Department of Land and Natural Resources

Division of Forestry and Wildlife

Oahu Branch

2135 Makiki Heights Drive • Honolulu • HI • 96822

(808) 973-9788

Hamakua Marsh Wildlife Sanctuary

Waterbird Report, 2018

Prepared by:

Aaron J. Works, Wildlife Biologist, Division of Forestry and Wildlife

Introduction

Hamakua Marsh Wildlife Sanctuary has been identified by the U.S. Fish and Wildlife Service as a core wetland for the recovery of the four endemic and endangered waterbirds: the Hawaiian Coot (*Fulica alai*), Hawaiian Duck (*Anas wyvilliana*), Hawaiian Gallinule (*Gallinula galeata sandvicensis*), and Hawaiian Stilt (*Himantopus mexicanus knudseni*; USFWS, 2011). Monitoring the waterbirds for abundance, habitat use, and nesting success remains imperative for informing wetland managers on affective habitat manipulations and predator control efforts that may lend to the recovery of Hawaii's four endangered waterbirds.

Methods

Waterbird surveys were conducted following the standard protocol initiated by the Division of Forestry and Wildlife biologists. Observers walked along the stream edge paralleling Hamakua Drive from Basin A toward Basin D (intersection of Hamakua Drive and Kailua Road). Basin A is on the southeast corner of the wetland and Basin D is toward the northwest (Figure 1). On each visit, overall wetland condition and the number of waterbirds and shorebirds in each of the four Basins were counted. Hawaiian Coot, Hawaiian Gallinule, and Hawaiian Stilt habitat usage, nesting activity, and banding information were also recorded. Habitat usage was identified as: stream, stream bank, mudflat, mudflat/vegetation, 0–3" water, 3–6" water and >6" water. Specific nesting activities measured include: pairing, territory, and survival rates of chicks to fledgling stage.

Figure 1. Map of Basins A, B, C, and D in Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii.

A two-sample *t*-test was used to check whether waterbird abundances were different pre- and post-treatment of pickleweed in specific basins within Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii. Statistical analyses were performed in Microsoft Excel with an α of 0.05 to indicate significance.

Results

The area of Olomana in 2018 had a total rainfall of 167.6 cm and an average monthly rainfall of 14.0 cm (Figure 2).

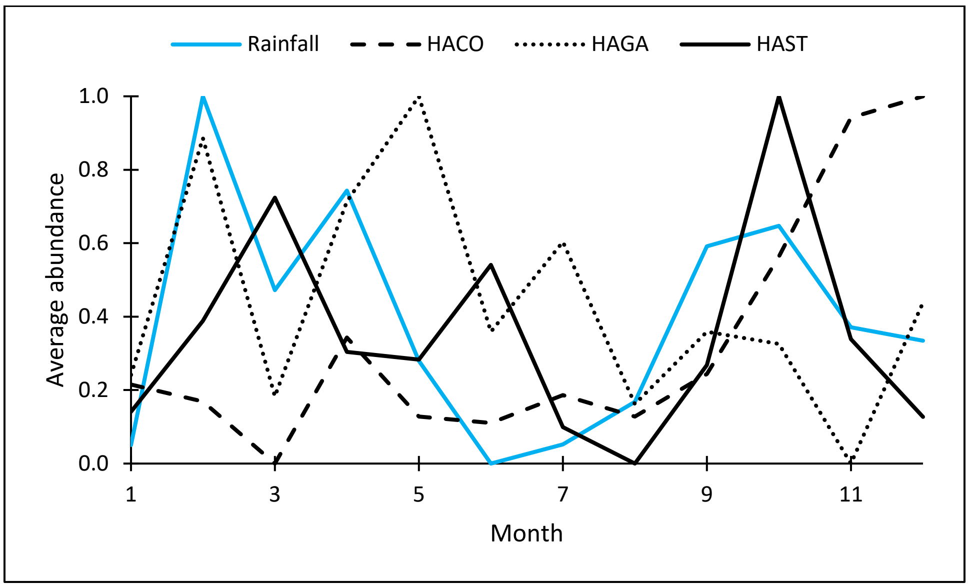

Figure 2. Total rainfall and average waterbird abundances by month in 2018 at Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii. All data was normalized on a 0–1 scale.

Mean abundances in 2018 for Hawaiian Coot, Hawaiian Gallinule, and Hawaiian Stilts were 17.5, 54, and 26.1 individuals, respectively (Figure 3). Mean waterbird abundances for each basin can be viewed in Appendix 1.

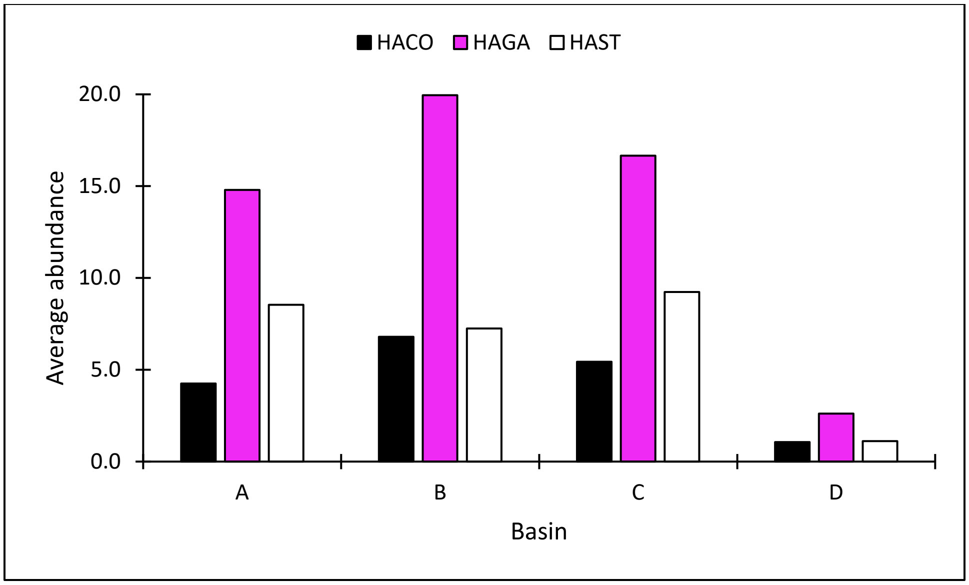

Figure 3. Average abundances of coots, gallinules, and stilts in Basins A, B, C, and D at Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii.

Habitat utilization differed by species. The Hawaiian Coot was found in stream and water >6" deep in 67.1% of the observations; the Hawaiian Gallinule was found in mudflat/vegetation and the stream bank in 78.2% of the observations; and the Hawaiian Stilt was found in mudflat/vegetation and 0–3" water in 77.3% of the observations (Figure 4).

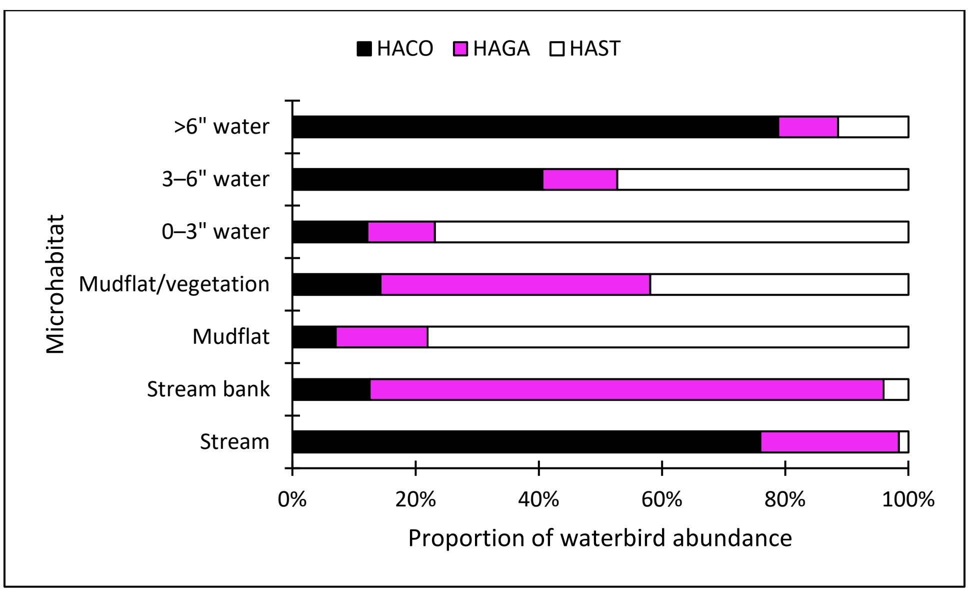

Figure 4. Proportion of coots, gallinules, and stilts in seven microhabitats found within Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii.

Hamakua Marsh supports an average of 8.1, 24.4, and 12.0 coots, gallinules and stilts per hectare, respectively (Figure 5). Mean waterbird abundances per hectare for each basin can be viewed in Appendix 2.

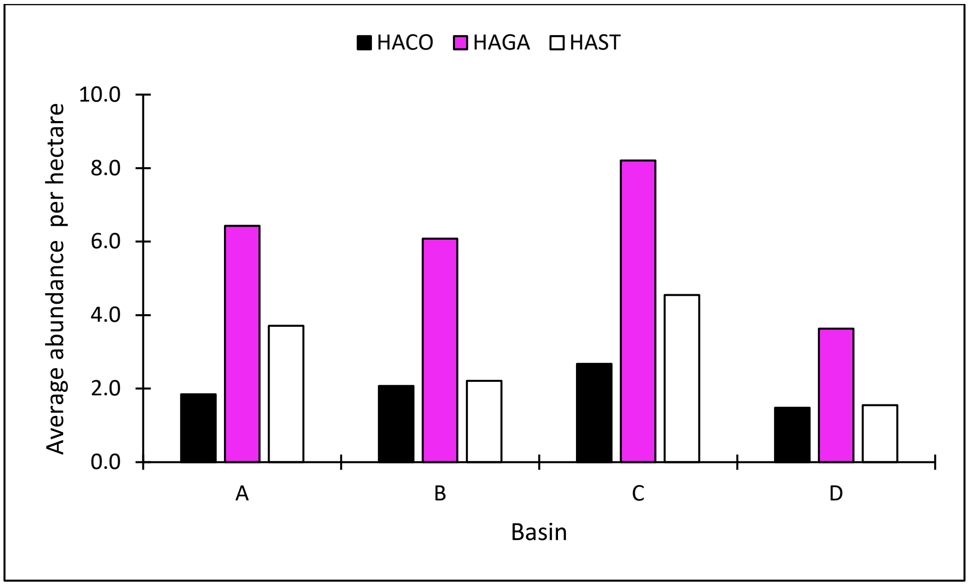

Figure 5. Average abundance of coots, gallinules, and stilts per hectare in Basins A, B, C, and D in Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii.

Nesting success.—Seventeen stilt nests were monitored with cameras by UH Manoa and 47% of nests were successful. Zero nests were depredated, 0 flooded, 5 abandoned, 8 hatched, and 4 had an unknown fate (Appendix 1).

Fledging success in Hamakua Marsh Wildlife Sanctuary from 2007 to 2018 ranged from 50–82%, 44–97%, and 8–81% for coots, gallinules, and stilts, respectively. For 2018 coots, gallinules, and stilts had an overall fledgling success rate of 54%, 44%, and 44%, respectively (Table 1).

Table 1. The number of observed chicks, fledglings, and percent fledgling success for coots, gallinules, and stilts in 2007 through 2018 in Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii.

	HACO			HAGA			HAST		
Year	# chicks	# fledglings	% success	# chicks	# fledglings	% success	# chicks	# fledglings	% success
2007	2	1	50%	41	30	73%	16	13	81%
2008	—	—	—	33	24	73%	13	1	8%
2009	3	2	67%	47	40	85%	38	29	76%
2010	11	9	82%	56	49	88%	9	6	67%
2011	14	9	64%	28	25	89%	4	2	50%
2012	—	—	—	31	24	77%	5	4	80%
2013	6	3	50%	43	25	58%	15	13	87%
2014	8	6	75%	95	77	81%	34	7	21%
2015	12	8	67%	62	42	68%	10	7	70%
2016	—	—	—	43	36	84%	42	32	76%
2017	11	6	55%	67	65	97%	12	9	75%

2018	13	7	54%	36	16	44%	16	7	44%
Total	80	51	64%	582	453	78%	214	130	61%

Predator control in Hamakua Marsh Wildlife Sanctuary in 2018 consisted of 163 mongooses, 15 black rats, and 10 cats. Waterbird abundance fluctuated with the increase and decrease in predator control (Figure 6).

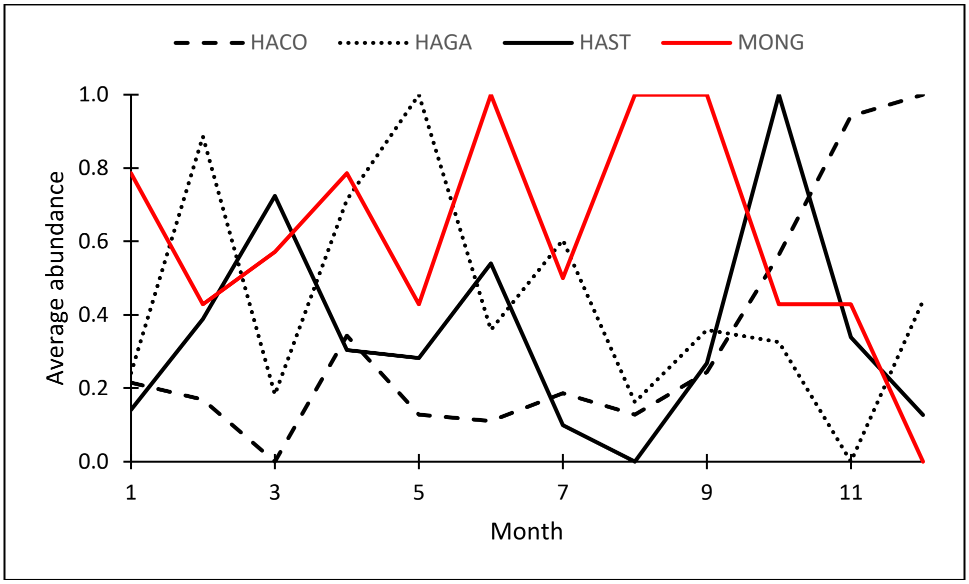

Figure 6. Mongoose captures per month projected alongside average coot, gallinule, and stilt abundances per month in Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii. All data was normalized on a 0–1 scale.

Wetland habitat was manipulated in Basins B, C, and D on September 4 and 5, 2018 by mowing the pickleweed (*Batis maritima*). Average waterbird abundances were compared pre- and post-treatment of the habitat. The mean abundances of coots in Basins C and D were significantly larger post-treatment ($P = 0.00$; $P = 0.00$, respectively). The mean abundance of gallinules in Basin B were significantly smaller post-treatment ($P = 0.01$). The mean abundance of stilts in Basin C were significantly larger post-treatment ($P = 0.04$).

Discussion

Gallinule abundance increases as rainfall increased and decreased when rainfall decreased. Coot abundance decreased during times of drought and the population remained steady during average rainfall. Large spikes in rainfall resulted in a decrease in coot abundance. Stilt abundance increased during moderate levels of rainfall and during drought abundance decreased.

Gallinules are the most abundant waterbird in all the basins; stilts are the second most abundant; and coots are the least abundant waterbird in Hamakua. Habitat availability may explain the differences in the mean abundances of coots, gallinules, and stilts. Although microhabitat area was not measured, mudflat/vegetation is the most dominate habitat type available within the marsh.

Coots prefer habitats that provide deeper water although 19.0% of observations identified coots moving or foraging on mudflat/vegetation. The stream and ponds >6” offer the best microhabitats for coots. The stream, >6” deep water ponds, and mudflat/vegetation explained 86.1% of coot observations. Gallinules prefer microhabitats that provide cover or easy escape from potential predators, like the stream bank, which provides quick access to protection in the stream. Mudflat/vegetation, stream bank, and stream accounted for 89.7% of gallinule observations. Stilts prefer open areas in mudflat/vegetation and shallow bodies of water 0–3” deep. Stilts and gallinules were predominately found in mudflat/vegetation, but gallinules are often seen hiding in the vegetation, whereas stilts are found in the vegetation but on the fringes of open shallow water ponds. Mudflat/vegetation, 0–3” water, and mudflat explained 86.5% of stilt observations.

The density of coots, gallinules, and stilts were greatest in Basin C. Further analyzing habitat and invertebrate availability in each basin may elucidate the reason Basin C supports the greatest density of coots, gallinules, and stilts. Managing Basins A, B, and D to replicate C may enhance waterbird production.

Nesting success in 2018 for coots, gallinules, and stilts was below average. My lack of observations during the beginning of the year leave me at a loss as to the reasons for the loss in chicks. It may be that flooding in April from excessive rainfall may have killed some chicks.

Assuming low trapping numbers of mongoose equate to lower mongoose density, gallinules responded well to the increase and decrease of mongoose trapping. When mongoose numbers were high gallinule abundance decreased, likewise, when gallinule abundance was high mongoose numbers were low. This suggests that the gallinules may be undergoing predation pressure. Gallinules are the most abundant waterbird in the marsh, so would provide the largest population and perhaps the most accessible by a predator since mudflat/vegetation is their preferred microhabitat. Stilts seem to respond to mongoose trapping. When the mongoose population is lower stilt abundance increased, likewise, when mongoose numbers increased stilt abundance decreased. The coot population seems to be less affected by mongoose and responds more to competition with gallinules. As gallinule abundance decreased coot abundance increased, likewise, when gallinule abundance increased coot abundance decreased. Other confounding factors (i.e., water levels, available forage, etc.) not accounted for in this analysis may also be the cause of the waterbird population fluctuations in Hamakua Marsh.

Vegetation manipulation within the wetland habitat resulted in a significant increase of coots in Basins C and D; a significant decrease in gallinule abundance in Basin B; and a significant increase in stilt abundance in Basin C. The results of the *t*-test suggest manipulating the pickleweed height by mowing benefits coots and to a lesser degree stilts, but negatively affects gallinule abundance. Further observation and analysis are necessary to understand the ecology of waterbirds in Hamakua Marsh. Further habitat manipulations will be necessary to understand any seasonal or cyclical patterns that affect waterbird abundances.

Understanding available foraging resources and conducting a habitat cover assessment for Hamakua Marsh would benefit future management decisions pertaining to waterbird ecology for their eventual recovery.

Appendix 1. Average abundances of coots, gallinules, and stilts in Basins A, B, C, and D in Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii.

Basin	HACO	HAGA	HAST
A	4.3	14.8	8.5
B	6.8	20.0	7.3
C	5.4	16.7	9.2
D	1.1	2.6	1.1

Appendix 2. Average abundances of coots, gallinules, and stilts per hectare in Basins A, B, C, and D in Hamakua Marsh Wildlife Sanctuary on Oahu, Hawaii.

Basin	HACO	HAGA	HAST
A	1.8	6.4	3.7
B	2.1	6.1	2.2
C	2.7	8.2	4.5
D	1.5	3.6	1.5

Appendix 3. Hawaiian Stilt nest fates and hatching success for the 2018 nesting season in Hamakua Marsh State Wildlife Sanctuary on Oahu, Hawaii.

# of nests	Predated	Flooded	Abandoned	Hatched	Unknown
17	0	0	5	8	4