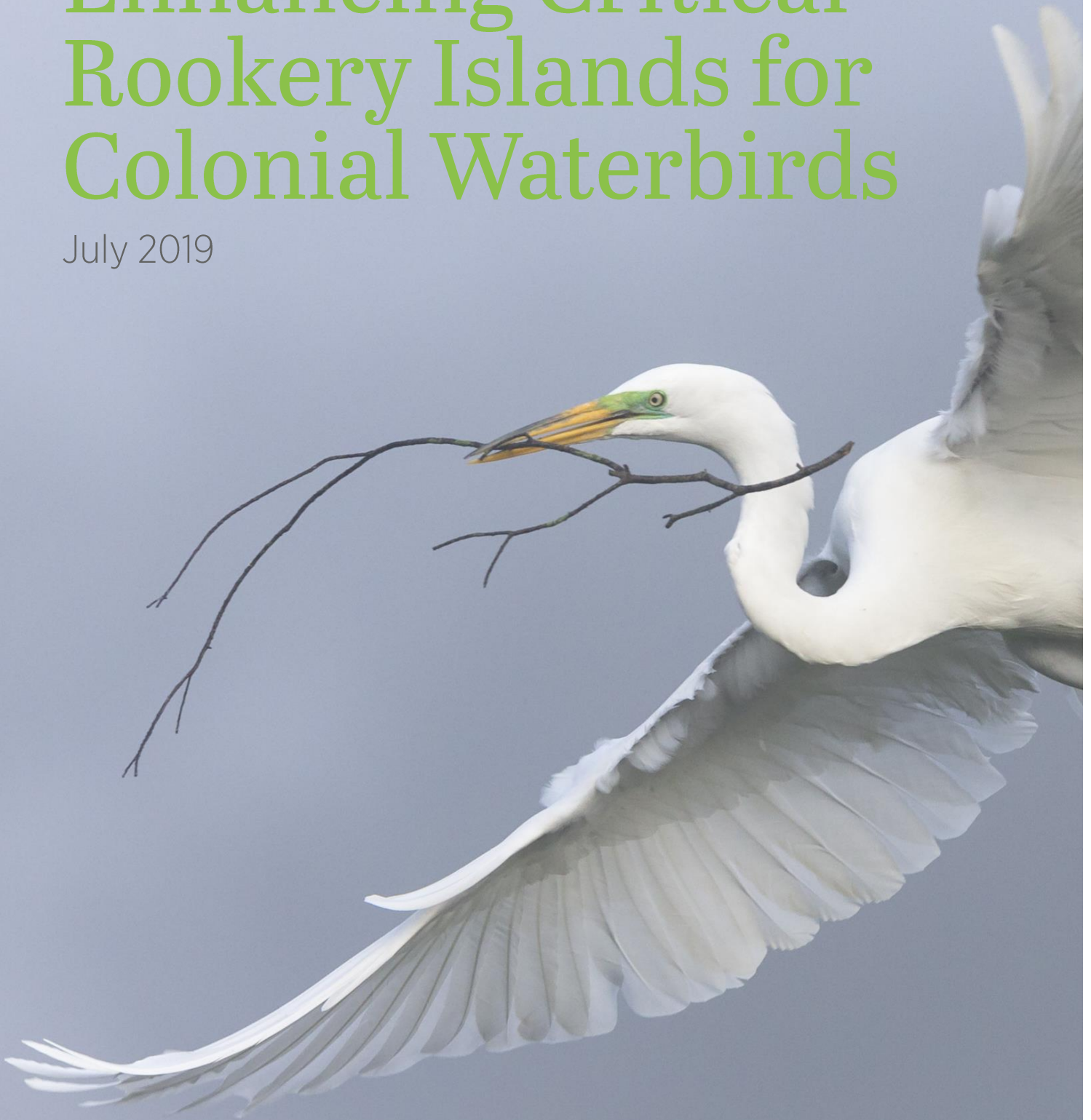


Enhancing Critical Rookery Islands for Colonial Waterbirds

July 2019



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Executive Summary

Colonial waterbirds, including iconic Texas species such as the Roseate Spoonbill and Reddish Egret, are invaluable to coastal ecosystems. For many, these birds symbolize bird and coastal conservation and waterbird birding drives ecotourism in coastal communities. Further, colonial waterbirds are effective indicators of ecological conditions, and are an essential component of coastal conservation planning.

However, colonial waterbirds, like many birds, are threatened by habitat degradation and loss, severe weather events, and human disturbance. Audubon Texas (ATX) has been working to protect colonial waterbirds on the Texas coast since 1923. Today, this work includes monitoring, protection, and enhancement of the habitat colonial waterbirds need to thrive. Audubon staff and Texas Estuarine Research Network (TERN) volunteer community scientists survey waterbirds and perform conservation activities in support of coastal habitats.

Through funding from CMP Cycle 22, ATX completed the following:

- Enhanced and protected rookery island habitat
- Trained community scientists to survey rookery islands
- Monitored colonial waterbird populations during breeding season
- Uploaded survey data to ATX's online database
- Participated in outreach events.

Task 1: Rookery Island Assessment

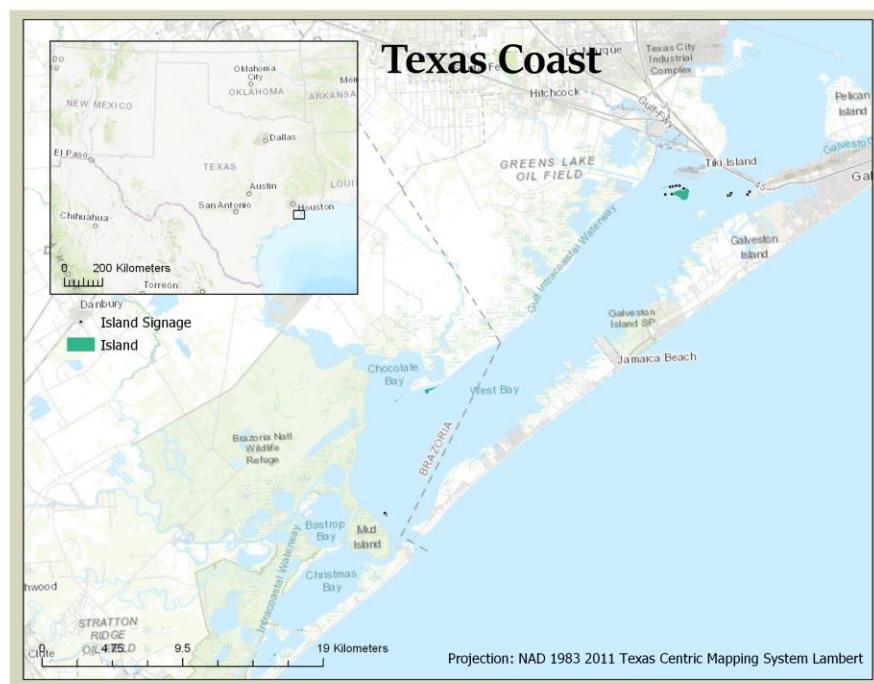
Beginning at the start of non-breeding season in September 2018, Audubon staff and TERN volunteers began site visits to rookery islands to assess island protection and enhancement needs. Assessments included observations of trash and debris on the islands, the need for new signage or boater education materials, and vegetation monitoring.

Vegetation monitoring, completed through transects and quadrats, documented vegetative species presence and location. This ground truthing data was then overlaid on island maps to determine composition of habitat types on each island.

NON-BREEDING SEASON WORK

In September 2018, Audubon Coastal Program Manager, Dr. Victoria Vazquez, met with Dr. Steve Alexander of Texas A&M University Galveston (TAMUG) on North Deer Island to develop a plan for the upcoming vegetation monitoring project. Dr. Vazquez and Dr. Alexander refined monitoring protocols and identified plants for upcoming trainings.

The first vegetation monitoring transects were completed in November 2018 on North Deer Island by Audubon, TERN volunteers, and Dr. Alexander and his Texas A&M University Galveston students. Additionally,



the island Mile Marker 52 was surveyed through several workdays.

By December 2018 - approximately halfway through non-breeding season – TERN community scientists had surveyed and visited more than half of Audubon's rookery islands. Vegetation monitoring transects were completed on four islands (Struvy Lucy, Jigsaw, Mile Marker 52, and North Deer Island), with data entry completed following each work day. December also saw a workday on North Deer Island to remove vegetation from gravel material placed for ground nesting birds, such as Black Skimmers.

In January 2019, Audubon completed significant island enhancement work, including trash removal, vegetation monitoring, and posting new signs around rookery islands to decrease human disturbances. Audubon completed weekly survey and enhancement visits to the following islands: Jigsaw, Struvy Lucy, Mile Marker 52, North Deer Island, Ving et une, Rollover Pass, and West Bay Bird Island.

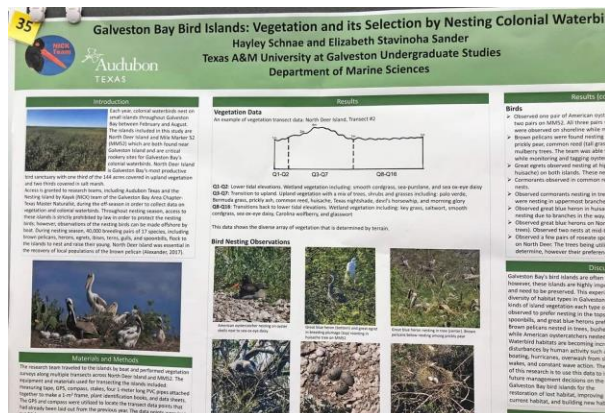
The beginning of February 2019 was Audubon's last opportunity to complete enhancement work on rookery islands before the beginning of breeding season. Audubon installed 19 informative signs and constructed eight platforms for nesting birds. TERN volunteers created a centralized database for monitoring data and Texas A&M University Galveston students began preliminary data analysis. Student analysis, as part of an undergraduate poster session project, sought to determine coastal nesting birds' habitat preferences. Further analysis is required prior to producing a full report.

BREEDING SEASON WORK

By the end of February 2019, breeding season on the rookery islands was in full swing, preventing Audubon from directly accessing the islands for further enhancement work. Since March 2019, Audubon's efforts have instead been focused on breeding bird surveys. As with vegetation monitoring data, bird survey data will be input into Audubon's database for analysis. Upon completion of analysis, Audubon will make the full report available to partners on request.

In April 2019, Dr. Alexander's Texas A&M University Galveston students presented their poster on vegetation and its selection by nesting colonial waterbirds in Galveston Bay. Presentations were made to TAMUG faculty and students as the capstone experience in the field study course completed by students. This course is taught by Dr. Steve Alexander and coursework

corresponds with Audubon's survey and habitat management seasons.



TAMUG student poster on colonial waterbirds.

AUDUBON ROOKERY ISLAND ENHANCEMENT AND PROTECTION PLAN

Further, these collective efforts supported the Audubon rookery Island Enhancement and Protection Plan, which outlined three strategies: enhance nesting habitat, restore and create nesting habitat, and reduce disturbance. The approaches utilized within these strategies successfully met Audubon's goal "to maintain colonial waterbird populations along the Texas coast." Specific examples of these successes are outlined below.

- Abated predation threats from imported red fire ants (*Solenopsis invicta*) and meso-carnivores to improve nesting success
- Provided eight new nesting platforms split equally between Sundown Island and Mile Marker 52
- Continued restoration efforts at Sundown Island with 7+ acres of annual shredding of invasive sunflowers
- Island nourishment (bare beach habitat) in the amount of approximately 100,000 cubic meters of beneficial use dredge materials placed on Sundown Island
- 26 new "no entry" signs installed at island to supplement existing signage
- Regular island monitoring by Audubon wardens with particular emphasis given to holiday weekends
- Over 2,000 coastal community members engaged and informed on risks to bird populations.

Task 2: Outreach and Education

Audubon Texas increased community awareness about the value and threats to colonial waterbirds and other coastal conservation issues through outreach events, workshops, and shoreline clean-ups. Audubon Texas also worked during the grant period to create new outreach materials educating the public on threats to colonial waterbirds, particularly monofilament line and plastic pollution.

TRAINING EVENTS

In August 2018, 24 senior citizens attended a workshop to learn about Audubon Rockies' MAPS community science bird banding project. These seniors are active participants in Audubon's Feederwatch program, and the workshop educated them on proper actions should they see a banded bird while logging data for Feederwatch.

Similarly, September 2018 saw 20 senior citizens attend a workshop about Audubon's island management program. These seniors grow plants for transplant onto rookery islands.



Seniors grow native plants at Libbie's Place.

During an initial site visit to Audubon's largest rookery islands (North Deer Island and Mile Marker 52), Audubon staff and TERN community scientists inventoried native plant vegetation containing remnant nests. From this plant list, native species were selected for senior citizens at Libbie's Place to plant and grow. Audubon staff hosted workdays at the Texas City Prairie Preserve (property in Galveston County owned and managed by The Nature Conservancy) to collect cuttings of native species to be grown for the rookery island. These species included: *Iva frutescens* (high tide bush), *Lantana urticoides*, and *Opuntia engelmannii* (prickly pear cactus).

In October 2018, Erik Johnson of Audubon Louisiana trained 14 TERN community scientists in preparation for upcoming bird surveys. Attendees advanced their skill level in identifying and surveying shorebirds during this six-hour workshop.



TERN community scientists survey shorebirds.

Audubon Texas has found that group bird surveys are an effective tool for both recruiting new community scientists and building birding skills for current monitors. In November 2018 in partnership with Galveston Bay Foundation, Audubon Texas completed a group survey and raptor identification workshop. The workshop was conducted by Audubon warden Dennis Jones at Texas City Prairie Reserve and focused on identifying migrating raptors. TERN volunteers partner with Hawk Watch volunteers during fall and spring migration to track migrating raptors.

TERN community science education programs are strategically scheduled during relevant bird monitoring programs in order to keep participants up to date on the latest topics related to bird species and protocols. While we do not provide pre- and post-tests for our education programs, Audubon has observed an increase in volunteer participation following workshops, as well as an increase in data quality through identification accuracies. Audubon completes program evaluations for teacher workshops (see Deliverables 3.1).

In March 2019, Audubon hosted a workshop for 61 new members of the Texas Master Naturalists, introducing them to Audubon's coastal conservation work and the TERN program.

OUTREACH EVENTS

Audubon's Conservation Leaders Program for Young Women stewards under-resourced high school girls in a year of conservation learning and outdoor recreation. Houston-based participants attended field trips with Audubon Texas coastal staff to learn field ecology skills. 18 participants completed a bird foraging and water quality survey in December 2018 on the Trinity River near Wallisville, Texas, learning new skills and discussing bird conservation issues. 16 of these same young women conducted a rookery island bird census in March 2019 at High Island Bird Sanctuary, learning survey protocols and bioillustration skills.

Audubon Texas also conducts educational outreach at local schools. For example, in December 2018, Audubon Texas gave a presentation on colonial waterbirds and the conservation threats they face to 15 students from Clear Falls High School. In May 2019, Audubon Texas engaged more than 600 1st through 5th grade students from Houston's Draw Academy in learning about colonial waterbird conservation.

Audubon Texas also conducted coastal conservation outreach by attending local festivals and hosting a booth at the February 2019 Texas Chapter of the Wildlife Society annual conference. At this event, Audubon reached partners and students from across Texas, providing information on our coastal conservation program. 33 attending students signed up to learn more about monitoring with TERN.

Local festivals included Feather Fest in April 2019, where Audubon Texas conducted four days of island tours and engaged 253 people in 612 hours of birding. In May 2019, Audubon Texas attended Bay Day Festival at Kemah Boardwalk, where we engaged more than 100 people, teaching our "fish, swim, and play 50 yards away" mantra to educate people on coastal nesting bird protection, as well as the dangerous effects of plastic pollution.

SHORELINE CLEAN-UPS

Audubon Texas conducts regular clean-ups along the Texas City Dike and in San Luis Pass. These areas typify foraging grounds for many of the colonial waterbirds that Audubon monitors. The areas are also significant as popular fishing spots, and need to be regularly cleaned of trash and fishing line. Audubon often receives reports of birds, including American Oystercatchers and Brown Pelicans, tangled in fishing line along Texas City Dike. Local TERN volunteers monitor the area and report on trash build up, informing Audubon when to schedule the

next clean-up event. During clean-ups along the Dike, Audubon and TERN communicate with local fisherman, explaining the clean-up, how fishing line impacts wildlife, and how they can recycle fishing line.

In 2015, Audubon staff encountered several birds entangled in monofilament line and were connected with the Texas Sea Grant Monofilament Recovery and Recycling Program (MRRP). Audubon works with John O-Connell in Galveston County to promote this program. Outreach messaging always includes opportunities for the general public to improve conditions for wildlife and visible ways to promote bird protection in foraging habitats.

In July 2018, 38 people, including TERN volunteers, Texas Master Naturalists, and Texas City Dike fisherman, cleaned up 84 bags of plastic pollution and fishing line.



TERN clean-up crew.

San Luis Pass is a significant habitat area for Least Terns, a species of concern, and several species of plovers. The area is also popular with fishermen and jeep drivers, creating need for regular shoreline clean-ups. In August 2018, Audubon removed 16 bags of plastic debris weighing 320 pounds from San Luis Pass.

Additionally, ten TERN volunteers conducted a clean-up at Harris County's Cow Bayou near an important roost spot, collecting 25 bags of plastic pollution.

TERN shoreline cleanups are performed both independently and in conjunction with partnering organizations. TERN community scientists who are regularly at these locations report on visual trash, helping Audubon schedule cleanups in the areas of

highest need. TERN community scientists are Audubon's eyes and ears on the Texas coast.

Task 3: Survey and Enhancement Training

Audubon Texas conducted training workshops for both new and current TERN community scientists, teaching the skills necessary to complete monitoring for foraging habitats and rookery island surveys. The TERN model includes recruitment, primary education and training, and secondary education and training. The program seeks to involve local communities in conservation activities, such as bird monitoring and habitat workdays.

Audubon recruits new community scientists through outreach events, where the general public has the opportunity to learn about the Audubon Texas coastal program and our role on the Texas coast. Audubon then hosts TERN training events that teach volunteers new to birding to conduct bird monitoring in foraging habitats and identify colonial waterbirds. Audubon hosts three monthly birding surveys, where new community scientists can gather to collect data with other, more experienced volunteers. Monthly surveys are led by tenured TERN community scientists.

Once a new community scientist completes the primary training and is engaged in monitoring, they are eligible for more monitoring and conservation activities. Secondary trainings and activities, including rookery monitoring, vegetation monitoring, and workdays, provide a deeper level of conservation engagement for volunteers. Other secondary education and trainings serve as continuing education opportunities that build bird skills and keep community scientists up to date on local research methods. The TERN program invests in continued trainings throughout the year.

TERN Volunteer Participation by Activity
July 2018 to June 2019

Activity Type	Volunteer s	Volunteer Hours
Bird surveys	378	1151
Outreach	426	758
Partner meetings	55	54
Work days	187	782
Workshops	1240	2080.5
Grand Total	2286	4825.5

TERN TRAININGS AND SURVEYS

In preparation for this season's surveys, Audubon staff and wardens worked with TERN community scientists to develop vegetation monitoring protocols and coordinate trainings for other TERN community scientists. Audubon Texas conducts monthly bird surveys along the Texas coast.



TERN vegetation survey training.

In July 2018, Audubon trained seven community members as new TERN community scientists, teaching the new scientists to record foraging monitoring data. From this training, Audubon was able to add five new monitoring sites to our database.

In November 2018, Audubon expanded the monthly bird surveys to a new site, Exploration Green, for foraging monitoring. A group survey led by seven TERN community scientists recorded more than 30 species at this restored habitat site.

Monthly surveys continued in December 2018 at Galveston Island's Sunny Beach, where Audubon and TERN monitored migratory and resident shorebirds. In January 2019, surveys at Galveston Island's East Beach recorded more than 300 Black Skimmers.

In March 2019, Audubon trained a total of 26 new TERN community scientists. Some of the new scientists will help look at new essential nesting habitats, while 12 were trained on the TERN database. Audubon also trained 12 new community scientists in April 2019 at Port O'Connor to monitor Chester Island, a key rookery island in Matagorda Bay. This training workshop was conducted with guest speaker Woody Woodrow of USFWS. Mr. Woodrow gave the group key suggestions on estimating bird populations on large islands like Chester Island. Four attendees stayed after the training to practice birding skills with Mr. Woodrow. In May 2019, Audubon trained 13 new TERN community scientists in Texas City on foraging habitats.

Audubon's vegetation transect project required additional training for TERN community scientists. This six hour training includes three hours of classroom style lecture on Audubon's legacy protecting birds, the biology of bird nesting and habitat use, how conservationists use data to inform management decisions, and the methods and protocols of vegetation monitoring. The lecture is followed by a practical field component where participants and trainers visit a local marsh environment to practice methods learned in the classroom. Participants run a transect line through the marsh and randomly select areas along the transect to lay quadrats in which to identify plant species and calculate percent coverage of vegetation. Transect and quadrat data includes latitude and longitude coordinates and is recorded on a provided datasheet.

In September 2018, Audubon co-hosted a training at Galveston County Extension Office with the Galveston Bay Area Texas Master Naturalists. 22 attendees learned Audubon's conservation history and were trained to conduct vegetation transects. Attendees were then able to practice their new skills at a nearby marsh. Eight training attendees went on to conduct the season's first vegetation transect in October 2018.

STUDENTS AND TEACHERS

Audubon and TERN work to bring coastal conservation and field ecology skills to local students and teachers. The TERN program has been adapted for students and teachers of all ages. This training breaks down foraging monitoring into six lessons and activities for students grades K-12th, beginning with how to use binoculars and building to identifying birds, collecting data, and analyzing a dataset. Teacher trainings cover monitoring in more detail, enabling teachers to guide their classrooms in collecting bird data for Audubon TERN. Audubon staff identify a nearby location for monitoring. In the Houston area, for example, most schools are within walking distance of a waterway containing waterbirds. A complete set of lessons and activities for TERN in the Classroom can be found in Deliverables 3.1.

In October 2018, eight students from Carver Elementary School in Baytown, Texas were trained as TERN community scientists. The students survey bayous at the northern tip of Galveston Bay.

In December 2018, Audubon trained seven Houston Independent School District teachers as TERN community scientists. These teachers conduct foraging monitoring and subsequent data recording and analysis with their students.



A teacher and student observe birds as part of the TERN in the Classroom program.

Task 4: Monitor Colonial Waterbird Populations

TERN community scientists monitored colonial waterbirds using Gulf of Mexico Avian Monitoring Network protocols, recording data on bird foraging and nesting, as well as volunteer service time. Monitoring data is recorded in Audubon Texas' database.

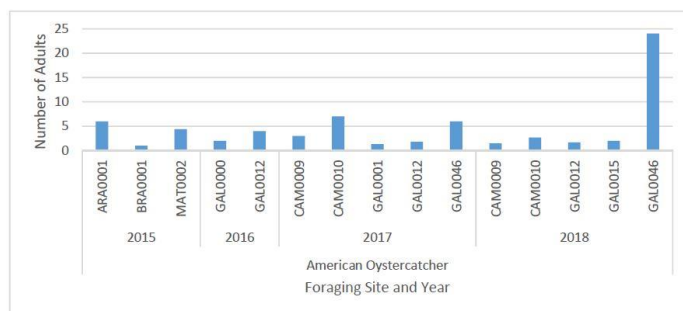
Audubon Texas conducts foraging surveys throughout the year (and thus throughout the grant period), while rookery surveys are conducted from February through August in alignment with bird breeding season. With the onset of spring migration in March, Audubon begins shorebird monitoring on Galveston beaches, while continuing foraging and rookery monitoring. Monthly surveys continue to draw in new participants while collecting valuable population and habitat data.

In January 2019, Audubon trained five new TERN community scientists to conduct rookery surveys in preparation for the upcoming breeding season. TERN volunteers are trained to conduct surveys both in partnership with Audubon wardens and independently. This independence allows the Audubon network to survey a greater range of sites than would otherwise be possible by Audubon staff alone. For example, TERN community scientists independently survey additional island habitat near Bay Harbor, as well as multiple inland colony sites.

These coordinated efforts between TERN volunteers and Audubon staff have provided contemporary data to

inform recent trend analysis and to provide baselines from which future interpretations can be made. Select interpretations of four species of conservation concern are provided below:

- American Oystercatcher counts never exceeded 25 adults at monitored sites throughout the subject regions. During 2018, there was a notable increase in foraging Oystercatchers at monitored sites in comparison to 2017.
- Black Skimmers were only observed to exceed 200 adults during the breeding season at Jigsaw Island and Ving et Un.
- Brown Pelicans consistently exceeded 200 observed adults at Mile Marker 52, North Deer Island, and Sundown Island.
- Reddish Egrets were only observed to exceed 200 individuals at Sundown Island. Observations of foraging Reddish Egrets remained steady to incrementally increase between 2017 and 2018.



Average number of adult American Oystercatchers at 10 foraging sites in Texas during four years (2015-2018).

Task 5: Online and Mobile App Data Entry

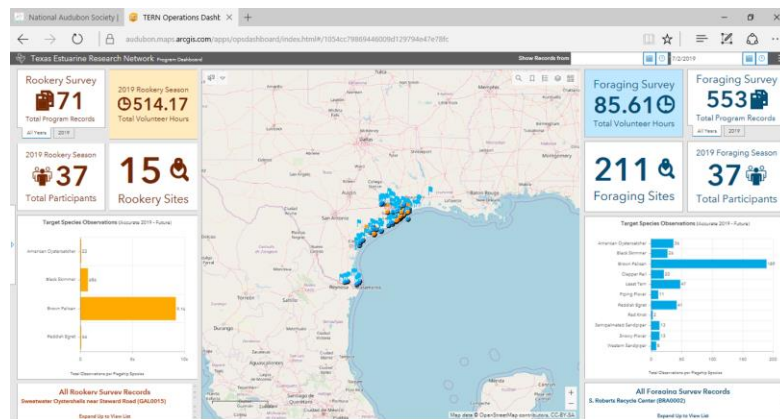
Monitoring data collected by Audubon and TERN community scientists is entered into both a data collection website and a mobile application created by Audubon Texas. Training instructions for entering surveys into the database on a computer or onto the mobile application are provided in Deliverables 3.1. The TERN volunteer portal can be found at <https://gis.audubon.org/TERN/>. The TERN volunteer portal is a database website with welcome page, pages for entering foraging monitoring surveys, and pages for rookery surveys. The site also includes an interactive map that allows TERN community scientists to search for existing monitoring locations. The portal contains a

page for volunteers to download photo release, liability, and medical forms required each year for continued participation.

TERN volunteers worked to input backlogged data from three previous years' surveys while maintaining an input schedule for data from current monitoring work. In April 2019, Audubon was able to share three years of monthly bird survey data with local area partner Galveston Bay Foundation.

Over the fall of 2018, TERN volunteers slowly integrated the existing monitoring database with a new version, created through ArcGIS Survey123. The transition was assisted by GIS science staff with National Audubon Society. TERN community scientists tested the new site, entered backlogged datasheets, and provided feedback on improvements before the 2019 launch.

The new TERN portal allows TERN community scientists to access survey data, view and search maps of active monitoring sites, and enter monitoring data. All program resources are now available in one online webpage. Additionally, the portal contains a dashboard with volunteer metrics, including volunteer hours, number of sites monitored, participants, and data entered. This dashboard streamlines Audubon's management of monitoring sites and TERN volunteers. The dashboard contains all metrics from the data collected by TERN community scientists, including survey data, hours spent volunteering, number of sites and surveys, and key bird species numbers and sightings. The dashboard can be searched using the interactive map and data can be filtered by dates or counties. A brief introduction to the dashboard is included in Deliverables 3.1. All data within the TERN database is available to partners on request. The hard launch of the TERN portal will take place in fall 2019.



TERN database dashboard.