FORAGING BEHAVIOR OF SNOWY EGRETS (*EGRETTA THULA*) IN RESPONSE TO TIDAL FLUCTUATIONS IN THE RIO SIRENA ESTUARY

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Abstract. Snowy egrets *(Egretta thula)* are predators on fish in shallow waters of estuaries and rivers. In this study, we examined the effects of the tidal cycle on the foraging behavior and abundances of snowy egrets along the mouth of the Rio Sirena at Corcovado National Park, Costa Rica. Water levels in the mouth of the Rio Sirena are subject to significant changes between low and high tides, which we predicted would affect abundance and foraging times of snowy egrets. We found that egrets occurred in highest abundance and spent more time actively foraging at the mid-tide levels, especially on the upcoming tide. At high and low tides, the number of egrets and the foraging times declined dramatically. These observations were probably related to greater prey (fish) availability at mid-tide water levels.

Key Words: tidal cycle

INTRODUCTION

The estuary of the Rio Sirena in Corcovado National Park is a habitat rich in both aquatic organisms and terrestrial species which forage on these aquatic organisms. In particular, the Snowy Egret *(Egretta thula)*, a common winter resident of both the Caribbean and Pacific lowlands of Costa Rica (Stiles and Skutch, 1989), frequents the Rio Sirena estuary where it forages on small fish and aquatic invertebrates (Stiles in Janzen, 1983).

The water levels and the topography of the shoreline of the Rio Sirena drastically change with tidal fluctuations every six hours. In a pilot study we observed more egrets foraging in the estuary at mid-tide levels than at low and high tides, which might be due to changes in the distribution and abundances of their prey organisms with the tidal fluctuations.

We therefore hypothesized that egret abundance and foraging behavior would be related to the changing tides. Specifically, we predicted that egrets would spend a greater percentage of their time foraging at mid-tide levels than at low and high tide, and that both the number of egrets and their percent of time spent foraging would be greater during the incoming tide than the outgoing tide. The latter was based on the presumption that more fish would be brought into the estuary on the upcoming tide.

METHODS

On 4 February 1997 over one tidal cycle we observed egrets at the mouth and adjacent portions of the Rio Sirena estuary at Corcovado National Park, Costa Rica. Two sites were selected: (1) the estuary observation tower off the Guanacaste trail and (2) a site on the beach near the river mouth. A two-person recording team was established at each site and every 30 min (between 06:30 and 17:00) each team scanned the area of the Rio Sirena in their viewing distance and counted the number of egrets present. From among the birds present, a maximum of five were randomly selected for behavioral observation. Each of these focal birds was observed for one minute. The behaviors recorded were: (1) foraging, (2) resting, (3) locomotion, and (4) interaction. Foraging was defined as any behavior that appeared to be directed towards capturing prey, including both stalking behavior (the focal egret walking along the shoreline, often in a hunched posture, looking for prey) and peering behavior (the focal egret standing motionless along the shoreline and peering into the water). During both of these foraging behaviors, egrets made stabbing attempts at prey in the water. Resting was defined as standing in a single place without peering into the water. Locomotion was defined as walking or flying without foraging. An interaction was defined as any behavior (aggressive or defensive) directed towards a conspecific.

The times of high and low tide were obtained from a tide table specific to the Rio Sirena. We grouped our observations by tide levels: low, mid, and high.

RESULTS

The number of egrets present at the river mouth was strongly affected by tidal level (Fig. 1). More egrets were observed during mid-tide levels than during either high or low tides ($t=2.23$, $df= 5$, $P<0.05$). At mid-tide levels, we observed significantly more egrets during the incoming than the outgoing tide ($t=4$, $df=4$, $P=0.016$).

In addition, the percent of the time that the egrets spent foraging also changed with tide level (Fig. 2). Peak levels of foraging occurred at mid-tide levels, and when the tide reached extreme levels, either high and low, the percent of time the egrets spent foraging decreased precipitously. Further, the mean percent of time that the egrets spent foraging at mid-tide levels was higher during the incoming tide than during the outgoing tide ($t=2.30$, $df=4$, $p=.083$).

DISCUSSION

Tidal fluctuations influence the foraging behavior and the abundance of snowy egrets. At low tide, the water is shallower, so that the egrets have more area (rocky shoals and total beachfront) from which to forage. While this would seem to favor foraging, the low levels of foraging behavior and low abundance of birds at low tide indicate that this part of the tidal cycle is not the best time in which to forage or that foraging is better in some other site. At low tide fish are probably not readily available to foraging egrets, as they are likely to move to deeper water at this time.

Likewise, at high tide fewer egrets were present and they spent less time foraging, probably because the majority of the foraging area is covered with water - including all of the rocky shoals and a large amount of the beachfront. In addition to the loss of foraging area, the water at high tide may be too deep for the egrets to stand. Deep water may also facilitate fish escape from striking egrets. Thus, it may not be beneficial for egrets to forage at high tide.

At mid-tide levels there are more egrets present and the proportion of time spent foraging increases. This is particularly notable on the upcoming tides, probably due to an increase in the number of fish carried into the estuary at that time. Similarly, as the tide goes out, more foraging area becomes available and prey are again more available to the wading egrets, but apparently prey are less available at this time, as indicated by the lower numbers and decreased foraging by egrets on the down going tide.

Our observations suggest that egret foraging within the inter-tidal changes with prey availability. At high tide, few egrets attempt to forage, and most leave the area, flying into the nearby trees to roost. At low tide, many egrets were seen resting along the shoreline, possibly waiting for the next incoming tide. The high rate of foraging at mid-tidal levels suggest that these are the conditions where the prey are either more abundant or more available. To verify these findings, it would be worthwhile to examine the availability of fish at different tidal levels, coupled with more detailed studies of time and energy allocations by the egrets.

LITERATURE CITED

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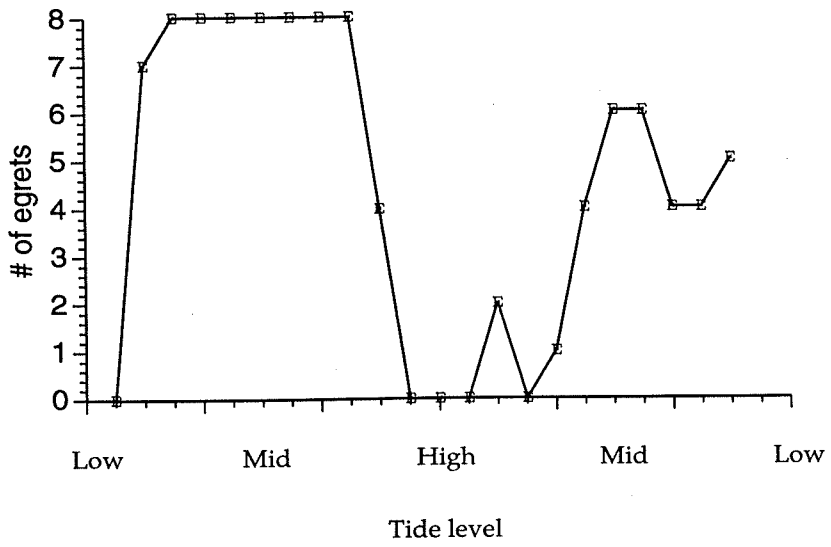

Fig. 1. The number of egrets present at single point counts at the mouth of the Rio Sirena, Corcovado National Park, Costa Rica in relation to tidal level (n = 22 observations over 11 hours).

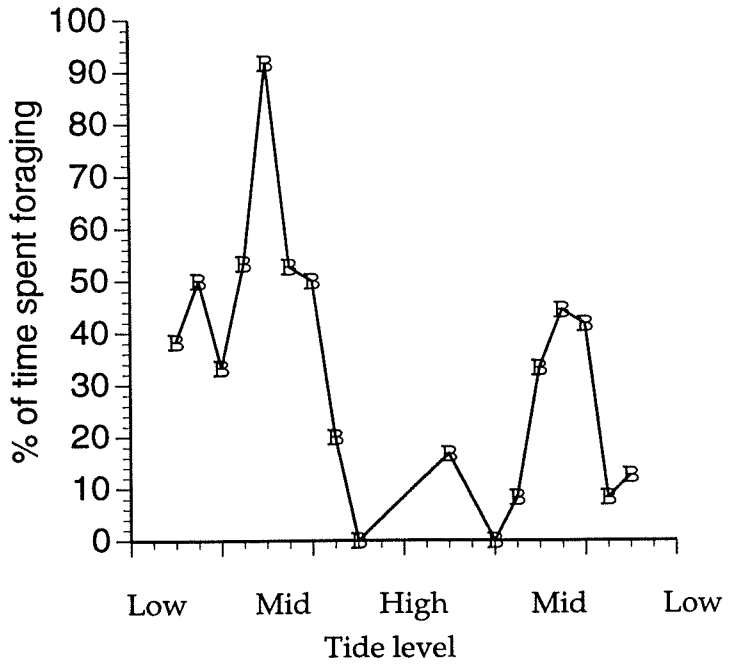

Fig 2. The mean percent of time spenf foraging as a function of tide level (n=17).