Lesser Yellowlegs (*Tringa flavipes*) with a leg flag and satellite tag; Zak Pohlen, USFWS (CC)

Assessing shorebird use of a public property in coastal Texas to inform habitat restoration and management

Conservation Contribution #20

Conservation Action: Land/Water Protection; Habitat & Species Management

Smithsonian Migratory Bird Center

Prepared by the Shorebird Science & Conservation Collective:
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January 2025

*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 Lesser Yellowlegs International Working Group (hereafter, "LEYE Working Group") requested shorebird tracking data from the Shorebird Science and Conservation Collective (hereafter, "Shorebird Collective") to inform habitat restoration and management in a 5,700-acre parcel of land ("Alligator Slough") in Matagorda County, Texas that is part of the larger multi-county San Bernard National Wildlife Refuge (NWR) in Texas, USA (**Figure 1**). Specifically, the LEYE Working Group requested information on electronically tracked shorebirds (see page 13 for more information on tracking data) located on or near Alligator Slough to determine if habitat restoration could support shorebirds, especially Lesser Yellowlegs (*Tringa flavipes*). 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 the LEYE Working Group'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 the LEYE Working Group 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 the Lesser Yellowlegs International Working Group

The LEYE Working Group was formed in 2022 to conserve Lesser Yellowlegs throughout the Americas. Learn more on their website: web link for the LEYE Working Group's website.

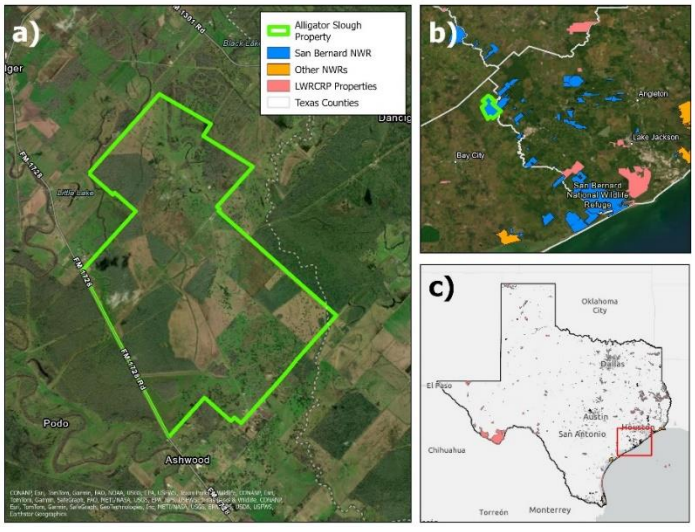


Figure 1. The Alligator Slough property, part of the San Bernard NWR in Matagorda County, Texas. Note that Land and Water Resources Conservation and Recreation Plan (LWRCRP) Properties are lands owned or operated by government entities or non-profits (TPWD 2012).

Key Outputs & Recommendations

Below we summarize key outputs, findings, and recommendations provided to the LEYE Working Group to inform habitat restoration and management efforts in the 5,700-acre Alligator Slough property:

1. The Shorebird Collective provided the LEYE Working with information on electronically tracked shorebird movements on or near Alligator Slough to help inform habitat restoration and management efforts for shorebirds. While no individuals were tracked on the land parcel, **five** individuals of **three** species were tracked within 10 kilometers of the property. In a full report to the LEYE Working Group and with permission of data owners, we provided maps of their movements with details of their seasonal timing of occurrence.

2. Tracking data can be biased to the individuals and/or species equipped with tracking devices. Therefore, an absence of shorebird tracking data in Alligator Slough does not necessarily indicate lack of use by or value to shorebirds. The Shorebird Collective explored habitat data to provide the LEYE Working Group with additional context about the potential value of Alligator Slough to shorebirds, in addition to providing general guidelines on timing based on tracking and eBird (Fink et al. 2022) data for the creation of shallow water habitat for shorebirds along the Texas coast.

3. Additional information may become available as data contributors continue to share new tracking data with the Shorebird Collective. We invited the LEYE Working Group to periodically check in with the Shorebird Collective on the availability of new data to support their work.

Images: 1. Two Buff-breasted Sandpiper (*Calidris subruficollis*) tracked near Alligator Slough; contributed by Lee Tibbitts, et al.; **2.** Scientists surveying a Texas wetland; Tim Romano, Smithsonian; **3.** Red Knot (*Calidris canutus*) with 3.4 g GPS tag, Tim Romano, Smithsonian

Summary of Results

Of the shorebirds tracked by GPS and Argos satellite technologies and contributed to the Shorebird Collective[1] (**Box 1**), 312 moved through the state of Texas during their annual cycle between 2008 and 2024. No shorebirds were tracked on the Alligator Slough property; however, **five** individuals of **three species** had tag transmissions (i.e., tracked locations) within 10 kilometers of the property (see **Figure 2** for an example from a subset of individuals tracked near the property). Tracked individuals include: **2** Long-billed Dowitcher (*Limnodromus scolopaceus*); **2** Buff-breasted Sandpiper; (*Calidris subruficollis*); **1** Long-billed Curlew (*Numenius americanus*)

Box 1. Summary of shorebird tracks in area of interest

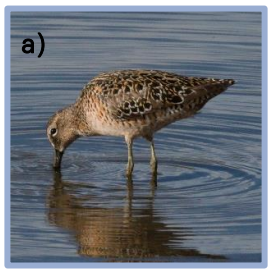
1,976 individuals of 24 species contributed to the Shorebird Collective

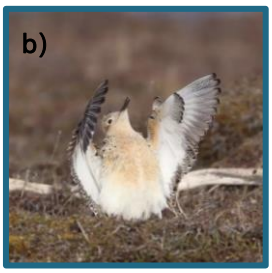
312 individuals of 15 species tracked in Texas

5 individuals of 3 species with tag transmissions within 10 km of Alligator Slough

Tracked locations from these individuals near Alligator Slough occurred during northbound (spring) migration and overwintering periods between 2017 and 2021. Additional shorebirds were tracked in Matagorda and surrounding counties (see **Figures 3** and **4** for gridded densities of the number of species and individuals tracked, respectively). Most shorebirds were tracked west of Alligator Slough and along the Gulf Coast. Upon visual inspection, tracking data tends to correspond with habitats in two EPA Level IV Ecoregions (Diamond 2009, U.S. EPA 2013), including the Northern Humid Gulf Coastal Prairie (**Figure 5**, shades of purple), which has largely been converted to cropland, rangeland, pasture, or urban use, and the Mid-Coast Barrier Islands and Coastal Marshes Ecoregion (**Figure 5**, shades of green). Alligator Slough falls within the Floodplains and Low Terraces Ecoregion (**Figure 5**, shades of red), where fewer shorebirds have been tracked to-date. Nonetheless, shorebirds may use the property if suitable habitat is created at the right times of year (**Figure 6**).

Additional information may become available as data contributors continue to share new tracking data with the Shorebird Collective. We invited the LEYE Working Group to periodically check in with the Shorebird Collective on the availability of new data to support their efforts.





a) Long-billed Dowitcher, Andy Boyce, Smithsonian; **b)** Buff-breasted Sandpiper, Shiloh Schulte, USFWS (CC); **c)** Long-billed Curlew, Tim Romano, Smithsonian

[1] These data come from 86 organizations, collected from 2006 to 2024

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 shorebird tracks on a map of Alligator Slough.

In a full report to the LEYE Working Group, we provided maps of tracked shorebird movements within a 10-kilometer buffer of Alligator Slough with details of their seasonal timing of occurrence (**Figures 2-4**), along with a habitat analysis (**Figure 5**) to provide the LEYE Working Group with additional context about the potential value of Alligator Slough to shorebirds. Additionally, because the LEYE Working Group is interested in restoration and management efforts for shorebirds at Alligator Slough, we provided them with general guidelines on timing based on tracking and eBird (Fink et al. 2022) data for creating shallow water habitat for shorebirds along the Texas coast (**Figure 6**).

Example of tracked shorebirds within 10km of Alligator Slough

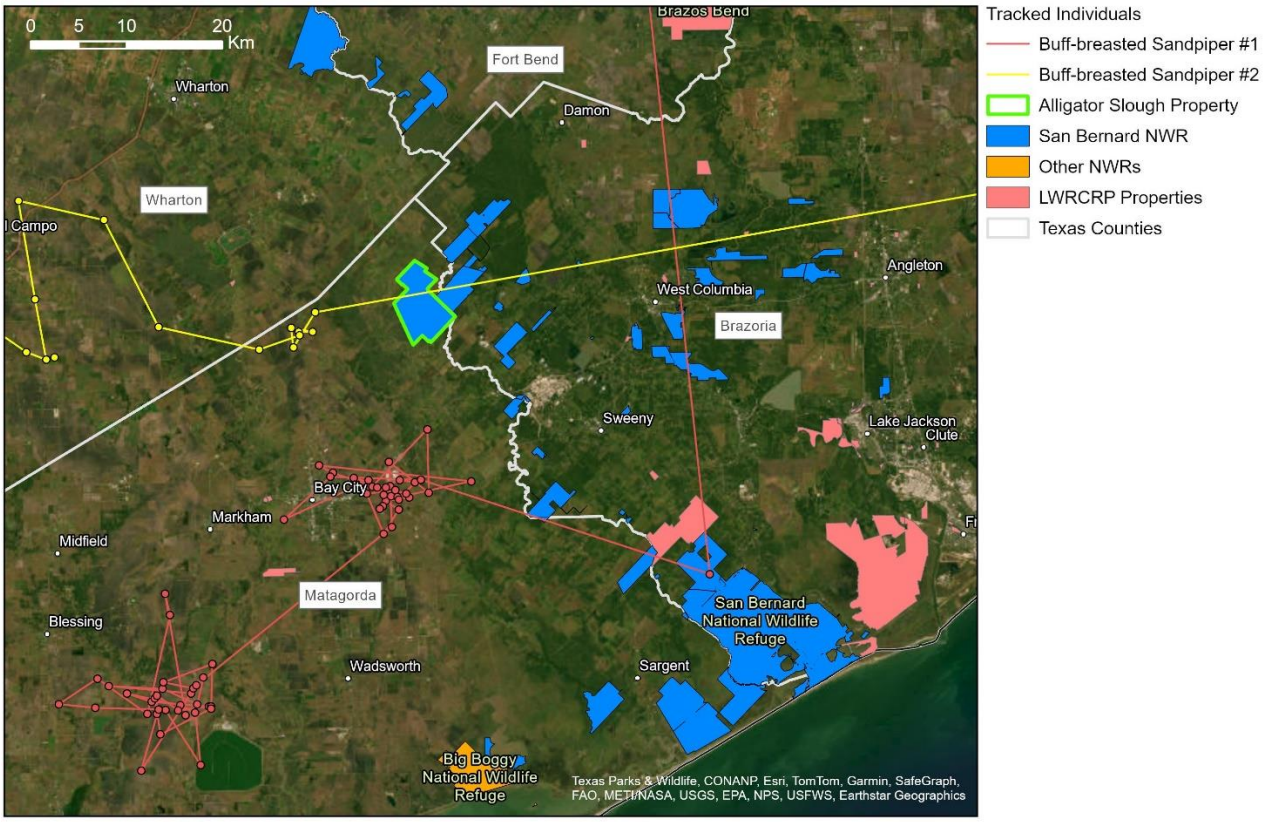


Figure 2. An example[1] of tracked Argos satellite locations of two Buff-breasted Sandpipers tracked within 10 km of Alligator Slough. Note that additional shorebirds tracked within the map extent, but not within 10 km of Alligator Slough, are not shown here. Land and Water Resources Conservation and Recreation Plan (LWRCRP) Properties are lands owned or operated by government entities or non-profits that allow public access (TPWD 2012). Data from these example tracks contributed by Lee Tibbitts, USGS Alaska Science Center et al. See page 14 for additional data contributor information.

[1] Tracking points for two Long-billed Dowitchers and one Long-billed Curlew are not shown on this public-facing map due to the privacy settings of the datasets but were provided to the LEYE Working Group for their internal planning use.

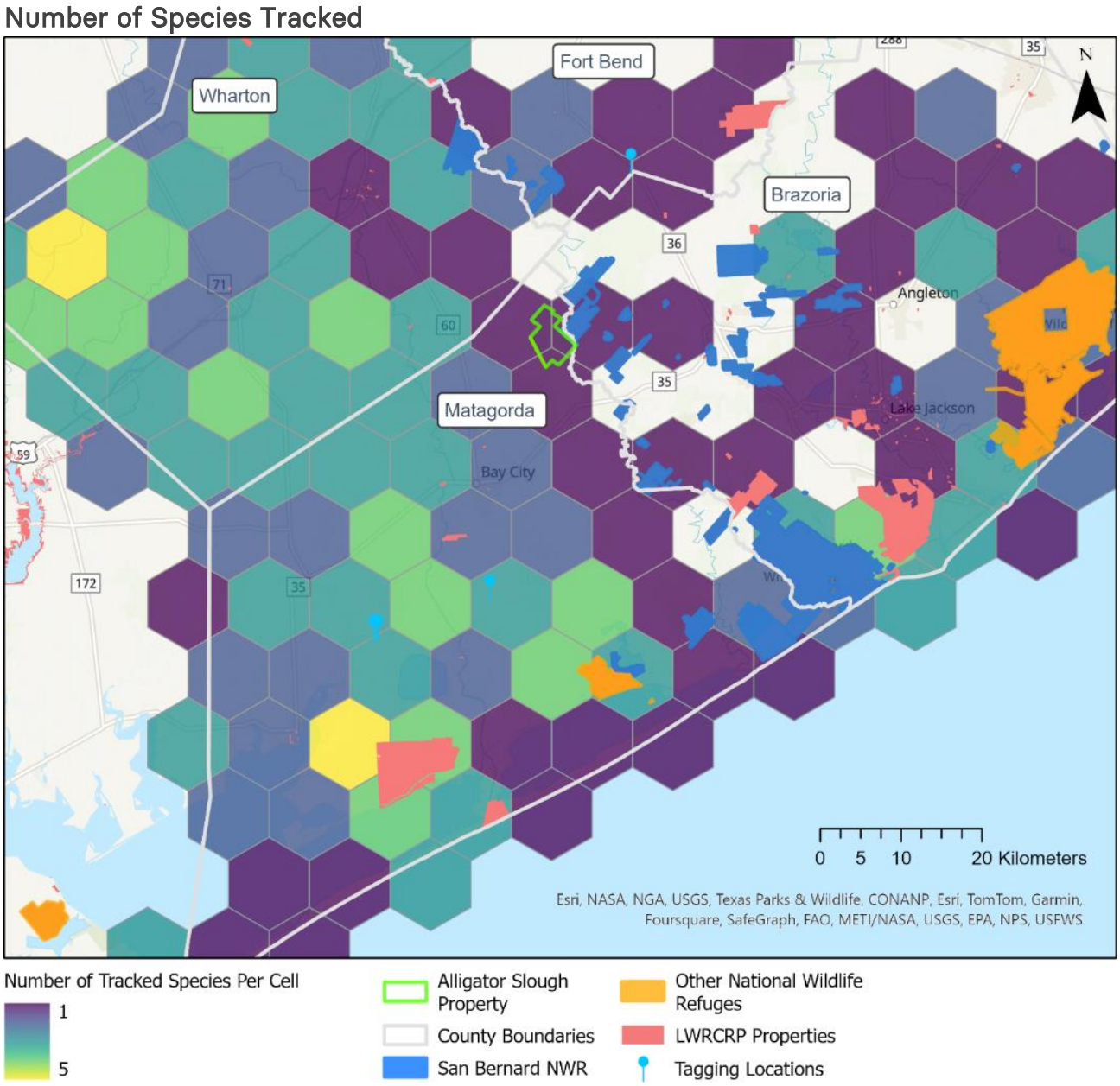


Figure 3. Gridded density maps of the number of shorebird species tracked with Argos or GPS technologies per 10 x 10 km hexagonal cell across all seasons in Matagorda, Wharton, Fort Bend, and Brazoria Counties. Data were summarized at the original timestep of each tag and include tag transmissions that occurred during stops and flights. Land and Water Resources Conservation and Recreation Plan (LWRCRP) Properties are lands owned or operated by government entities or non-profits (TPWD 2012). Note that Buff-breasted Sandpipers were tagged in Matagorda County, resulting in higher counts of tracked individuals in cells where birds were tagged and in adjacent cells.

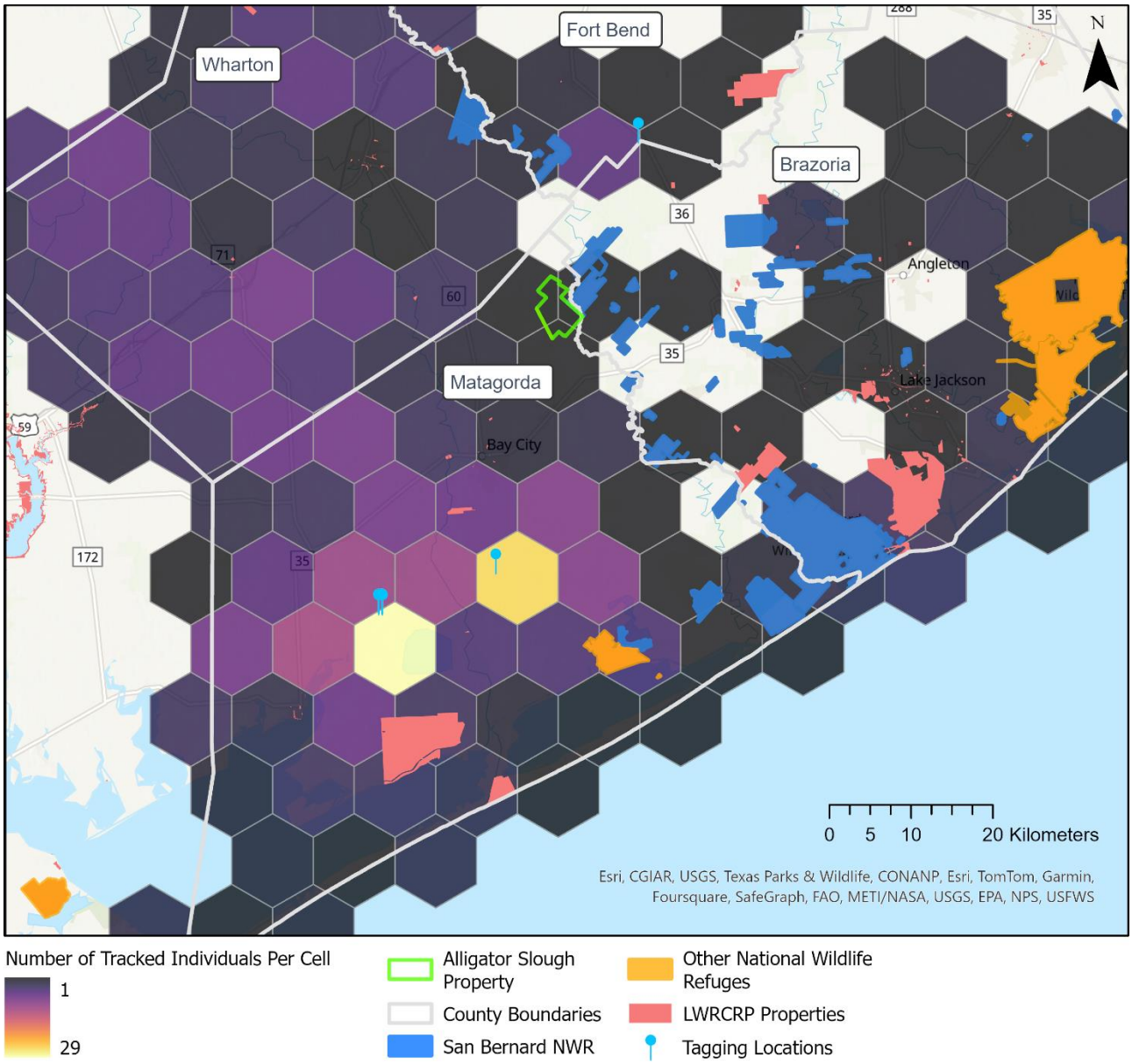


Figure 4. Gridded density maps of the number of individual shorebirds tracked with Argos or GPS technologies per 10 x 10 km hexagonal cell across all seasons in Matagorda, Wharton, Fort Bend, and Brazoria Counties. Data were summarized at the original timestep of each tag and include tag transmissions that occurred during stops and flights. Land and Water Resources Conservation and Recreation Plan (LWRCRP) Properties are lands owned or operated by government entities or non-profits that allow public access (TPWD 2012). Note that Buff-breasted Sandpipers were tagged in Matagorda County, resulting in higher counts of tracked individuals in cells where birds were tagged and in adjacent cells.

Habitat in Surrounding Counties

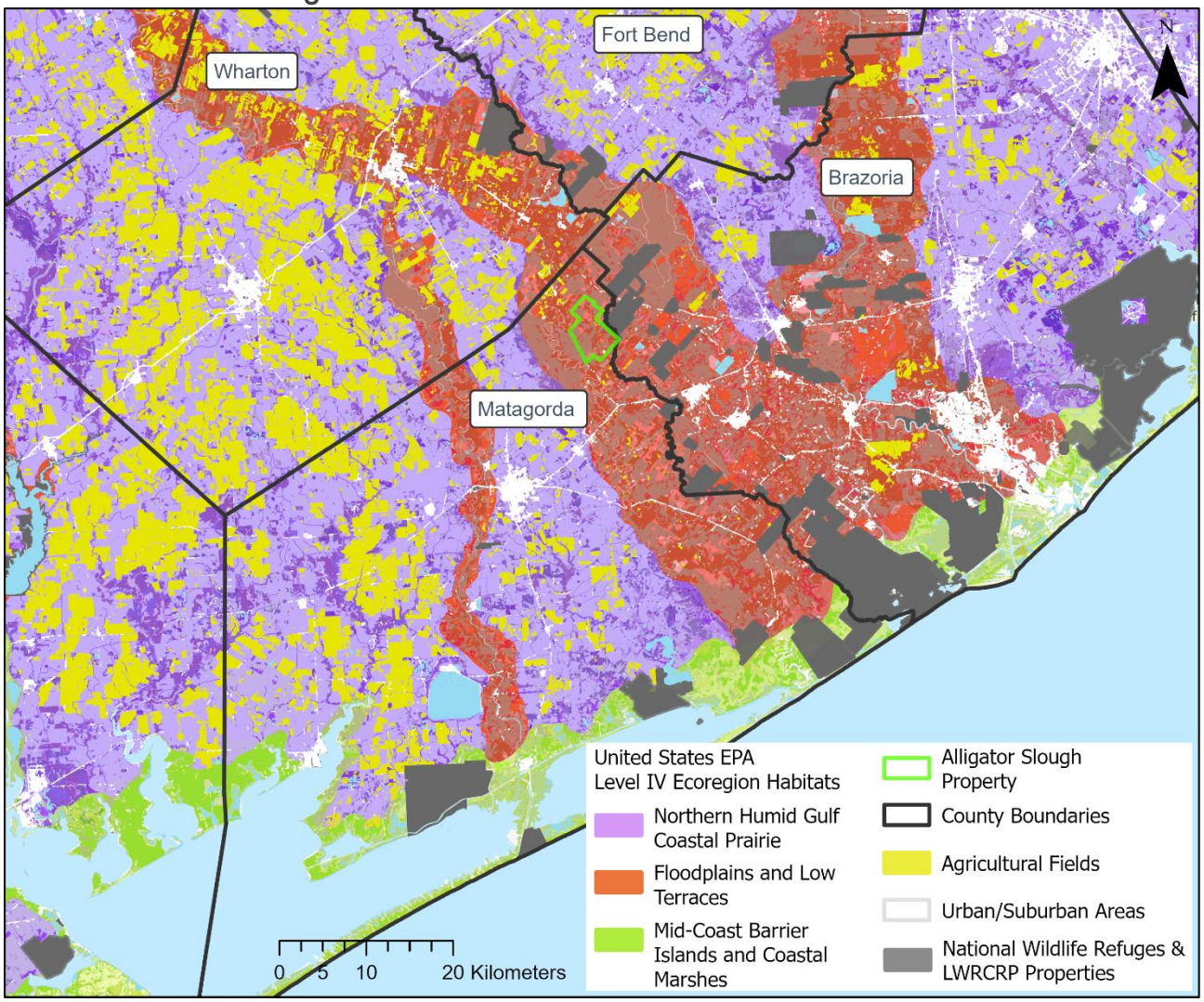


Figure 5. Habitats and Level IV Ecoregions (Texas Ecological Mapping Systems, TPWD 2014) in Matagorda, Wharton, Fort Bend, and Brazoria Counties in relation to the Alligator Slough Property. Different habitat types are displayed as different shades within the ecoregions. Note that Land and Water Resources Conservation and Recreation Plan (LWRCRP) Properties are lands owned or operated by government entities or non-profits (TPWD 2012).

Land Management/Restoration Considerations

Because the LEYE Working Group is interested in restoration and management efforts for shorebirds at the Alligator Slough property, we provided them with general guidelines on timing based on tracking and eBird (Fink et al. 2022) data for creating shallow water habitat for shorebirds along the Texas coast (**Figure 6**). If the LEYE Working Group plans to flood a portion of Alligator Slough for shorebirds, we recommend flooding two to four weeks prior to the expected arrival of shorebirds to allow the invertebrate population to grow (Iglesia and Winn 2021).

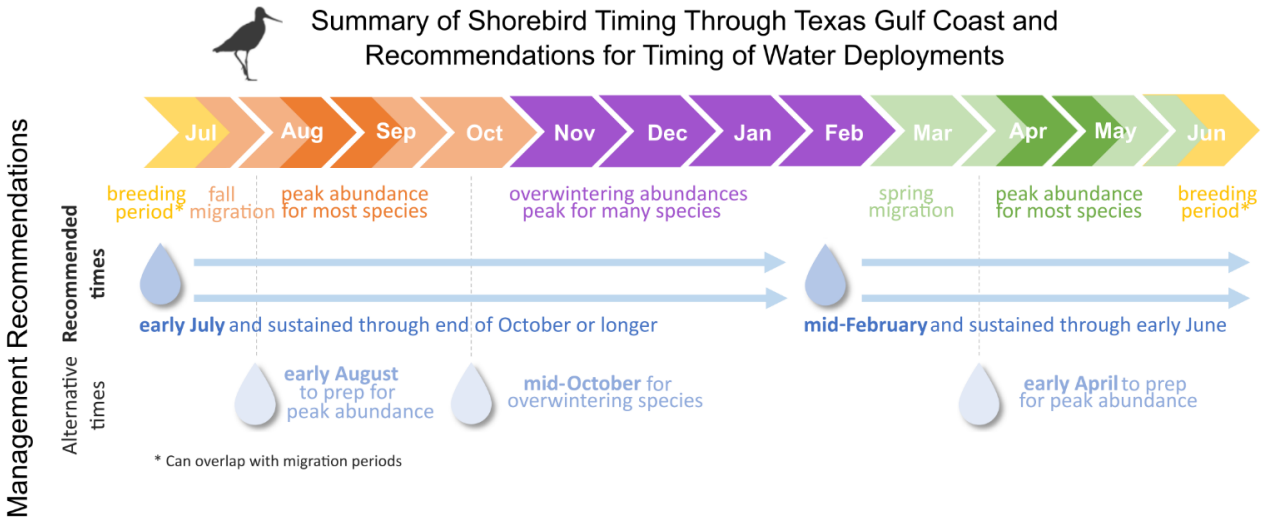


Figure 6. A simplified guide to the timing of shorebird migration and movements through the Texas Gulf Coast and recommended water deployment times for the creation of shallow flooded habitat to support shorebirds.

Coastal Texas and Shorebirds

The Gulf Coast is considered one of the most significant regions in the United States for shorebirds (Elliot and McKnight 2000). Along the Texas coast in particular, the variety of wetland, riparian, and coastal prairie habitats provide critical breeding, stopover, and/or wintering habitat for at least 38 Nearctic shorebird species (Elliot and McKnight 2000). For shorebirds using the midcontinent, areas along the Texas coast also provide the first and/or last suitable habitat for individuals migrating to and from more distant wintering sites in Central and South America, providing an important area for shorebirds to rest and refuel before and/or after a strenuous journey over the Gulf (Withers 2002).

Coastal wetlands in Aransas National Wildlife Refuge, Calhoun County, Texas; Melissa Zieschang, USFWS (CC)

The Alligator Slough property, situated along the Texas mid-coast, is part of the San Bernard NWR. This refuge primarily consists of coastal marsh habitat and is considered an important shorebird area in the mid-coast region (Elliot and McKnight 2000). Other important shorebirds areas along the mid-coast include Big Boggy NWR/Mad Island WMA complex, San Luis Pass, Aransas NWR/Guadalupe Delta WMA complex, and Matagorda Island NWR (Elliot and McKnight 2000). Outside of these protected lands, surrounding rice fields, river floodplain wetlands, and seasonal prairie wetlands also provide critical habitat resources for shorebird populations (Elliot and McKnight 2000).

Breakwater and marsh at San Bernard NWR; Bryar Johnson, USFWS (CC)

Flock of Marbled Godwits (*Limosa fedoa*) next to a shorebird scientist along the Texas coast; Tim Romano, Smithsonian

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 (*Limosa fedoa*) 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 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. Data from shorebirds tracked with satellite tags were shared with the LEYE Working Group.

Black-bellied Plover (*Pluvialis squatarola*) with <5 g 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 contributed GPS and Argos satellite data to support the LEYE Working Group's 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 7. 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 <5 g 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 analysis 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.

Buff-breasted Sandpiper
Contributed by Lee Tibbitts and co-owned by Joaquin Aldabe (Manomet, Aves de Uruguay, Universidad de la Republica Uruguay), Juliana Almeida (Manomet, SAVE Brasil), Gabriel Castresana (Ministerio de Ambiente de la Provincia de Buenos Aires), Rick Lanctot (U.S. Fish and Wildlife Service), Rebecca McGuire (Wildlife Conservation Society), Daniel Ruthrauff, Dave Douglas, and Bob Gill (U.S. Geological Survey, Alaska Science Center)

Long-billed Curlew
Contributed by Andy Boyce (Smithsonian Migratory Bird Center) and co-owned by Jeff Kelly, Kate Goodenough, Paula Cimprich (University of Oklahoma)

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

References

Diamond, D.D. 2009-2014. Ecological Systems of Texas: 391 Mapped Types. Phase 1 – 6, 10-meter resolution Geodatabase, Interpretive Guides, and Technical Type Descriptions. Texas Parks & Wildlife Department and Texas Water Development Board, Austin, TX. Link.

Elliott, L., and K., McKnight. 2000. Lower Mississippi/Western Gulf Coast shorebird planning region. U.S. Shorebird Conservation Plan, Lakewood, CO.

Fink, D., Auer, T., Johnston, A., Strimas-Mackey, M., Ligocki, S., Robinson, O., Hochachka, W., Jaromczyk, Rodewald, A., Wood, C., Davies, I., Spencer, A. 2022. eBird Status and Trends, Data Version: 2021; Released: 2022. Cornell Lab of Ornithology, Ithaca, NY.

Iglecia, M., and B., Winn. 2021. A shorebird management manual. Manomet, MA.

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.

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.

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.

[TPWD] Texas Parks and Wildlife Department. 2012. LWRCRP 2012 Data Download. Link.

[TPWD] Texas Parks and Wildlife Department. 2014. Texas Ecological Mapping Systems 2014 Data Download. Link.

[US EPA] U.S. Environmental Protection Agency. 2013. Level IV Ecoregions of the Conterminous United States. U.S. EPA Office of Research & Development (ORD) - National Health and Environmental Effects Research Laboratory (NHEERL), Corvallis, OR. Link.