EFFECTS OF LARGE-SCALE CATTAIL MANAGEMENT ON LOCAL, MICROHABITAT-SPECIFIC FORAGING BEHAVIOR OF GREAT EGRETS

KATHERINE R. AMATO AND NATHAN H. RAINES

Research advisors: Faculty and graduate students. Faculty editor: David R. Peart

Abstract: In Palo Verde National Park in Costa Rica, cattail abundance in the marsh has been managed since 1998. The correlated increase in Great Egret (*Casmerodius albus*) abundance may be due to increased representation of preferred microhabitat types following cattail control. We focused on relatively open habitats, in both managed and unmanaged areas, to determine whether cattail management in the surrounding area influenced the local abundance and microhabitat-specific foraging behavior of Great Egrets. We hypothesized that the local abundance of Great Egrets would be greater when cattail abundance in the surrounding area had been reduced by management; this hypothesis was supported by our data. Our second hypothesis, that foraging behavior would depend upon local microhabitat, rather than the surrounding cattail abundance, was also confirmed by our results. Because local microhabitat conditions appear to be the primary influence on Great Egret foraging behavior, we suggest that the creation of suitable microhabitats should play a prominent role in strategies for cattail management.

Key Words: Casmerodius albus, *forage, habitat management, microhabitat*

INTRODUCTION

Since 1998, managers in Palo Verde National Park, Costa Rica have controlled cattail abundance in marshy areas along the Tempisque River, and the abundance of waterbirds has correspondingly increased. Reducing cattail abundance increases open water habitats, and may create gaps for other species of plants. However, little is known about how cattail management affects bird foraging behavior.

We focused on relatively open habitats, in both managed and unmanaged areas, to determine whether cattail management in the surrounding area influences the local abundance and microhabitat-specific foraging behavior of Great Egrets (*Casmerodius albus*). We hypothesized that the local abundance of Great Egrets in a particular area would depend on the suitability of habitat in the surrounding, larger area. Specifically, we predicted that local Great Egret abundance would be greater when cattail abundance in the surrounding area had been reduced by management.

In contrast, because foraging behavior should depend on a bird's immediate surroundings, we hypothesized that it would be best predicted by microhabitat (local scale), rather than whether an area had been managed or not (larger scale). Mahar et al. (2000) found that *Jacana spinosa*, a species with similar habitat preferences, spent significantly more time foraging in vegetative mats than they did on cattails. Therefore, we expected that Great Egrets would spend more total time, and more foraging time, in microhabitats dominated by low vegetative mats. We also expected the proportion of time spent foraging by Great Egrets to vary according

to the occupied microhabitat, and to be least in local areas dominated by cattails.

METHODS

We observed focal Great Egrets in Palo Verde National Park, Costa Rica on 12 January 2006 and 13 January 2006. We collected data on each day starting at approximately 5:30am, 10:30am, and 4:00pm, for one-hour intervals in two locations of roughly the same size: a marsh area where cattails had been crushed 7 times since 1998, and a naturally cattail-free marsh area. In each location, we recorded the total number of Great Egrets present and observed each bird for a 15 minute interval. We described the microhabitat occupied by each bird as mostly reed, mostly floating vegetative mat, mostly open water, half reed-half vegetative mat, half reed-half open water, half vegetative mat-half open water, or a mix of the three based on estimated percentages. We described behavior as foraging (extended neck), resting (retracted neck), or flying, and recorded the time whenever microhabitat or behavior changed.

We compared bird numbers between the managed (reduced abundance of surrounding cattails) and unmanaged areas, and the proportion of time spent foraging in each area and in each microhabitat, using ANOVA in JMP 5.0.1. We compared the fraction of total time spent in each microhabitat and the fraction of foraging time spent in each microhabitat, with ANOVA. We ran a Tukey-Kramer HSD to test for differences between microhabitat categories.

RESULTS

Great Egrets were significantly more numerous locally in areas where the surrounding cattail dominance had been reduced ($F_{1, 10}$=23.44, P=0.0007; Fig. 1). The proportion of time spent foraging (across all local microhabitats) was similar, irrespective of the surrounding cattail abundance (i.e. managed or not; $F_{1, 67}$=0.25, P=0.62; Fig. 2). In both managed and unmanaged areas, Great Egrets spent significantly more time in the mostly-vegetative-mat microhabitat than in any other microhabitat type ($F_{5, 252}$=17.88, P<0.0001). Also, Great Egrets spent by far the greatest proportion of their foraging time in the mostly-vegetative-mat microhabitat ($F_{5, 245}$=22.5, P< 0.0001; Fig 3). Proportion of total time in a microhabitat that was spent foraging also differed significantly among microhabitats ($F_{5, 63}$=6.80, P< 0.0001; Fig. 4). When we pooled all microhabitat data, we found that Great Egrets spent a significantly greater proportion of their time foraging when in mixed microhabitats (0.97) and mostly vegetative mat microhabitats (0.85) than when in half-vegetative-mat-half cattail (0.47) and mostly-cattail microhabitats (0.17; Fig. 4).

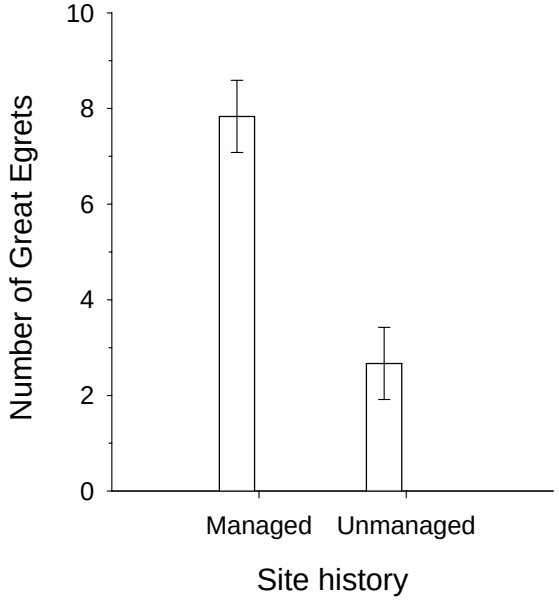

Figure 1. Number (mean ± SE) of Great Egrets observed per hour in a marsh managed for cattails and an unmanaged marsh in Palo Verde National Park, Costa Rica. In managed areas, the surrounding cattail abundance has been reduced. Data are from 6 periods of observation at each site.

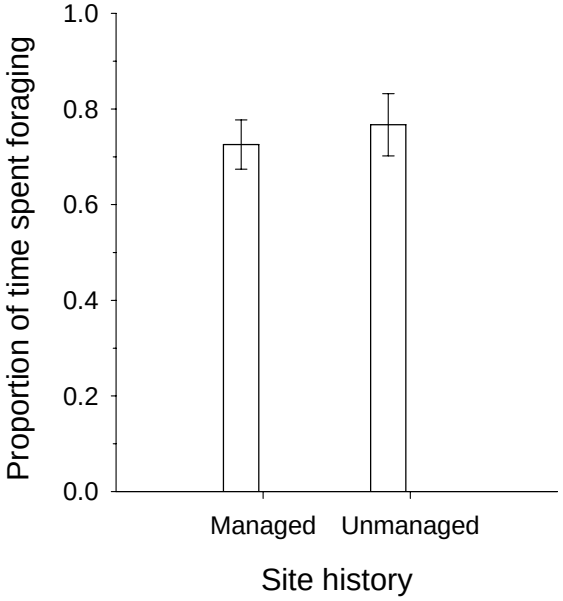

Figure 2. Proportion of time (mean ± SE) Great Egrets spent foraging in a marsh managed for cattails and an unmanaged marsh at Palo Verde National Park, Costa Rica. In managed areas, the surrounding cattail abundance has been reduced. Sample sizes of birds from left to right are 33 and 9.

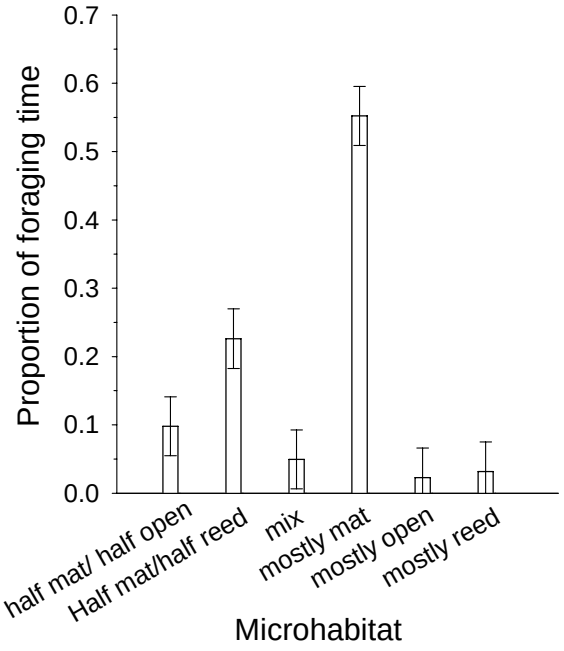

Figure 3. Proportion of foraging time (mean ± SE) Great Egrets spent in different microhabitats in the marsh at Palo Verde National Park, Costa Rica. Microhabitats not sharing the same letter are significantly different (α = 0.05). Microhabitat data are pooled across sites with different management histories. Sample size is 42 birds for each microhabitat. "Reed" refers to cattails.

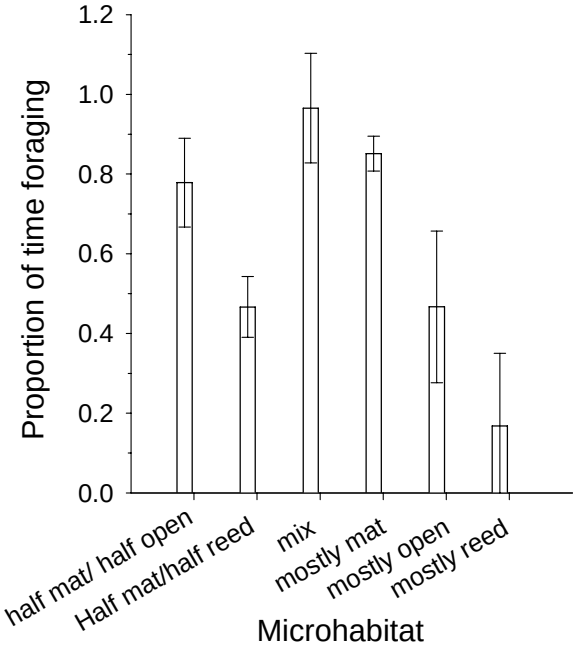

Figure 4. Proportion of time (mean ± SE) Great Egrets spent foraging, by microhabitat, in the marsh at Palo Verde National Park, Costa Rica. Values not sharing the same letter are significantly different (α = 0.05). Sample sizes from left to right are 11, 16, 6, 30, 3, and 3 birds. Microhabitat data were pooled across sites with different management histories. "Reed" refers to cattails.

DISCUSSION

Habitat suitability on a large scale, as influenced by cattail management, clearly influences the abundance of Great Egrets in local microhabitats. May et al. (in prep.), who studied the same managed and unmanaged areas, found a trend towards greater fish abundance in the managed area, which could improve Great Egret habitat quality. On a smaller scale, Great Egret foraging behavior seems to be determined by local microhabitat conditions. Because we believe our sites to be representative of managed and unmanaged areas in the Palo Verde marsh in general, we suggest that the creation of suitable microhabitats should play a prominent role in strategies for cattail management.

LITERATURE CITED

Mahar, E.M., Aucoin, L.E., Frank, A.K., Jennings, M.K., and Foote, M.D. 2000. Preferred foraging habitats of *Jacana spinosa* in the Palo Verde marsh. Pp. 11-13 in Dartmouth Studies in Tropical Ecology 2000. Dartmouth College: Hanover, NH.

May, C.H., Önen D.D., and Sullan K.M. 2006. Manuscript in preparation.