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ASSESSMENT OF SHOREBIRD POPULATIONS IN GALVESTON BAY USING CONVENTIONAL AND UAV TECHNIQUES



Anna Vallery, George Guillen, Mustafa Mokrech
Environmental Institute of Houston, University of Houston-Clear Lake
University of Houston-Clear Lake, School of Science and Computer Engineering



Background

Close to 75% of U.S. bird species utilize Texas wetlands, including saltmarsh, intertidal oyster reef, tidal flats and seagrasses, as either a permanent or seasonal habitat (TCELCP, 2010). Wetlands are at risk of degradation as a result of sea level rise and urbanization. Developing estimates of population densities of target species in relation to the spatial coverage of coastal habitat types and water level are necessary to implement effective approaches to manage and protect wetland bird species and their habitats. It is likely that loss of these habitats in the future will affect foraging and nesting success for many species of shore birds. The foraging behavior of wading and shorebirds are affected by a number of factors: prey density, substrate type, and human activities (Galbraith et al, 2002; Goss-Custard, 1977). Little is known about how frequently various intertidal substrates are utilized by shore and wading bird species in the Galveston Bay estuary. Gathering information for this area can be difficult due to the size, complexity and shallow depths of the estuary. Conventional methods often include surveying intertidal zones by boat. New methods using Unmanned Aerial Vehicle (UAV) technology have the potential to make large-scale surveys of intertidal areas easier and less expensive than previous ground surveys and/or manned aerial surveys.

Objectives

- Document how different species of wading bird and shorebird utilize intertidal habitats at different tide/water levels and seasons within Bastrop Bay.
- Determine if UAV technology can be used to gather accurate information on shorebird community composition and numbers.

Study Site

Bastrop Bay lies within the Bastrop Bayou watershed about fifty miles south of Houston. It encompasses 217 square miles, including oyster reefs, salt marsh, and seagrass beds. The amount of aerially exposed intertidal oyster reef varies considerably depending on tide stage and weather.

Study Population

Shorebirds – Members of the suborder Charadrii, including sandpipers, plovers, curlew, avocets, stilts, and oystercatchers
Wading Birds – Members of the families Threskiornithidae and Ardeidae, including ibises, spoonbills, herons and egrets

Materials

- Bushnell Fusion 1-Mile ARC 12x50 mm magnification binoculars with built-in laser rangefinder (Figure 1.a.) and compass
- QUESTUAV AQUA Drone equipped with Sony 6000A camera



Figure 1. a. Conventional bird surveys are conducted from a small vessel. b. Oyster Reef with an assemblage of birds in Bastrop Bay. c. Our team of graduate students and staff with the UAV.

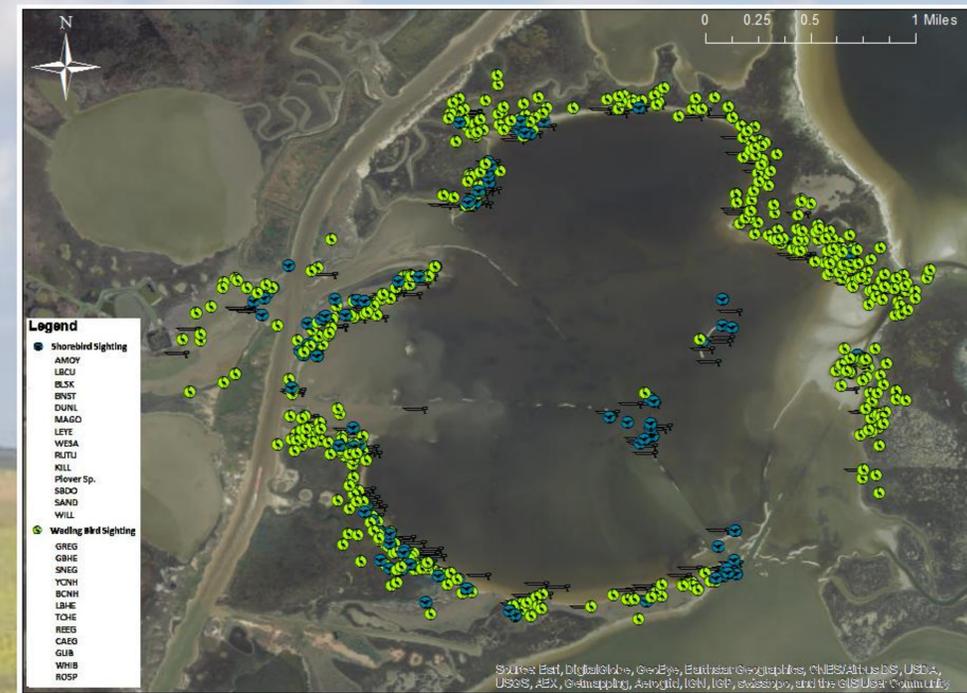


Figure 2. Map of all water bird sighting incidences around Bastrop Bay taken during bi-weekly surveys from August to October, 2016.

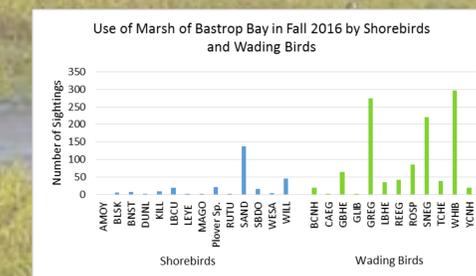


Figure 3. Use of marsh habitat in Bastrop Bay by shorebirds and wading birds from Fall 2016 surveys.

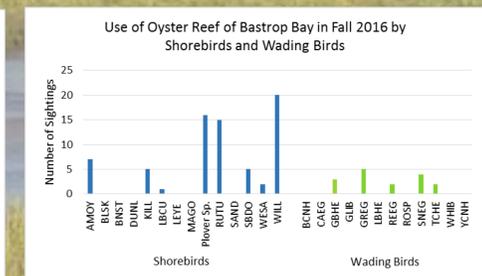


Figure 4. Use of oyster reefs in Bastrop Bay by shorebirds and wading birds from Fall 2016 surveys.

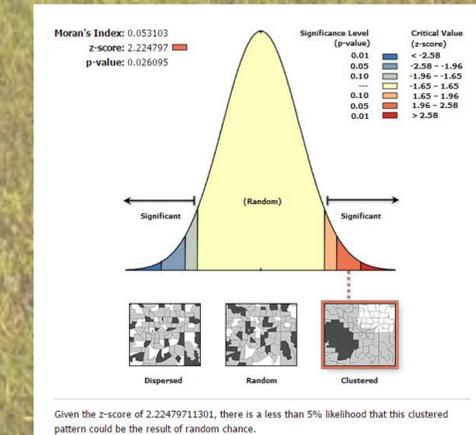


Figure 5. Spatial autocorrelation report for shorebird habitat use across Bastrop Bay in Fall 2016.

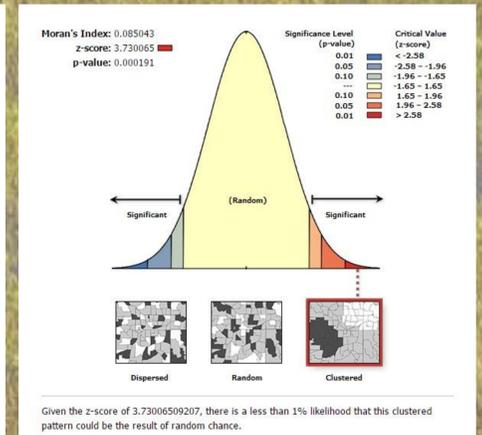


Figure 6. Spatial autocorrelation report for wading bird habitat use across Bastrop Bay in Fall 2016.

Methods

- Both bi-weekly and monthly surveys began August 2016.
- Bi-weekly surveys of Bastrop Bay by boat collecting data on bird species, location, behavior and occupied substrate (Figure 1.a.).
- Monthly surveys using UAV and conventional surveying techniques.
 - UAV surveys transects while taking continuous images.
 - During flight, ground surveyors count birds and record behavioral response.
 - Images taken are processed using Pix 4D Software and then reviewed.
- Spatial distribution of bird communities were analyzed using cluster analysis within the ESRI ArcGIS 10.4 software package.

Preliminary Findings and Discussion

Conventional Survey Method:

- Bi-weekly surveys have been successful in collecting data on habitat use and foraging behavior of shore and wading birds.
- Visually comparing use of marsh and habitat of these two bird groups found evidence of preference for marsh by wading birds and oyster reef by shorebirds (Figures 3 and 4).
- Preliminary geostatistical analyses of data collected in Fall (August-October) 2016 found that there was significant spatial clustering of both wading birds and shore birds (Figures 5 and 6).
- Continued surveying is necessary to gain an understanding of seasonal trends in substrate use and community assemblage of the birds in Bastrop Bay.
- Additional analyses, such as “optimized hot spot analysis”, will be used to identify trends in areas frequently used by birds.

UAV Survey Method:

- Initial surveys displayed greater disturbance of the birds by the presence of the UAV than previous literature had suggested.
- Many species of bird flushed at UAV launch, rendering the images obtained during the survey an incomplete picture of the area.
- The scope of this study has shifted to incorporate a behavioral study aimed at better understanding behavioral response of birds to presence of the UAV under different conditions (height, flight pattern, UAV type).

Acknowledgements

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