Feature

Volunteers Keeping Tabs on Superheroes of the Sea: Florida's Adventure Coast

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Abstract

Horseshoe crabs (Limulidae) are ancient superheroes still walking our beaches today. Besides being a favored prey item for many fish, birds, and sea turtles, pharmaceutical companies use horseshoe crab's unique blue blood to ensure intravenous drugs are free of harmful bacteria. Historically, horseshoe crabs thrived along Florida's extensive shoreline, but population estimates are lacking. Comprehensive surveys across all coastal habitats by paid faculty or staff are financially and logistically impossible. To address data gaps and better inform fishery managers, collaborators created the Florida Horseshoe Crab Watch program. Intricacies of this program are described, with particular emphasis on Hernando County's training regimen. This case study can inform those interested in using effective citizen science programs to answer questions where volunteer involvement may supersede available funding limitations.

BACKGROUND

Salt-tolerant marsh vegetation, seagrasses, and submerged hard bottom comprise the low-energy coastal and marine systems of Hernando County, otherwise coined Florida's Adventure Coast (Hine et al. 2003). It is well known that such ecosystems benefit the people and wildlife in the area serving as the feeding and reproduction grounds for a diverse suite of species, including

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the American horseshoe crab *Limulus polyphemus* (Barbier et al. 2011; Kendrick et al. 2021). Many of these coastal and marine ecosystems face numerous threats ranging from pollution to storm damage (Duarte et al. 2008). The largest residential community in Hernando County relies heavily on dredged channels to access coastal waters. Unfortunately, the activities that sustain these local economies can also damage the ecosystems that support them, including essential horseshoe crab nesting habitat (Barbier et al. 2011; Kendrick et al. 2021).

In response, *A Strategic Marine Area Plan for Hernando County* (Barshel et al. 2018) was drafted, outlining the vision to incorporate citizen science as a method to fill in regional data gaps and enhance and preserve marine ecosystems. Concurrently, the University of Florida (UF) and the Florida Fish and Wildlife Conservation Commission (FWC) were spearheading a mark–recapture volunteer-led program, Florida Horseshoe Crab Watch (FHCW), to provide horseshoe population estimates for the Atlantic States Marine Fisheries Commission's Interstate Fishery Management Plan (ASMFC 1998). The UF Institute of Food and Agricultural Sciences (UF/IFAS) Extension Hernando County marine agent joined forces with the FHCW program and established a team of volunteers to collect horseshoe crab nesting habitat data along Florida's Adventure Coast (Figure 1). Over time, this data will contribute to population estimates throughout the state and inform local agencies when making decisions for coastal projects. Intricacies of Hernando's training regime and lessons learned are described.

PROJECT DESCRIPTION

The FWC's public reporting data identifying horseshoe crab nesting beaches in Hernando County, Florida, were lacking. To establish a viable survey site, volunteers completed a year-long pilot study at five locations across coastal areas between Alfred McKethan Pine Island Park and Aripeka. Volunteers surveyed each site simultaneously during the highest high tides in

spring and fall of 2017, documenting the presence and absence of mating horseshoe crabs (Sasson et al. 2020). Upon the conclusion of the pilot study, Alfred McKethan Pine Island Park was selected as the official FHCW survey site for the County. This location is also easily accessible and allows for a repeatable survey design.

Before sampling, volunteers attend a multipart training. Official FHCW survey methods and design followed are outlined by Heres et al. 2021; however, additional measures are implemented to ensure robust training. Using materials created by the FHCW program, a short overview of horseshoe crabs' life history, management, and data collection procedures are covered within a classroom setting. Participants then complete activities to familiarize themselves with program components, and practice data collection. Answers are recorded on mock datasheets as they proceed through the activities, and the order of training activities coincides with field events they will experience.

For the first activity, participants independently walk a staged nesting beach. All paired and unpaired horseshoe crabs are tallied, and already tagged crabs are noted. Answers are reviewed and discussed as a group. Participants then proceed to a gear station, where they independently identify gender and measure dead horseshoe crabs previously collected. Answers are reviewed as a group before moving forward. In pairs, participants practice working with digital and spring scales and finish with tagging. The participants use sharpened awls to make holes in the cardboard provided and select the proper tag corresponding to the chosen awl. The tag number is read aloud to group members, recorded, and repeated back to reinforce the necessity of correctly transcribed data. Tagging roles are then swapped to ensure all participants practice skill.

After the classroom session, participants proceed to the official survey site and complete a beach survey as a group during an active nesting event. The group discusses the proper datasheet coding for each horseshoe crab sighting along the route and practices horseshoe crab safe handling techniques as crabs are randomly collected and placed into 5-gallon buckets (Figure 2). Participants take turns obtaining data from the collected horseshoe crabs at the county picnic area and learn how to code crab injuries on datasheet. The survey boundaries, hazards, and access points are also discussed during this field activity.

Upon training completion, participants are provided with the code to the gear shed and access to an online website to sign up for sampling dates and roles. Gear leaders are the contact for the day's sampling event. They are responsible for the pickup and return of gear from the storage shed, communicate meeting points with team members, and relay to the UF/IFAS Hernando site coordinator of canceled survey dates due to inclement weather and equipment needs.

During official survey days, gear leaders and trained volunteers walk the fixed sampling location and tally the number of horseshoe crabs observed, including their mating status and gender. Additionally, participants collect a subsample of horseshoe crabs to tag and release. The age, gender, prosoma width, weight, and injuries are recorded for each tagged horseshoe crab. Other environmental metrics recorded include the time at which high tide occurred, height of tide, and percent of moon visible (Heres et al. 2021).

After each survey, completed data sheets are stored in a secured gear shed, and pictures are sent electronically to the site coordinator. Data is entered into an online portal by the site coordinator, and physical copies are mailed to the FWC program coordinator.

USE IN MANAGEMENT

Data is reported and used by the FWC and the U.S. Fish and Wildlife Service to make informed management decisions (Heres et al. 2021). Local and state departments use FHCW data to assess the impacts of construction projects, such as beach renourishment, shoreline hardening, and installation of wave attenuation devices on horseshoe crab nesting habitat (Heres et al. 2021). Florida's Adventure Coast team contributes to data needs regarding the abundance in Hernando County, clinal variation, and red tide impacts.

LESSONS LEARNED

In addition to the multipart training, there are many other tips and tricks to leading a fruitful citizen science program. Some lessons learned during the FHCW Hernando County chapter are as follows.

An online registration page allows volunteers to view the season's schedule and sign up for specific roles and dates that work for them as their availability unfolds. If there is a cancellation due to an unforeseen conflict, the site coordinator reopens the registration slot for other volunteers to fill in. Having volunteer roles defined, i.e., gear leader and sampling volunteer, on the registration page prevents miscommunication of obtaining the sampling gear when the project gear is shared. Furthermore, allowing volunteers to select their role self-assigns responsibility for essential components that keep the project running smoothly, like needed gear replacements or refills.

The gear accessibility and distance the gear is from the sampling site is another critical consideration. Volunteers sample multiple days in a row, but not all volunteers participate for the entire stretch. Swapping gear is challenging and limits those who participate in the program.

Having a secure location to store the gear that is accessible at any time, including weekends, attracts more participation in the program and prevents tampering. Also, selecting a storage location close to the sampling site encourages more volunteers to take on the role of gear leader, ultimately increasing coverage of sampling dates. Duplicate sampling kits at the storage location provide gear pickup and drop-off flexibility between gear leaders and serve as a backup when tag refills or datasheets are needed but not communicated. Extra kits also proved fruitful when gear could not be shared during COVID-19 restrictions.

Site accessibility and easily defined boundaries ensure the survey is repeatable and consistent. Requiring boats can limit the pool of available volunteers, especially in inclement weather conditions. Selecting stationery boundaries, such as established trees and seawalls, prevents miscommunication in the survey area or modification between volunteers over time.

Annual refresher courses that include gear demonstrations and field site visits are essential for all volunteers, regardless of their length of service within the program. Bad habits can form over time and quickly spread among volunteers if not remedied. Furthermore, participants struggle with measuring in millimeters and reading spring scales, thus the need for practice prior to each sampling season.

Lastly, volunteer appreciation remains a commitment to the program. Simple tokens, such as certificates for donated hours or program T-shirts acknowledge the value of the volunteers' effort towards the program's success. Furthermore, provide volunteers with updates seasonally or annually of the program's progress, even if it is as simple as how many horseshoe crabs were identified and tagged. It lets the volunteers know how their time contributes to the greater good.

NEXT STEPS

We will continue the program in perpetuity and maintain our high level of volunteer training and appreciation. We hope our efforts can be used as a guide for similar programs.

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Figure Captions

Figure 1: Tagged pair of nesting horseshoe crabs along Florida's Gulf Coast. Photo credit: Brittany Hall-Scharf.

Figure 2: Hernando County volunteers Therese Stewart (left) and Jacquelin Pacchiarotti (right) conducting a beach survey during the fall 2019 season. Photo credit: Brittany Hall-Scharf.

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FSH_10795_Hall-Scharf_Brittany_Horseshoe crabs_Image 2.jpg