Determining if Interspersion is a Habitat Requirement for *Gallinula galeata sandvicensis*

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Background

The endangered Hawaiian Gallinule (*Gallinula galeata sandvicensis)* is a wetland specialist endemic to two islands in Hawaii. It has suffered extensive habitat loss, on the island of Oahu, where 75% of its wetlands have been lost since human arrival to the island. One goal to reduce the extinction risk of Hawaiian Gallinules is for resource managers to create more habitat. Despite it being acknowledged as a crucial requirement for their abundance and conservation, no research has been published and little is known about their habitat requirements. My overarching goal is to determine the wetland features required by Hawaiian Gallinule. Understanding habitat selection has strong implications for the success of habitat management plans and the conservation of endangered species.

There are several features known, or suspected, to be critical to gallinule habitat use; my focus for this project is to quantify what is referred to as interspersion. This project focuses on quantifying the site-scale land cover characteristics of ponds and its conversion into spatial maps for subsequent spatial analysis to determine the effects of interspersion on the Hawaiian Gallinule's habitat selection.

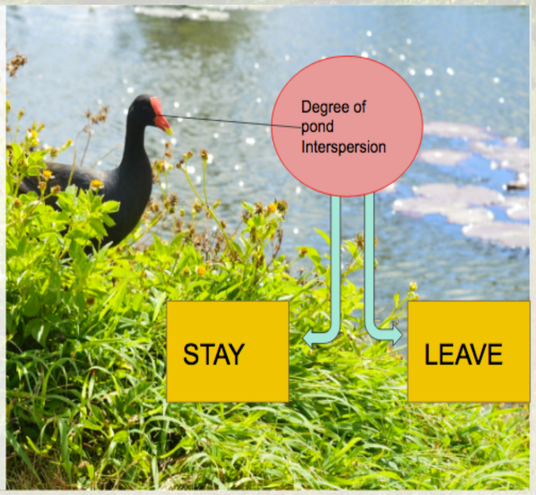
Interspersion is the degree to which patches of emergent vegetation are intermixed with patches of water and bare ground (mud) in a pond:

Interspersed

Not Interspersed

Hypotheses:

- Gallinules use degree of pond interspersion as a cue for selecting habitat
- Gallinules will be more abundant in wetlands with greater interspersion



Data Sources & Methodology

Spatial data included false-color Digital Orthophoto Quarter Quadrangle (DOQQ) images (U.S. Geological Survey), which were provided by the Hawai'i Geospatial Consortium and the State of Hawai'i GIS Program and personally given to the Reed lab here at Tufts University. These images are false colored raster files of detailed images of most wetland areas on the island of Oahu in the year 2007.

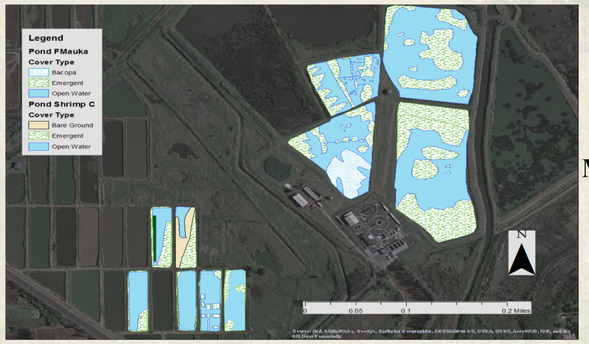
The National Wetlands Inventory is from the U.S. Fish and Wildlife Service government website. This is a vector data set containing outline polygons of wetlands on the island of Oahu.

Habitat characteristics at each pond were documented following modification to the National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats. Each pond was visually assessed and a hand drawn interspersion map was made of each one. Gallinule abundances at each pond was recorded using a protocol developed and evaluated for the Hawaiian Gallinule.

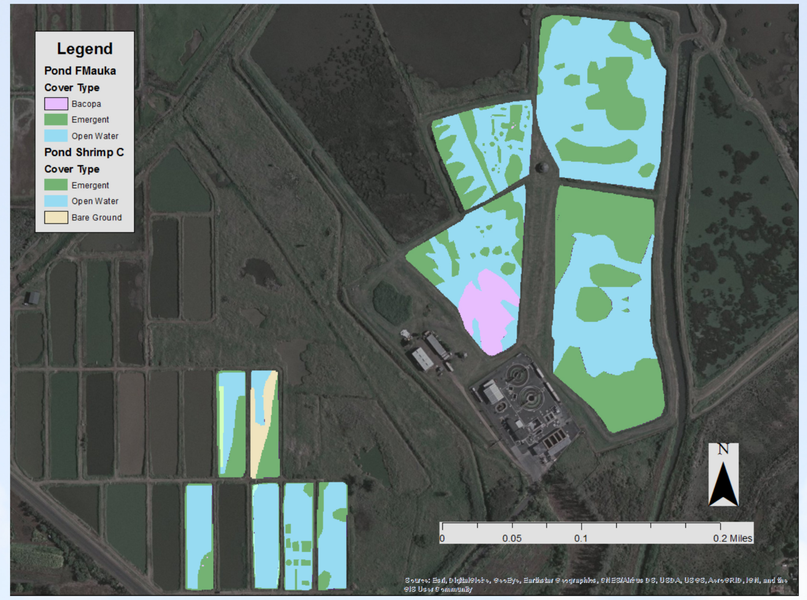
The creation of polygon outlines was facilitated by the DOQQ images and existing polygons within the National Wetlands Inventory data set. The polygons in the National Wetlands Inventory were edited against DOQQ images or Google Earth to create more up to date outlines. Outlines that did not exist in the National Wetlands Inventory were created using the editor toolbar and creating new polygons against DOQQ images or rubber sheeting Google Earth screenshots.

On top of these outlines, the hand drawn interspersion maps in the field were made into vector interspersion maps on ArcMap. Each polygon represented a land cover type. These maps were converted to raster using the conversion tool for a final map product.

Outline of Gallinule Habitat Ponds on Oahu, Hawaii



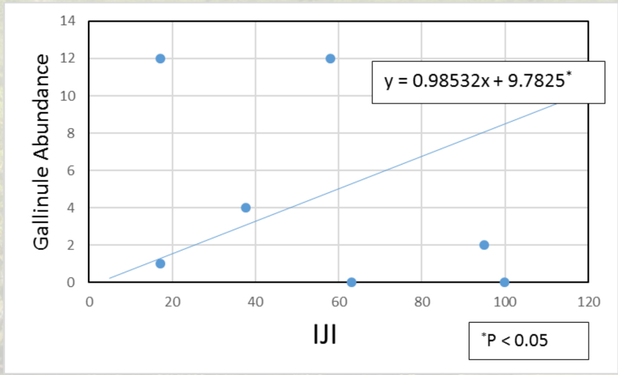
Vector Interspersion Map of Ponds on Oahu, Hawaii



Raster Interspersion Map of Ponds on Oahu, Hawaii

Raster Interspersion Maps were used with FRAGSTATS to compute IJI, or interspersion, values. These values were then inputted into R Studio and were used to create a general linear model of IJI (interspersion) values vs. gallinule abundance.

Results



According to this model, as interspersion increases, gallinule abundance increases confirming my hypothesis that interspersion is most likely a habitat requirement for the Hawaiian Gallinule. However, it must be noted that these results may be the product of a very small sample size (n=7). The significance of these results is critical for creating more effective habitat refuges for the Hawaiian Gallinule changing the way the U.S. Fish and Wildlife Service approaches the restoration of wetlands on Oahu and how it approaches species conservation when it relates to extreme habitat loss.

Alejandra Munoz, GIS101– Intro to GIS, December 18th, 2016, NAD_1983_UTM_Zone_4N, Google Maps BaseMap