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SPATIAL RELATIONSHIPS OF FORAGING AND ROOST SITES USED BY SNAIL KITES AT LAKE KISSIMMEE AND WATER CONSERVATION AREA 3A, FLORIDA

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Abstract.—Although several researchers have studied the numbers of Snail Kites using communal roosts, little information exists on the proportion of the kite population using communal roosts, or the spatial relationship between their foraging areas and roost sites. Foraging Snail Kites were located on Lake Kissimmee and in Water Conservation Area 3A (WCA3A) and followed to their roost sites. Foraging and roost locations were recorded using a Global Positioning System. These data were used to calculate distances from foraging areas to roost sites for 19 kites on Lake Kissimmee and 16 kites in WCA3A. We counted the number of birds using each roost and recorded the vegetation. The distances traveled from foraging sites to roost sites were greater at WCA3A than at Lake Kissimmee. Four kites selected roost sites that were greater distances than alternative communal roosts. Twenty percent of the 35 kites followed from their foraging areas roosted alone, indicating that a significant portion of the population could be uncounted if communal roost counts alone are used to survey populations in Florida. Kites that roosted alone flew shorter distances than those kites who flew to a communal roost.

Willow (*Salix caroliniana*) was the most common substrate used by kites for their roosts, but herbaceous vegetation (cattail, *Typha* spp. and bulrush, *Scirpus californicus*) was used more extensively on Lake Kissimmee. Kites roosting solitarily tended to use herbaceous vegetation compared to communally roosting birds.

The Snail Kite (*Rostrhamus sociabilis plumbeus*) is a federally-listed endangered raptor that feeds almost exclusively on freshwater apple snails (*Pomacea paludosa*). The Snail Kite is gregarious, apparent in its tendency to nest colonially and roost communally (Sykes 1985, Bennetts et al. 1994, Rumbold and Mihalik 1994). Communal roosts are used most often during nonbreeding periods (Sykes 1982,

Beissinger 1988). Communal roosts in Florida have been used by as few as two individuals to as many as 372 (Takekawa and Beissinger 1989, Sykes 1985). Roost counts, in conjunction with transect surveys, continue to be used to assess kite populations in Florida (Sykes 1982, Rodgers et al. 1988).

Nesting ecology of Snail Kites has received considerable study; however, studies of roosting have focused primarily on times of arrival or departure, direction of flight to and from roost sites, and numbers of kites using roosts (Sykes 1985, Rumbold and Mihalik 1994). With the exception of two birds that were followed from their roost site to their foraging areas (Rumbold and Mihalik 1994), little is known about the spatial relationships between roosting and foraging areas of kites. Here we examine the (1) distances traveled between foraging and roosting sites, (2) spatial configuration of these sites, and (3) proportions of kites roosting communally or individually.

Study Areas and Methods

Observations of foraging and roosting Snail Kites and kites at evening roosts were conducted on Lake Kissimmee, Osceola County, in Central Florida, and the western portion of Water Conservation Area 3A (WCA3A) south of Interstate 75, Dade and Broward counties (Figure 1). Lake Kissimmee comprises approximately 14,200 ha, with water depths up to five meters, and includes an extensive littoral zone of cattail (*Typha* spp.), maidencane (*Panicum hemitomon*), and pickerelweed (*Pontederia cordata*). WCA3A is a 237,000-ha shallow impoundment with sawgrass (*Cladium jamaicensis*) interspersed with willows (*Salix caroliniana*) and tree islands of mixed species. The western edge of WCA3A supports extensive tracts of cypress (*Taxodium* spp.). Observations on Lake Kissimmee were conducted from 17 December 1993 through 6 January 1994; observations in WCA3A were conducted from 11 January 1994 through 17 January 1994.

This study was conducted as part of a larger ongoing study of demography and movements of Snail Kites in Florida. At the time of our observations approximately 100 radio-transmitted birds were being monitored throughout the state. Our observations of these and other birds suggested that all of the birds reported here were not breeding at the time of our observations.

Individual kites were found at foraging sites at least one hour before sunset and subsequently followed to their roost sites. Kites rarely go to roost earlier than one hour before sunset (Sykes 1985, pers. obs.). After following a bird to its roost, we remained in the area until approximately one hour after sunset to avoid the possibility that birds were merely using stopover sites prior to continuing to a roost. Radio transmitter signals were used when possible to locate birds and follow them to roost. This was especially useful in WCA3A where the vegetation reduced visual range and obstructed navigation between the foraging and roost sites. At the time of the study only two birds on Lake Kissimmee had radio transmitters, but the vegetation provided little hindrance to visual range and navigation. All following was done by airboats and a distance of at least 200 m maintained from the bird being followed to avoid disturbance. Only one kite was followed per boat per night. Locations of foraging areas and roost sites were recorded using a Global Positioning System (GPS). GPS locations were averaged for a three-minute period (an internal option of the GPS) to reduce error (generally ± 30 m). Communal roosts were counted on the evening following their discovery, beginning two hours prior to sunset to

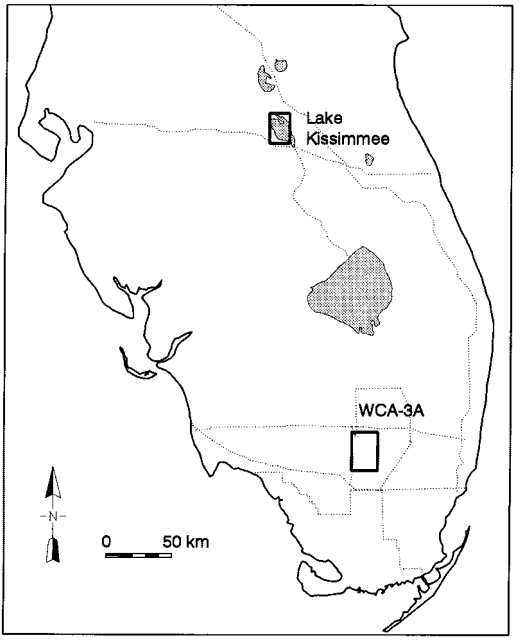

Figure 1. South Florida showing study sites at Lake Kissimmee and Water Conservation 3A.

ensure that the count did not exclude early arrivals. For birds apparently roosting alone, the roost site was approached by airboat to flush any potentially unseen birds that may have arrived earlier than the bird followed to roost. Forage-to-roost site distances were calculated using the Pythagorean theorem. Distances were compared using t-tests (Sokal and Rohlf 1981).

RESULTS

A total of 35 Snail Kites was followed from their foraging to roost sites; 19 on Lake Kissimmee and 16 in WCA3A. Eleven of these 35 birds had radio transmitters. Thirty birds were counted at five different roosts on Lake Kissimmee and 245 birds were counted at nine roosts in WCA3A. One additional known roost was counted within the study area, but no birds were followed to that particular roost (Figure 2).

Fourteen of 16 Snail Kites followed in WCA3A moved in an east or northeast direction from foraging areas in the western cypress tracts, towards roost sites within the sawgrass marsh to the east (Figure 2). Kites on Lake Kissimmee did not demonstrate a consistent direction of travel (Figure 3). Snail Kites in WCA3A had a tendency to fly greater

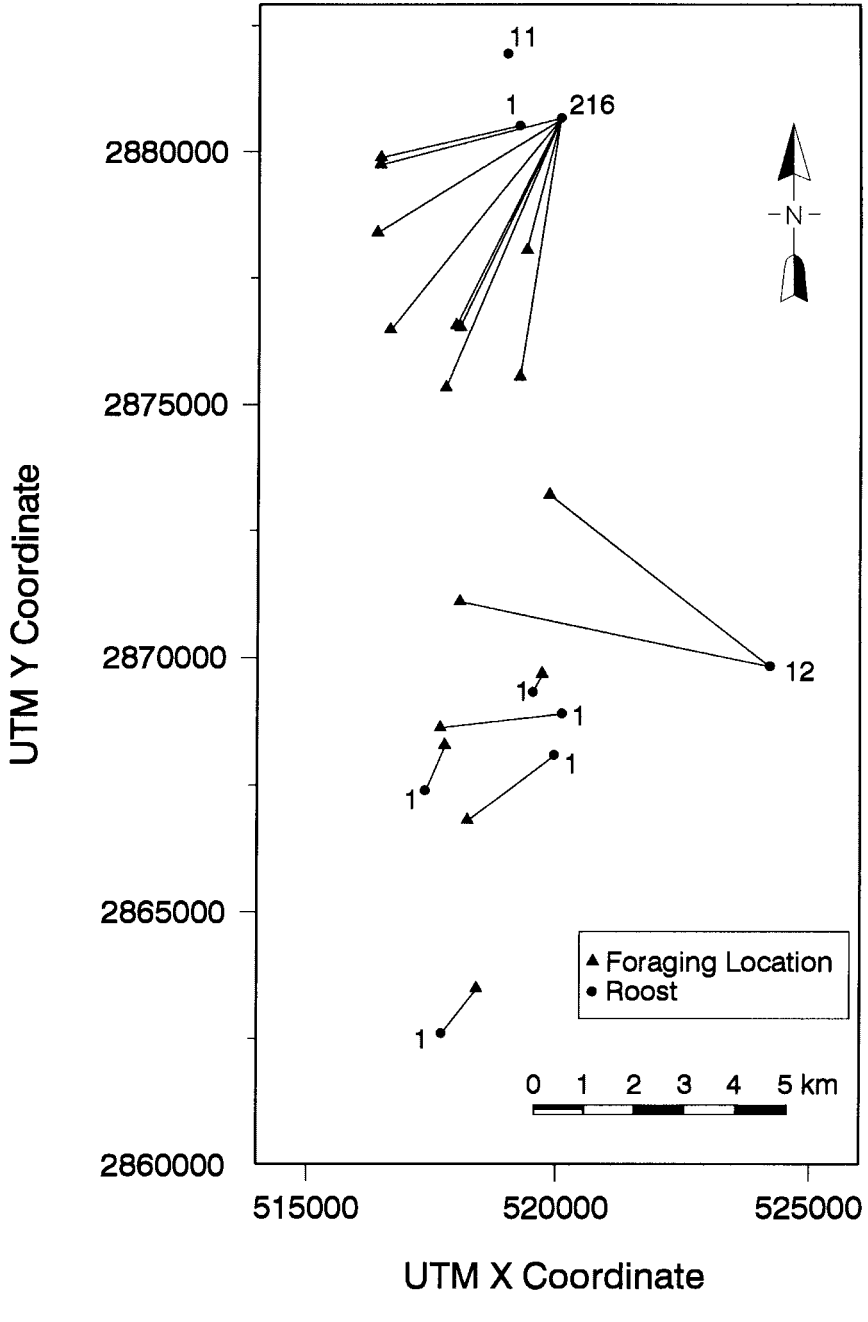

Figure 2. Direction and distance flown by Snail Kites in WCA3A from foraging area to roost site. Numbers indicate roost count.

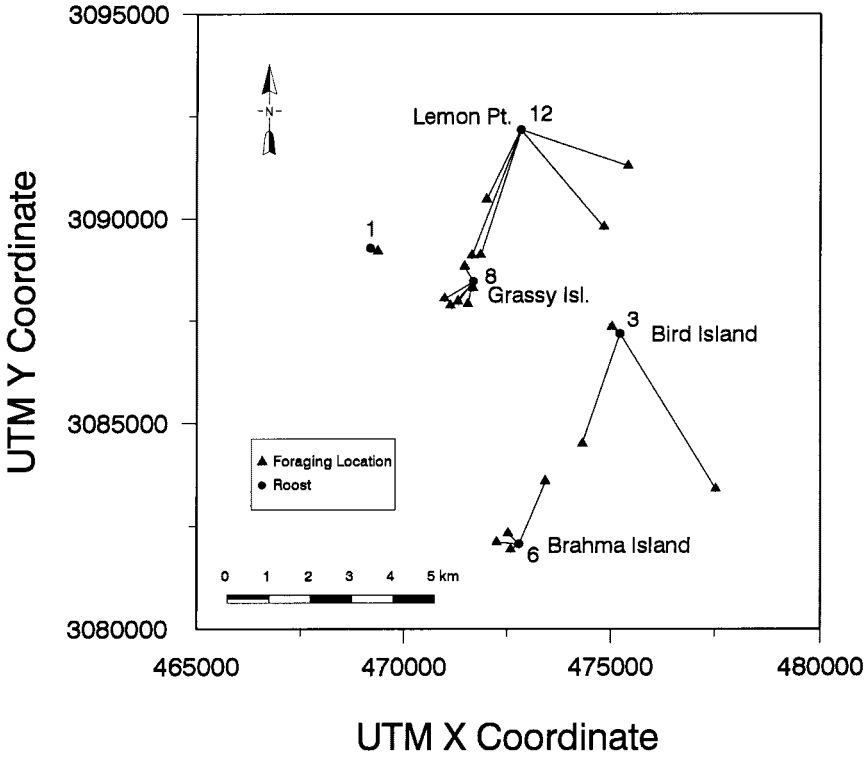

Figure 3. Direction and distance flown by Snail Kites on Lake Kissimmee from foraging area to roost site. Numbers indicate roost count.

distances to roost than did kites on Lake Kissimmee [t = 4.05, 33 df, P<0.05] (Figure 4).

Of the 19 kites followed on Lake Kissimmee, only one (5%) roosted alone; however, six of the 16 (38%) kites followed in WCA3A roosted alone. Snail Kites that roosted alone in WCA3A flew shorter distances than did those that roosted communally [t = 5.93, 14 df, P<0.05] (Figure 5). A similar analyses could not be done for Lake Kissimmee because only one Snail Kite roosted alone.

Most communal-roosting Snail Kites appeared to select the nearest identified roost site (89 and 90% at Lake Kissimmee and WCA3A, respectively). However, three birds on Lake Kissimmee and one in WCA3A chose roost sites further from their foraging area than other potentially closer communal roosts (Figure 2).

Most (98%) of the 245 kites we counted at WCA3A roosted in willow, including all birds roosting communally. None of the six solitary-roost sites in WCA3A were in willow. Four of these solitary roosts were

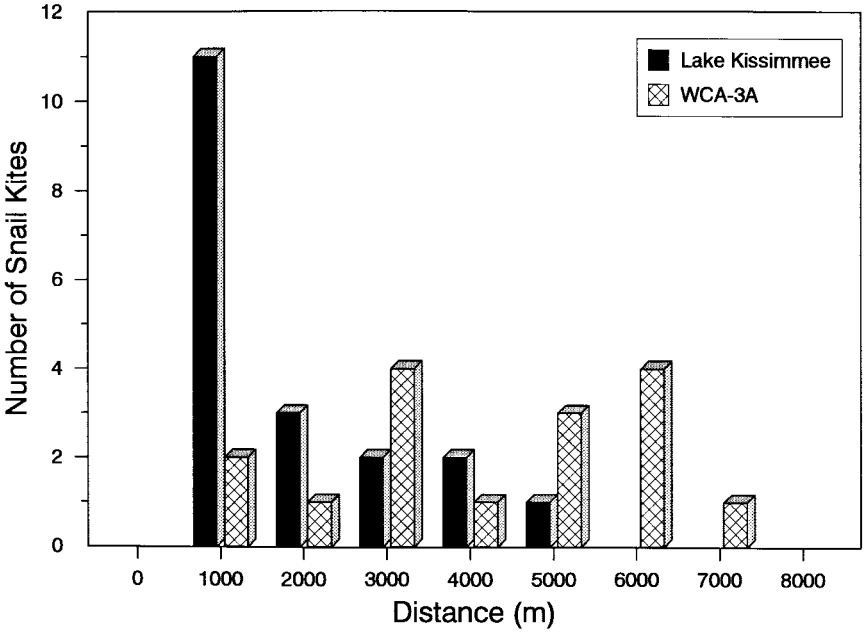

Figure 4. Number of Snail Kites that flew particular distance intervals from forage to roost site on Lake Kissimmee and WCA3A. Number represents high end of interval.

in sawgrass and the remaining two in cypress. At Lake Kissimmee, 15 of 30 (50%) kites roosted in willow and two of the four communal roosts were in willow. The remaining communal roosts were in cattail (n = 1) and bulrush (n = 1). The one solitary roost at Lake Kissimmee was in cattail.

Discussion

Snail Kites used roosts differently at Lake Kissimmee and at WCA3A. In WCA3A kites tended to forage in areas with cypress trees (favorable for perch hunting), and move to roost sites of willow located east of the cypress in the open marsh, up to 6.3 km away. In contrast, foraging areas and roost sites on Lake Kissimmee were dispersed throughout the lake system. The distances between foraging areas and roost sites were shorter on Lake Kissimmee than those in WCA3A. We also found that the distances from foraging areas to solitary roost sites were shorter than those for kites roosting communally. This indicates that distance may be a factor influencing their decision to roost solitarily or communally. Rumbold and Mihalik (1994) followed two kites from their foraging areas to their roost sites that flew distances of 7.0

and 18.5 km, respectively. They also reported birds foraging up to 37 km from the closest known roost site and speculated that birds may travel that distance to roost. However, they could not verify that birds actually traveled that distance, and we have observed (REB, pers. obs.) kites using roost sites in other years that were considerably closer to the foraging area they describe (i.e., there were possibly closer roost sites that were unknown to Rumbold and Mihalik).

Sykes (1985) reported that 18 of the 19 roosts he studied in WCA3A were in willow, which is similar to our data for kites roosting communally in WCA3A. The proportion of birds roosting in willows or herbaceous vegetation on Lake Kissimmee was different from that found in WCA3A; kites in the central lakes region used emergent marsh plants more frequently than those kites nesting in WCA3A. This pattern of vegetation use parallels that reported for kites nesting in these two areas (Snyder et al. 1989, Bennetts et al. 1994, J. Rodgers, Jr., pers. comm.). The difference may reflect the relative availability of woody vegetation, which tends to diminish under conditions of permanent inundation (Bennetts et al. 1994). The plant species of roost sites also

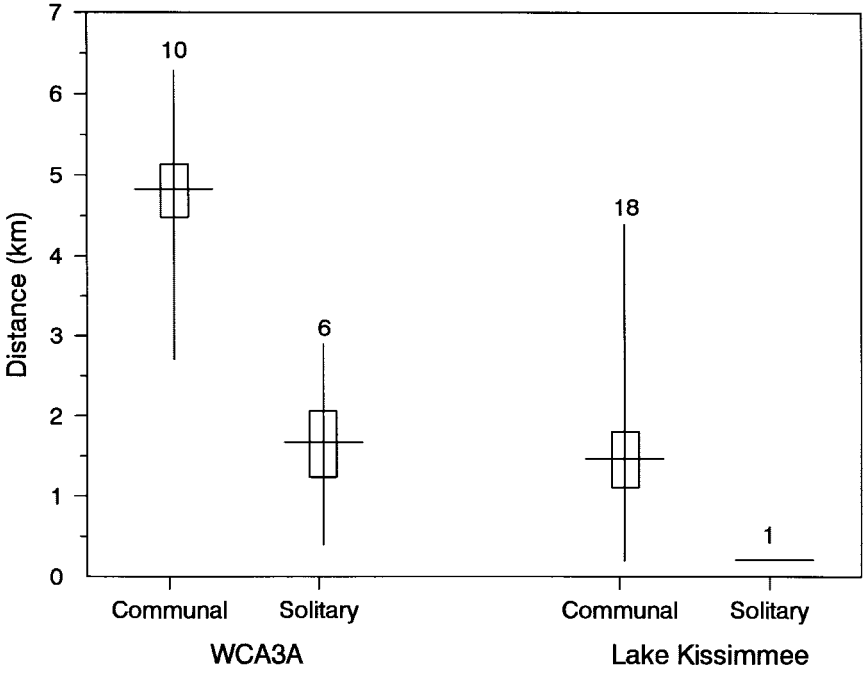

Figure 5. Mean distances (horizontal bars) flown by kites to solitary and communal roosts on Lake Kissimmee and Water Conservation Area 3A. Also shown are standard error (rectangles), range (vertical lines), and sample size.

was related to the size of the roost. All of the communal roosts in WCA3A were in willow. In contrast, four of six solitary roosts in WCA3A were in herbaceous vegetation (sawgrass), as was the single solitary roost at Lake Kissimmee (cattail). Similarly, the communal roosts on Lake Kissimmee were subdivided into smaller "satellite roosts" (in proximity) with only 3 or 4 kites per subunit. It seems apparent that the number of kites using a given roost is limited by the patch size and substrate stability. This may partially explain the predominate use of willow, when available, as a communal roost substrate. Presumably birds roosting solitarily or in small groups in herbaceous vegetation would have a greater number of options for roosting than large communal roosts confined to patches of woody substrates such as willow.

Twenty percent of the 35 birds we followed roosted alone, and an additional 37% roosted in small groups of 2 and 10 birds. The relatively high number of birds roosting alone or in small roosts has implications for surveying Snail Kite populations. One method used in the annual Snail Kite survey is to count kites at communal roosts. Rodgers et al. (1985) suggested that transect surveys of greater than 10 birds in an area indicate the presence of a communal roost, which should be counted to verify the transect count. However, our results indicate that a significant portion of the Snail Kite population may be overlooked by simply placing observers at known communal roosts, especially if smaller roosts (< 10) are not located.

Acknowledgments

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