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SNAIL KITE USE OF A DROUGHT-RELATED HABITAT AND COMMUNAL ROOST IN WEST PALM BEACH, FLORIDA: 1987-1991

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Abstract.—We monitored Snail Kites (*Rostrhamus sociabilis plumbeus*) at a communal evening roost in West Palm Beach, Florida from 1987 to 1991. Use of the roost peaked at 212 kites during a drought in 1989. The five-year mean of monthly roost counts was 30 ± 21 birds. Roost size was generally largest from April through September. Kite numbers usually decreased as water levels dropped in the West Palm Beach Water Catchment Area, a large wetland system adjacent to the roost. Kites often flew in a westerly direction when departing the roost and were followed by helicopter 18 km from the roost on foraging forays. Kites nested at the site in 1991 and successfully fledged 10 young, possibly signaling reestablishment of this area as a nesting colony. These observations suggest that this roost and the surrounding wetlands are important resources to kites in years with normal rainfall as well as being a crucial refuge during drought years.

The Snail Kite (*Rostrhamus sociabilis plumbeus*) is an endangered subspecies of hawk found in Florida and Cuba (Sykes 1985). It feeds almost exclusively on freshwater apple snails (*Pomacea paludosa*) (Beissinger 1988, 1990). In Florida, kites congregate in communal roosts each evening during the non-breeding season and tend to be nomadic, moving in response to changes in water levels and prey abundance (Beissinger and Takekawa 1983, Sykes 1985, Takekawa and Beissinger 1989). During drought years, kites concentrate in areas that hold water (Sykes 1979, 1983; Beissinger and Takekawa 1983). These areas have been termed "drought-related habitats" (Beissinger and Takekawa 1983, Takekawa and Beissinger 1989).

It is known that historically Snail Kites have used the West Palm Beach area for foraging and breeding grounds. Howell (1932) stated that kites were "reported" to be breeding abundantly within the Loxahatchee Marsh in 1921 (i.e., the Loxahatchee slough; Sykes 1984). However, a search of the marsh in the spring of 1923 by Howell and H. W. Brandt failed to reveal a single kite (Howell 1932). From 1927 to early 1970 no kite sightings were reported for the area (Sykes 1984). The annual mean number of kites recorded during United States Fish and Wildlife Service (USFWS) midwinter surveys from 1967 to 1980 was 1.1 birds for the marsh (Sykes 1983). According to Florida Game and Fresh Water Fish Commission (FGFWFC) midwinter surveys, the mean number of kites for the area from 1980 to 1985 was 2.8 birds (Rodgers et al. 1988).

Then on 12 June 1985, a drought year, 372 kites were discovered in what was to be the largest communal roost encountered in Florida (Takekawa and Beissinger 1989). A single nest, the first documented for this area since the 1920s, was also discovered in June 1985 (Takekawa and Beissinger 1989). This roost was located adjacent to the West Palm Beach Water Catchment Area (WCA) on property under consideration for development by the Solid Waste Authority (SWA) of Palm Beach County. Following extensive modifications to the original site development plan and substantial mitigation procedures as required by the U. S. Army Corps of Engineers, the SWA began construction of a waste-to-energy facility and landfill on this property in 1987. One permit requirement was that the roost be monitored over a 7 year period to determine long-term use by kites. In this paper we review a portion of the data from the monitoring program. In particular, we present data on the use of this communal SWA roost and surrounding drought-related habitat by kites from 1987 to 1991.

Study Area and Methods

The Snail Kite roost was located on 24 spoil islands in an abandoned 16-ha shell excavation pit mined in the early 1960s in Palm Beach County, Florida (Lat. 26° 46'N; Long. 80° 08'W) (Fig. 1). The spoil islands consisted of overburden material and ranged from 5 to 367 m in length, with an average width of 5 m. Islands were separated by 5-6.5 m with vegetation touching among close islands. The borrow pit was flooded with fresh water to a depth of 3 m. Dominant vegetation was Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casurina spp.*), and Melaleuca (*Melaleuca quinquenervia*), all non-native species.

A wading bird roost and rookery, also at this site, was comprised of the following species in order of abundance: White Ibis (*Eudocimus albus*); Cattle Egret (*Bubulcus ibis*); Anhinga (*Anhinga anhinga*); Little Blue Heron (*Egretta caerulea*); Tricolor Heron (*E. tricolor*); Great Egret (*Casmerodius albus*); Snowy Egret (*E. thula*); Black-crowned Night-Heron (*Nycticorax nycticorax*); Green-backed Heron (*Butorides virescens*); and Great Blue Heron (*Ardea herodias*).

Local features influencing the roost include: 1) the waste-to-energy plant and landfill, constructed within 0.8 km of the roost and, 2) the WCA, a 44 km^2 remnant of the Loxa-

hatchee Slough, a marsh dominated by sawgrass (*Cladium jamaicense*) and spikerush (*Eleocharis* sp.) with scattered low hammocks. The WCA is managed as a water reservoir by the City of West Palm Beach.

From October 1986 to December 1991, we made 712 hours of visual observations, representing over 1280 man-hours. Observations and counts of Snail Kites entering and leaving the roost were made from four 5-m high observation blinds just outside the roost. Once a month, kites were counted by four observers for 60 minutes at dawn and at midday. A minimum of one evening count per month was conducted beginning at least 90 minutes prior to sunset and continuing until full darkness. We recorded arrival or departure time, flight direction, and roost island used by each kite. To avoid double counts, observers stayed in radio contact with each other. If sightings were ambiguous, they were categorized as a single sighting if birds had specific time, flight direction, and roost island in common. Water level data of the WCA were provided by the City of West Palm Beach Water Utilities.

From February through August each year, all islands were systematically searched for Snail Kite nests at least once every six weeks. Weekly observations of breeding activities also were made during this period.

Between year and monthly differences in the maximum number of kites counted at the roost were tested statistically by the Kruskal-Wallis test. If multisample null hypotheses were rejected, multiple comparisons were performed to determine which pairs of samples differed (Conover 1980). The relationship between water levels in the WCA and maximum number of kites roosting each month was evaluated by a Spearman's rank correlation using the statistical software package SYSTAT (Wilkinson 1989). The frequency distribution of flight directions used by kites departing and arriving at the roost was tested for randomness by a G-test for goodness of fit (Sokal and Rohlf 1981). Data are expressed as the mean ± 1 standard deviation. The significance level for all tests was alpha = 0.05 unless otherwise noted.

RESULTS

Size of the Roost. Snail Kites' use of the roost was nearly continuous except for the ten week interval from 17 March to 3 June 1987 (Fig. 2). The largest number of kites to use the roost during the study was 212 birds in May 1989. The 5-year mean of the maximum number of kites each month was 30 ± 21 (N=60). When pooled over the 5 year period, roost size differed significantly from month to month (T = 23.4, 11 df, $P < 0.05$). Generally, roost size peaked from April through September (45 ± 64; N=30) and was smallest from October through March (15 ± 7; N=30).

The size of the roost also differed among years (T = 11.31, 4 df, $P < 0.05$), and while 1989 had two of the highest ranked months in terms of roost size, 1991 had a higher rank sum than 1989 or any other year ($P < 0.05$). No other differences in rankings were found in pairwise comparisons of years ($P > 0.05$). Kites' use of the roost was not significantly correlated with water levels in the WCA ($r_s = -0.12$, 1 df, $P > 0.05$).

WCA Hydroperiod. Because of pumping into the WCA by the City of West Palm Beach, water levels shown in Fig. 2 do not truly reflect the severity of a 3-year drought that began in late 1988. The 5-year mean of monthly minimum water levels was 5.35 ± 0.29 m above mean sea level (msl) (N=60). More important was the number of days the WCA

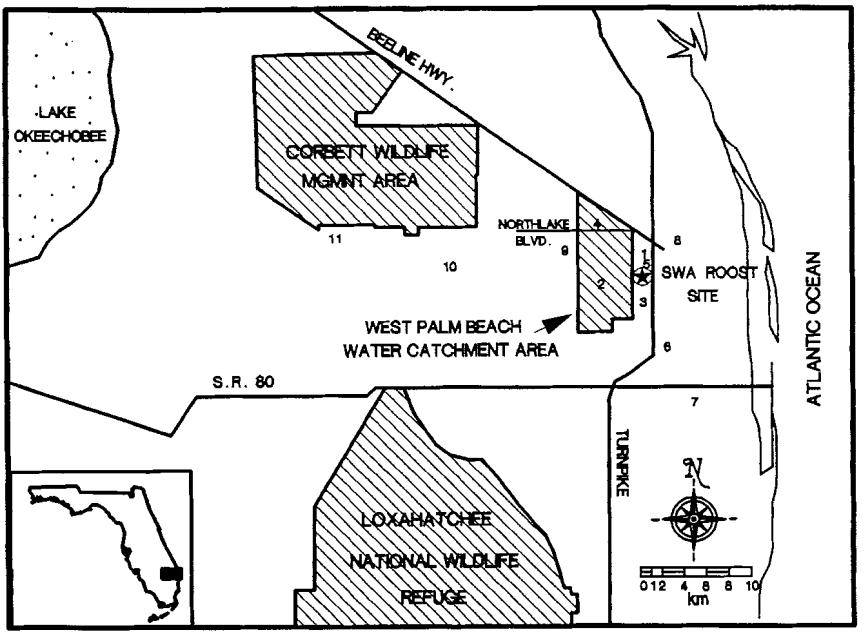

Figure 1. Area map showing regional features in the vicinity of the SWA Snail Kite roost in West Palm Beach, Florida. Numbers refer to locations identified in Table 1.

went dry each year (when water levels fall to about 5.18 above msl). The WCA went dry for 31 days in 1987, 0 days in 1988, 109 days in 1989, 150 days in 1990 and 0 days in 1991.

Flight Directions. Kites arrived and departed from the roost in a non-random fashion ($G = 1202$, 7 df, $P < 0.001$ and $G = 776$, 7 df, $P < 0.001$ respectively). They generally returned from and departed to a westerly direction (Fig. 3).

Foraging Area. Limited information was gathered over the 5-year period on the foraging areas that the Snail Kites used when roosting at the SWA site (Table 1). Most sightings were opportunistic and were not the result of systematic observations. The mean number of kites sighted during four surveys of the WCA by airboat and two helicopter searches was 2.8 ± 1.8 birds. The average size of the evening roost on or near the date of those searches was 21.25 ± 10 birds.

Kites were followed by helicopter on two occasions to Ibis Landing, a golf course development located 7.0 km northwest of the roost, and an orange grove located 18.5 km away (see Table 1). It required 42 min for a kite (joined during flight by a second individual) to fly nonstop 18.5 km from the roost directly to the orange grove. Kites did not appear to be disturbed by the helicopter.

Table 1. Sightings of Snail Kites foraging in the vicinity of the SWA roost over the 5-year period from 1987 to 1991.

Map ID No.	Location	Habitat	Distance (km) from roost	No. of sightings	No. of kites
1	SWA site	borrow pit, marsh	0.7	28	1-5
2	WCA-main	marsh	<5.6	10	1-13
3	WCA-south of SWA	marsh	1.1	3	1-4
4	WCA-north of Northlake Blvd.	marsh	6.3	1	1
5	Turnpike canal	roadside canal	1.3	52	1-6
6	Turnpike pond	roadside pool	7.0	19	1-2
7	C-51 canal	major canal	11.1	1	1
8	Steeplechase development	urban canal, ponds	4.3	1	1
9	Ibis Landing development	borrow pit, marsh	7.0	1	1
10	Orange grove	agricultural canal	18.5	1	2
11	L-8 Canal near Corbett WMA	major canal	26.9	1	1

Breeding Activities. Snail Kites did not nest at the SWA roost site from 1987 to 1990. No nesting activity was observed in 1987, but in 1988, twig carrying was noted on three occasions although no nests were produced. In 1989 and 1990, numerous courtship and pre-nesting behaviors were observed (e.g., carrying snails and twigs to the roost, increased vocalizing aerial displays, and birds remained at the roost during the day), but no nests were found. In 1991, eleven kite nests had eggs (mode = 3 eggs, 2.18 ± 0.98) at the SWA roost, and a false start and an old nest containing snail shells were found in the nearby WCA. Seven nests fledged at least one chick each (63.6% success rate). One of the unsuccessful nests (eggs missing) was rebuilt in the same location either by the same pair or another breeding pair. A total of 10 fledglings were produced from the eight nests (1.25 ± 0.46 per nest). Nests were built in Brazilian Pepper (N=7) with one nest found in a Melaleuca tree.

DISCUSSION

A small number of Snail Kites used the SWA site throughout the year and continued to forage in the surrounding wetlands over the 5-

year period from 1987 to 1991. However, during the 1989 drought a maximum of 212 Snail Kites roosted at the SWA site (Fig. 2). This number represented almost 50% of all the kites counted during the previous 1989 mid-winter annual state-wide survey by FGFWFC (Rodgers 1990). Snail Kites apparently traveled from other areas to this site during the drought. Kites also used this same roost during the previous drought in 1985 (Takekawa and Beissinger 1989).

Continual use of a roost for an extended length of time is unusual for Snail Kites. Sykes (1985) found that 89% of Snail Kite roosts were used for 3 years or less before they were abandoned. It is likely that

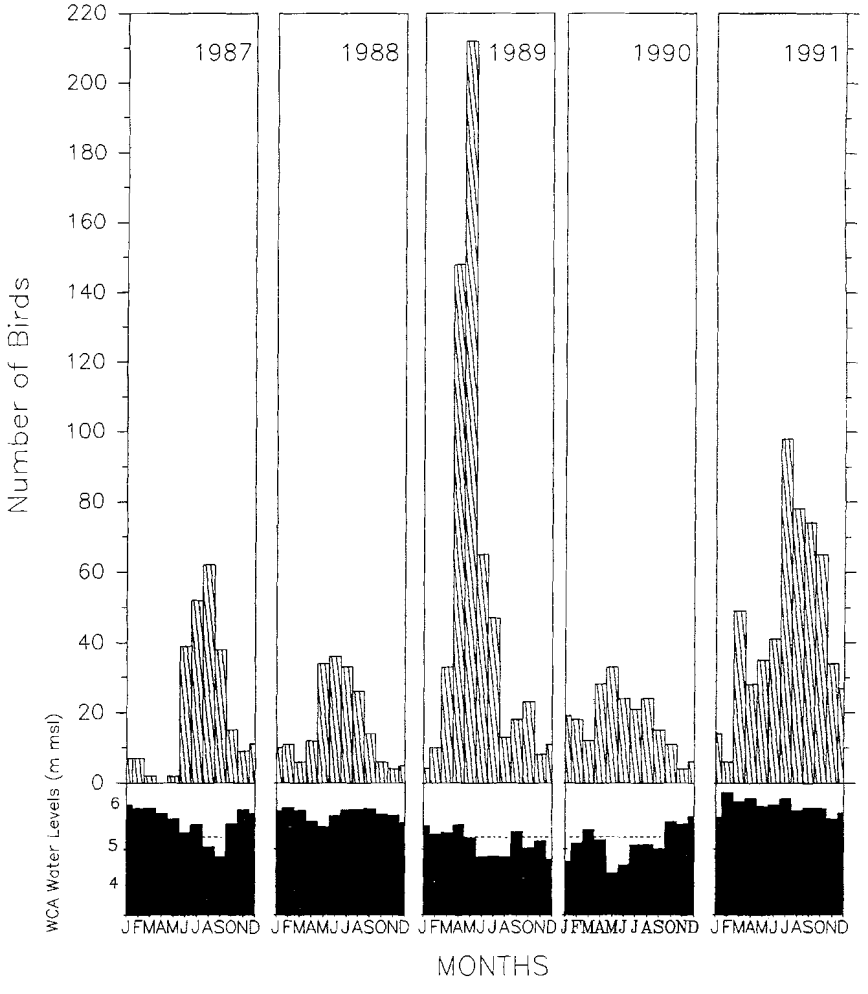

Figure 2. Snail Kite use of SWA roost compared to water levels in the West Palm Beach Water Catchment Area from 1987-1991. Monthly highs are displayed.

changing habitat conditions, particularly dropping water levels associated with droughts, lead to roost abandonment and kite dispersal from a particular area (Beissinger and Takekawa 1983, Sykes 1985). Kites began to disperse from the SWA roost when water levels were drawn down to levels that exposed the adjacent WCA marsh floor in 1987, 1989 and 1990 (Fig. 2).

The exact locations of the Snail Kites' foraging areas when roosting at this site are not known. The westerly flight pattern of most kites (Fig. 3) is not surprising in view of the lack of good habitat to the east near the cities of Riviera Beach and West Palm Beach. The most obvious area for the kites to forage is the nearby WCA, which is directly west of the roost. However, several observations suggest that kites do not rely solely on the available habitat within the WCA. First, low numbers of kites were observed during midday surveys of the WCA, even when large numbers of kites roosted at the nearby roost. Second, large numbers of kites roosted on this site long after the WCA and adjacent small wetlands went dry. For example, 47 kites roosted at the SWA site during a 34-day dry down in 1989 and 20 kites remained for six months of dry down in 1990. Finally, the large number of kites that were present in 1985 and 1989 (372 and 212, respectively) probably had to forage over an area considerably larger than the WCA to find sufficient food.

Snail Kites have been followed in a westerly direction a distance of 18.5 km from this roost. Kites have also been sighted some 9.3 - 18.5 km further west at the J. W. Corbett Wildlife Management Area and adja-

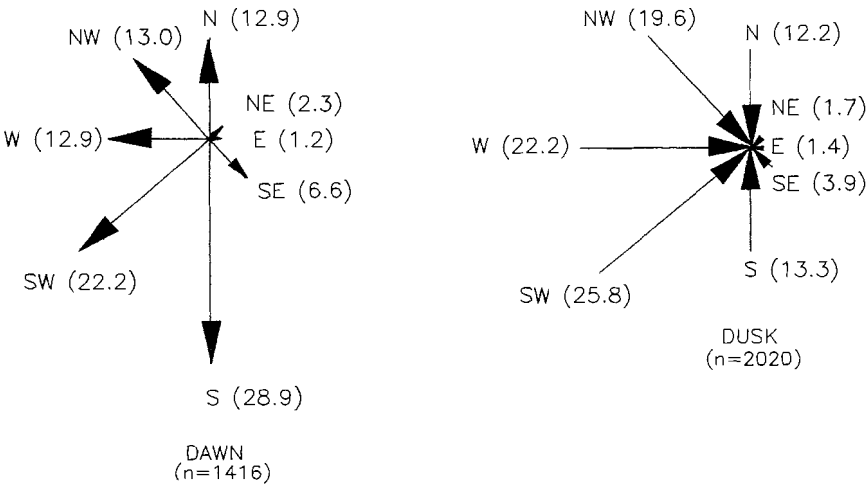

Figure 3. Flight directions and percent of Snail Kites departing roost at dawn and arriving at dusk during 1987-1991.

cent property (Laura Richards, pers. comm.). Although we do not know if these birds came from the SWA roost, these observations suggest that kites may forage up to 37 km from this roost. Foraging areas include natural wetlands, borrow pits, storm water retention ponds within urban developments, and agricultural and roadside canals (Beissinger and Takekawa 1983, Takekawa and Beissinger 1989). Additional information on the foraging sites used by the kites while in this vicinity is needed. Incremental losses or degradation of the isolated wetlands may drastically affect the carrying capacity of the area.

Ultimately, apple snail abundance and availability, as well as the distance from the roost to foraging areas, may be the significant factors that influence kite use or abandonment of a roost. Even if the WCA was not the kites' sole foraging area, its changing water levels undoubtedly were a source of some of the variability in kite use of the SWA roost. However, numbers of roosting kites were not correlated with water levels in the WCA. This suggests that by itself water level in the WCA is not a good predictor of kite use of the SWA site. This is not surprising because snail abundance depends not only on water levels at a given moment but also on the recent hydroperiod of the area, including the frequency and duration of recent drydowns, as well as other factors. Apple snails are usually abundant only in areas that have been continuously wet for several years (Sykes, 1983).

The number of kites residing at the SWA site was strongly dependent on conditions elsewhere in Florida and seasonality. The large numbers of kites present at this roost coincided with times of low water in the Everglades Water Conservation Area-3A (WCA-3A) (Dade and Broward Co.) and at Lake Okeechobee in 1985 and 1989 (Takekawa and Beissinger 1989). Conversely, in 1987 when conditions in WCA-3A permitted nesting (Bennetts et al. 1989), the kite population did not increase at the SWA roost until mid-to-late summer (Fig. 2). This pattern of increase in SWA roost size in mid-to-late summer was typical for most years with normal rainfall, and may be part of a regular pattern of dispersal from southern Florida to the east coast corridor which follows the breeding season (Beissinger and Takekawa 1983).

Snail Kites successfully nested at the SWA roost in 1991, possibly indicating a reestablishment of this area as a nesting site. According to the FGFWFC 1991 Summer Breeding Snail Kite Survey, the number of nests located at this site represented 3.4% of the state-wide nesting population and was the southern most site that kites nested in Florida (Rodgers 1991). The production of 1.25 young per successful kite nest at the SWA site is low when compared to the average of 2 young per successful nest documented by Synder et al. (1991) on Lake Okeechobee and in WCA-3A. The cause of the relatively low number of offspring per

nest is unknown. However, it could indicate an inability to feed young due to low food resources in the area (S. Beissinger, pers. comm.).

In conclusion, the SWA roost is a drought-related habitat that is not only crucial to the kites in low water years, but with its associated wetlands it is also important in years with normal rainfall. This is evidenced by a resident kite population, even in wet years, and the successful nesting that occurred in 1991. The WCA appears to provide very important habitat for this kite population. Takekawa and Beissinger (1989) have recommended that the WCA be declared a kite sanctuary. This recommendation seems logical and necessary for the long term protection of kites in this portion of their range. The hydroperiod in the WCA should be managed to assure adequate foraging habitat for kites during droughts. Coordination between the South Florida Water Management District and the City of West Palm Beach is necessary to ensure that the WCA remains wet during times of drought and provides adequate foraging opportunities for kites.

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LITERATURE CITED

BEISSINGER, S. R. 1990. Alternative foods of a diet specialist, the Snail Kite. Auk 107:327-333.

BEISSINGER, S. R. 1988. The Snail Kite. Pages 148-165 *in* Handbook of North American birds, Vol. 4 (R. S. Palmer, ed.). Yale University Press, New Haven.

BEISSINGER, S. R., AND J. K. TAKEKAWA. 1983. Habitat use by and dispersal of Snail Kites in Florida during drought conditions. Fla. Field Nat. 11:89-106.

BENNETTS, R. E., M. W. COLLOPY, AND S. R. BEISSINGER. 1989. Nesting ecology of Snail Kites in Water Conservation Area 3A. U.S. Army Corps of Engineers, South Florida Water Manage. Dist., Florida Coop. Fish and Wild. Research Unit. Report No. 09/8930005.

CONOVER, W. J. 1980. Practical nonparametric statistics, 2nd ed. John Wiley and Sons, New York.

HOWELL, A. H. 1932. Florida Bird Life. Coward-McCann, Inc., New York.

RODGERS, J. A., JR., S. T. SCHWIKERT, AND A. S. WENNER. 1988. The Status of the Snail Kite in central and south Florida: 1981-1985. Am. Birds 42:30-35.

RODGERS, J. A., JR. 1990. Annual Snail Kite survey and habitat assessment. Florida Game and Fresh Water Fish Commission Report No. 7520, Gainesville.

RODGERS, J. A., JR. 1991. Annual Snail Kite survey and habitat assessment. Florida Game and Fresh Water Fish Commission Report No. 7520-El-II-H-l, Gainesville.

SOKAL, R. R., AND F. J. ROHLF. 1981. Biometry. W. H. Freeman and Co., New York.

SYKES, P. W., JR. 1979. Status of the Everglades Kite in Florida—1968-1978. Wilson Bull. 91:495-511.

SYKES, P. W., JR. 1983. Recent population trend of the Snail Kite in Florida and its relationship to water levels. J. Field Ornithol. 54:237-246.

SYKES, P. W., JR. 1984. The range of the Snail Kite and its history in Florida. Bull. Florida State Mus. 29:214-264.

SYKES, P. W., JR. 1985. Evening roosts of the Snail Kite in Florida. Wilson Bull. 97:57-70.

SYNDER, N. F. R., S. R. BEISSINGER, AND R. E. CHANDLER. 1991. Reproductive and demography of the Florida Everglade (Snail) Kite. Condor 91:300-316.

TAKEKAWA, J. E., AND S. R. BEISSINGER. 1989. Cyclic drought, dispersal, and the conservation of the Snail Kite in Florida: lessons in critical habitat. Conserv. Biol. 3:302-311.

WILKINSON, L. 1989. Systat: the system for statistics. Systat, Inc., Evanston.