Does Predator-Proof Fencing Improve Reproductive Success of the Hawaiian Stilt (Himantopus mexicanus knudseni)?

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Introduction

Figure 1: Conceptual illustration of predator-proof fencing.

•Listed as Endangered in 1967, the U.S. Fish & Wildlife Service (USFWS) requires a population of 2,000 individuals to delist the subspecies (USFWS 2009).

•To grow a self-sustaining population, active predator control is required until non-native predators are eradicated.

•Freshly hatched chicks are highly vulnerable to depredation. Accurate estimates of chick mortality during this vulnerable period are essential for assessing the risk of extinction and increasing population stability (Reed 1998).

•The 0-10 day window is a very vulnerable time and it is suspected that many chicks are depredated or die reducing the overall number of chicks that can be found. By day 10, if they are still alive, chicks are far more mobile.

•Stilt response to predators differs depending on the predator type (Sordahl 2004).

•With limited resources, managers strive to make decisions that result in the greatest reduction in extinction risk for the lowest cost.

Concept

•The USFWS recently completed the construction of a predator-proof fence around the Honouliuli unit of the Pearl Harbor National Wildlife Refuge (PHNWR) in hopes to exclude a subset of predators from the refuge.

•This study examines the benefits of predator-proof fencing around Honouliuli and compares it to the Waiawa unit, an adjacent wetland site without predator-proof fencing.

Methods

Figure 2: Map of O'ahu and the two study sites Honouliuli and Waiawa, with and without predator-proof fencing, respectively.

•Prior to hatching, motion activated cameras were set three meters away and one meter high to detect Stilts in the nesting area.

•Both study sites were visited weekly to survey for new nests and to maintain the cameras on active nests.

Methods


Figure 3: Stilt nest with freshly hatched chicks.

•The Hawaiian Stilt breeding occurs predominantly from March to August and peaks between May to June (Coleman 1981). Data collection for the 2019 season is ongoing.

•After a nest had hatched, the camera was left up for at least 10 days. Nests that were predated or flooded had their camera taken down soon after.

• A portion of the data was processed and analyzed. Chi-squared analyses were used to test the difference in hatch rate and depredation rate among the two sites.

Discussion


Figure 4: An rare photograph of a mass stilt chick gathering (~15 chicks & 14 adults).

In 2019, of the nests that were detected, Waiawa (without predator-proof fencing) had significantly fewer nests hatch when compared to Honouliuli (with predator-proof fencing). This may be due in part to heavy depredation by rats and cats . Of the nests detected at Honouliuli 2019, over 90% hatched successfully. This is a significantly higher proportion then Waiawa in 2019 but also Honouliuli itself in 2018, indicating improved reproductive success. It is unclear whether the preliminary results can be attributed to the predator-proof fencing or variance from year to year.

Novel interactions with introduced pressures such as rats and cats could drive novel responses in Hawaiian Stilts such as those depicted in Figure 4. Furthermore, based on the number of hatch-year sub-adults sighted throughout the island, some sites are suspected to be sinks for stilt chicks.

Bullfrogs are known predators of Stilt chicks and are detected more frequently at Honouliuli. This may be because it is more of a fresh water system when compared to the more saline Waiawa ponds. While predator-proof fencing may increase hatching success, it cannot be verified that there is increased recruitment into the population.

Preliminary results suggest that the predator-proof fencing erected by USFWS around the Honouliuli unit within PHNWR is in deed improving the reproductive output of Hawaiian Stilts. If true, this increase is one step closer to recovery for this conservation reliant species.

Objectives


Figure 5: A timeline of Hawaiian Stilt life history and research milestones.

1. Detect any improvement or decline in Stilt reproductive success following the construction of a predator-proof fence in the PHNWR (Figure 2).
2. Identify the mean hatch time for each site at the PHNWR.
3. Identify which predators have the most impact during the hatching period at each site in the PHNWR and compare.

Preliminary Results

Figure 6: Proportion of nests that hatched at both study sites for the years 2018 and 2019.

Figure 7: Proportion of nests depredated at each study site for both 2018 and 2019.

•There is a significant difference in the # of eggs hatched between Honouliuli and Waiawa for 2019.
p<0.001 X2=20.58 Chi-square

•There is a significant difference in the # of depredated nests between Honouliuli and Waiawa 2019.
p=0.05 Fisher's Exact Test (for small sample size) *Used Fisher Exact Test, so no chi-square value

•There is a significant difference in the # of depredated nests between Honouliuli 2018 and 2019.
p=0.02 X2=4.85 Chi-square

There is NOT a significant difference in the # of depredated nests between Honouliuli and Waiawa 2018.

p=0.19 X2=1.70 Chi-square

•There is NOT a significant difference among predator types in the proportion of days a potential predator visited each nest at Honouliuli in 2019.
p=0.34 F=1.11 ANOVA

Figure 8: Mean hatch times of the first stilt chick at each nest for both Waiawa (09:57) and Honouliuli (13:20) in 2019 .

Management Implications & Acknowledgments

This research is impactful in 3 ways.
1. Hawaiian Stilts, like other Hawaiian waterbirds, are a conservation reliant species. Understanding basic hatching ecology during this vulnerable life stage has the capacity to improve management practices.
2. Understanding and describing novel interactions can provide insight on the many introduced pressures waterbirds face.
3. Improved camera trap methods in combination with a banded Stilt population can provide a less invasive method for monitoring population demographics.

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