the future.

A conservation easement is a voluntary legal agreement between a landowner and land trust or government agency that ensures permanent protection of the land (Gustanski and Squires 2000). The landowner retains rights to the land but restrictions are set on how the land is used, even if ownership changes over time (Rissman et al. 2007). In return, the landowner may receive incentive payments and/or tax credits (Byers and Ponte 2005). An estimated 40 million acres of easement land exists in the United States today (LandScope America 2023).

When a landowner agrees to a conservation easement on their property, specific terms are negotiated between the landowner and land management agency (Merenlender et al. 2004). Depending on the land's value and landowner objectives, conservation easements can be created to protect lands with ecological, agricultural, cultural, historical, or scenic value (Rissman et al. 2007).

One of the greatest ecological benefits to conservation easements is its role in protecting biodiversity. By placing restrictions on development and encouraging sustainable land management practices, easement lands can reduce habitat loss, increase connectivity, promote biodiversity, and thereby contribute to the overall resiliency of a diverse, functional landscape (Byers and Ponte 2005). Conservation easements also offer an opportunity to provide habitat for shorebirds. When managed appropriately, easements with shallow wetland and/or open grassland habitat can provide shorebirds with the necessary resources they need for breeding, overwintering, and/or migration.

Scientists surveying private land in Saskatchewan, Canada; Amy Scarpignato, Smithsonian

Conservation easement boundary on private land; USDA NRCS (CC)

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

While shorebirds are champion migrants, 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 facing shorebirds today. Effective shorebird management can be challenging because many species depend on habitats across multiple countries under different political jurisdictions. Despite these trends and logistical challenges, 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

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About Shorebird Tracking Data

Tracking data provide valuable insight into where shorebirds move and are located throughout the year (**Figure 4**). 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. Tracking data shared with TPWF were from satellite tags.

Black-bellied Plover (*Pluvialis squatarola*) 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 <100 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 the BLIP. 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 4. Full cycle track lines 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 and 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. 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: link to Shorebird Collective webpage.

The following contributors provided detailed tracks and maps of shorebird movements:

Hudsonian Godwit Track

Nathan Senner*[1,2], Jennifer Linscott[1], Jorge Ruiz[3], Mitch Weegman*[4,5], Bart Ballard*[6], Juan Navedo[3]

Associated Citation: Linscott, J. A., Navedo, J. G., Clements, S. J., Loghry, J. P., Ruiz, J., Ballard, B. M., Weegman, M. D., and Senner, N. R. 2022. Compensation for wind drift prevails for a shorebird on a long-distance, transoceanic flight. *Movement Ecology*, 10(1), 1-16.

Lesser Yellowlegs Tracks

Callie Gesmundo*[7], Jim Johnson*[7], Katie Christie[8], Laura McDuffie[9], Christian Friis[10], Christopher Harwood[7], Benoit Laliberte[10], Erica Noll[11], Jennie Rausch[10], Audrey Taylor[12], Jay Wright[13], U.S. Department of Defense, Joint Base Elmendorf-Richardson[14]

Unpublished Data, U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, U.S. Geological Survey, Alaska Science Center, Canadian Wildlife Service, Environment and Climate Change Canada, Trent University, University of Alaska Anchorage, Ohio State University

Long-billed Curlew Track

Andy Boyce*[15], Jeff Kelly[16], Kate Goodenough[16], Paula Cimprich[16]

Unpublished Data, Great Plains Science Program

Long-billed Dowitcher Tracks

Bart Kempenaers*[17], Eunbi Kwon[17]

Unpublished Data, Department of Ornithology, Max Planck Institute for Biological Intelligence

Pectoral Sandpiper Track

Bart Kempenaers*[17], Mihai Valcu[17]

Associated Citation: Kempenaers, B., & Valcu, M. (2017). Breeding site sampling across the Arctic by individual males of a polygynous shorebird. *Nature*, 541(7638), 528-531.

Whimbrel Track

Jennie Rausch*[10], Fletcher Smith[18,19], Bryan Watts[18], Brad Winn[20]; Julie Paquet[10]

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.

These additional contributors shared data of birds tracked in Texas:

Erik Blomberg[21], Amber Roth[21], Alexander Fish[21], Liam Berigan[21], Autumn-Lynn Harrison*[15], David Newstead[22], Lee Tibbitts[9], Daniel Ruthrauff[9], Joaquín Aldabe[20,24,25], Juliana Almeida[20,26], Gabriel Castresana[23], Rick Lanctot[7], Rebecca McGuire[27], Dave Douglas[9], Bob Gill[9], Jay Carlisle*[28], Stephanie Coates[28], David Bradley[29], Alina Olalla Kerstupp*[30], Gabriel Ruiz Aymá[30], José Ignacio González Rojas[30], Antonio Guzmán Velasco[30], Stephen Brown[20], Jason Hill[31], Jean-Francois Lamarre[32,33], Christopher

Latty[7], Bridget Olson[7], Allison Pierce[34], Rosalind Renfrew[31], Sarah Saalfeld[7], Shiloh Schulte[20], Walter Wehtje[35], Michael Wunder[34]

Contributor Organizations

[1] University of South Carolina, [2] University of Massachusetts Amherst, [3] Universidad Austral de Chile, [4] University of Missouri, [5] University of Saskatchewan, [6] Texas A&M University, Kingsville, [7] U.S. Fish and Wildlife Service, [8] Alaska Department of Fish and Game, [9] U.S. Geological Survey, Alaska Science Center, [10] Canadian Wildlife Service, Environment and Climate Change Canada, [11] Trent University, [12] University of Alaska Anchorage, [13] Ohio State University, [14] U.S. Department of Defense, Joint Base Elmendorf-Richardson, [15] Smithsonian Migratory Bird Center, [16] University of Oklahoma, [17] Max Planck Institute for Biological Intelligence, [18] College of William & Mary, [19] Georgia Department of Natural Resources, [20] Manomet, [21] University of Maine, [22] Coastal Bend Bays and Estuaries Coastal Bird Program, [23] Ministerio de Ambiente de la Provincia de Buenos Aires, [24] Aves de Uruguay, [25] Universidad de la Republica Uruguay, [26] SAVE Brasil, [27] Wildlife Conservation Society, [28] Intermountain Bird Observatory, Boise State University, [29] Birds Canada [30] Universidad Autónoma de Nuevo León, [31] Vermont Center for Ecostudies, [32] Polar Knowledge Canada, Canadian High Arctic Research Station, [33] Université du Québec à Rimouski, [34] University of Colorado Denver, [35] Ricketts Conservation Foundation

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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.