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SNAIL KITE NESTING ACTIVITY IN THE BLUE CYPRESS MARSHES DURING THE 2000 AND 2001 BREEDING SEASONS

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ABSTRACT

During the spring of 2000 and 2001, the Blue Cypress Marsh Conservation Area and the Blue Cypress Water Management Area (collectively referred to as the BCM) within the watershed of the upper St. Johns River were surveyed to determine the breeding activity of Snail Kites (*Rostrhamus sociabilis plumbeus*). A total of six nests were located within this area in 2000, but only one in 2001. There has been a general decrease in nesting activity and nest success in the BCM since 1992, though it is unlikely that low apple snail densities or habitat change are contributing factors. A recent study by Dreitz et al. (2002) was unable to detect any significant change in the Florida snail kite population or the rate of population change, suggesting reasons other than population decline are affecting the numbers of kites nesting and frequenting the BCM. Kites exhibit considerable variation in their spatial and temporal distribution, as well as areas of concentrated nesting activity. Breeding activity of snail kites is monitored annually in the watersheds of the Everglades, Lake Okeechobee, the Kissimmee River Valley and Loxahatchee Slough. During the 2000 breeding season, the majority of nests were located on the western side of Water Conservation Area 3A (WCA3A), while in 2001 98% of the nesting activity was located on East and West Lake Tohopekaliga and Lake Kissimmee. The total number of nests found in all of the surveyed areas in 2000 (166) was more than three times that of the 2001 total (49). The 2001 breeding season was impacted by a widespread drought, resulting in the complete absence of nesting activity and the dispersion of kites from virtually all of the surveyed wetlands, with the exception of the aforementioned central Florida lake habitats. During such events, smaller, hydrologically disjunct wetlands (such as the BCM) and lacustrine systems become increasingly important to the kites as areas of refuge. Had the BCM been less affected by the 2001 drought, the number of kites frequenting the area and the nesting activity could have been substantially higher. A variety of smaller, isolated wetlands are important for creating a mosaic of hydrologic regimes in the network of wetlands used by snail kites in central and southern Florida.

INTRODUCTION

The snail kite (*Rostrhamus sociabilis plumbeus*) is an endangered raptor that inhabits flooded freshwater areas and shallow lakes in peninsular Florida and Cuba (Sykes 1984, Sykes et al. 1995). The historical range of the snail kite covered over 4000 km^2 (2480 mi^2) of Florida, including the panhandle region (Sykes et al. 1995), but is now restricted mainly to the watersheds of the Everglades, Lake Okeechobee, Loxahatchee Slough, the Kissimmee River, and the Upper St. Johns River. These habitats exhibit considerable variation in their physiographic and vegetative characteristics, and include graminoid marshes (wet prairies, sloughs), cypress swamps, lake shorelines, and even some highly disturbed areas such as agricultural ditches or retention ponds (Bennetts and Kitchens 1997a). Two features that remain constant in the variety of selected habitats are the presence of apple snails and areas of sparsely distributed emergent vegetation (Sykes 1983b, 1987a), both of which are critical to the nesting and foraging success of the snail kite.

Snail kites are dietary specialists, feeding almost exclusively on one species of aquatic apple snail, *Pomacea paludosa* (Sykes 1987a, Sykes et al. 1995). They use two visual foraging methods, either flying 1.5-10m above the water surface or hunting from a perch (Sykes 1987a) and both require open water or sparse vegetation. Kites usually nest in woody vegetation overhanging water, such as willows, bald cypress, wax myrtle, elderberry, etc. (Beissinger 1988, Bennetts et al. 1988). The snail kite's survival depends on those hydrologic conditions that support these specific vegetative communities and subsequent apple snail availability in at least a subset of wetlands across the region each year.

Wetland habitats throughout central and southern Florida are constantly fluctuating in response to climatic or managerial influences, resulting in a mosaic of hydrologic regimes. Snail

kites respond to these fluctuations through regular movement among the network of wetlands in central and southern Florida (Bennetts and Kitchens, 1997a, 1997b). Hydrologic conditions are likely to be similar among wetlands within the same watershed, making wetlands in multiple watersheds extremely important for increased habitat variation (Bennetts and Kitchens 1997a, 1997b). Wetlands such as the Blue Cypress Marsh Conservation Area and the Blue Cypress Water Management Area (referred to collectively as the BCM) that are essentially hydrologically disjunct from other major wetlands are an extremely important component to the long-term viability of snail kites in Florida.

This report will present data on the abundance and breeding activities of snail kites in the BCM for the reproductive years 2000 and 2001, as well as comparative data for other wetlands in the central and south Florida wetland network. This monitoring is required by the biological opinion (FWS Log No: 4-1-96-246 [amended]).

STUDY AREA

The BCM comprise approximately 6,000 ha (15,000 ac) of marsh within the Upper St. Johns River Basin in Indian River County, FL (Figure 1). Toland (1991, 1992, and 1994) describes the vegetation and hydrologic characteristics of the BCM. This area is a small part of the network of wetlands that are monitored for snail kites each year.

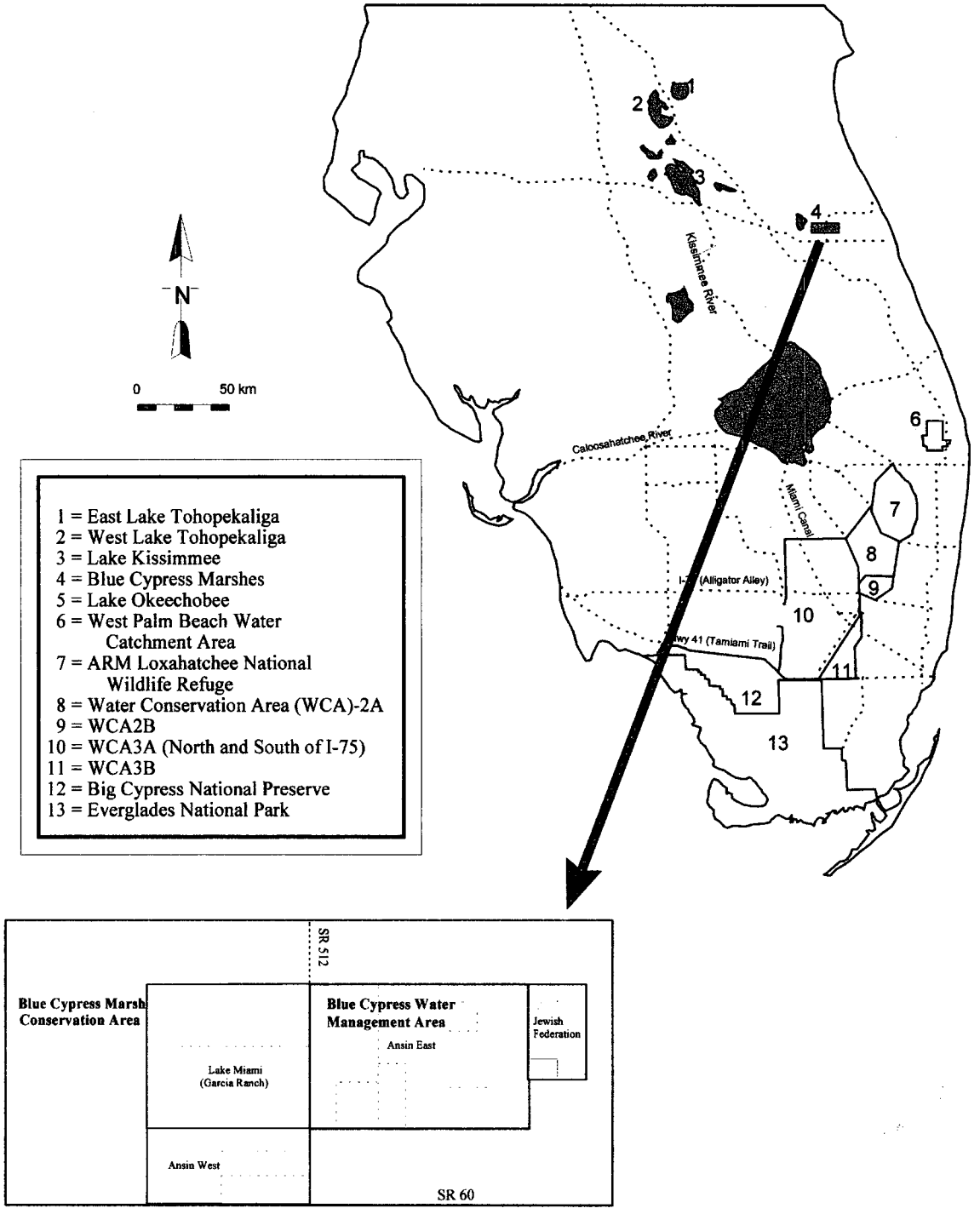


Figure 1. Wetland areas monitored for snail kite nesting activity in central and southern Florida during the 2000 and 2001 breeding seasons. Notice the relative isolation, both spatially and hydrologically, of the Blue Cypress Marshes (not to scale) in relation to the other monitored wetlands.

The population of snail kites is best viewed as one continuous population that is distributed among a network of heterogeneous wetland units in central and southern Florida (Bennetts and Kitchens 1997a, 1997b). They use the entire spatial extent of their range, exhibiting considerable interchange among wetland units (Rodgers and Stangel 1996, Bennetts and Kitchens 1997a, 1997b). Our study area includes a large portion of these different wetland units used by snail kites in peninsular Florida.

METHODS

Sampling Duration. During the 2000 and 2001 breeding seasons, snail kite nests were monitored from March to June. This time period coincides with the occurrence of peak nesting activity in this population of snail kites (Bennetts and Kitchens 1997a).

Sampling Methods. Six consecutive surveys were conducted each year throughout the BCM and other designated wetland units (Figure 1) from March to June at 2-3 week intervals. The surveys followed a format similar to the quasi-systematic transects conducted by airboat for the annual count (Sykes 1979, 1982; Rodgers et al. 1988, Bennetts et al. 1994). In other words, transects were run in general directions and locations each survey, rather than with specific coordinates, so as to fully survey the area to the extent the water levels and vegetation structure allowed. Six surveys were conducted each year from March through June in 2000 and 2001.

Nest monitoring followed guidelines suggested by Bennetts (1988 et. al). Though some studies (Beissinger 1986, Snyder et al. 1989) have considered nest building (prior to egg laying) as the beginning of a breeding/nesting attempt, we followed the protocol of Steenhof (1987) who considered a nesting attempt to begin with the laying of the first egg. This definition was preferred for this species because pair bonds are not often established before eggs are laid. Failures at this stage are more appropriately deemed courtship failures rather than nesting

failures (Bennetts et al. 1994). A nest was considered successful when at least one young reached 24 days of age (80% of the age of first flight) (Steenhof and Kochert 1982). After this time, fledglings begin to leave the nest and may or may not be found in the immediate vicinity of the nest.

Nests were checked with a telescoping mirror pole to determine their status. Water depths at each nest were determined by placing a meter stick vertically into the water column until it rested on the sediment. Nesting substrate and height were also recorded.

Analysis. For nest success estimates we used only those nests found during the egg laying stage to eliminate biases (e.g. overestimation of nest success) associated with finding nests after hatching. The Mayfield method (Mayfield 1961, 1975) takes into account such biases (Hensler and Nichols 1981), but not enough nests were present in this study to satisfy the suggested sample size (n=20) (Hensler and Nichols 1981) for such an analysis. Thus, nest success was determined using only those nests found during the egg stage and is defined as the number of successful nests/the number of nests.

RESULTS

Spatial and temporal distribution of snail kite nesting activity

In 2000, 6 nests were reported in the BCM and only 1 in 2001. Statewide, 166 nests were found in 2000, while only 49 nests were found in 2001(Table 1). 29 of the 49 nests in 2001 were on Lake Kissimmee where monitoring is performed by Jim Rodgers of the Florida Fish and Wildlife Conservation Commission (FFWCC). The overwhelming majority of nesting activity in 2001 took place on 3 lakes within our study areas, as 48 of the 49 nests were located on Lake Kissimmee, East Lake Tohopekaliga and West Lake Tohopekaliga.

Table 1. *Estimations of Snail Kite nesting success for 2000 and 2001 in the BCM and other wetland units surveyed in central and southern Florida.*

	2000		2001	
AREA	**# Nests**	**# Successful**	**# Nests**	**# Successful**
Blue Cypress Marshes (BCM)	6	1	1	1
Big Cypress National Preserve	–	–	–	–
Everglades National Park	10	9	–	–
Lake Kissimmee	–[2]	–[2]	29[2]	9[2]
Lake Okeechobee	–	–	–	–
East Lake Tohopekaliga	Unknown[3]	Unknown[3]	4	4
West Lake Tohopekaliga	6	2	15	4
Loxahatchee Nat'l Wildlife Refuge	–	–	–	–
Water Conservation Area-2A	–	–	–	–
Water Conservation Area-2B	–	–	–	–
Water Conservation Area-3A	105	43	–	–
Water Conservation Area-3B	26	15	–	–
WPB Water Catchment Area	3	–	–	–
TOTAL	**156**[1]	70	**49**	18

[1] 10 nests were excluded from our analysis as their success was unknown

[2] Nest monitoring on Kissimmee is conducted by Jim Rodgers of the FFWCC – only 2001 data is shown

[3] No monitoring was performed on East Lake Tohopekaliga in 2000

Nest-site characteristics

In the BCM from 1990-1999, the average percentage of nests in coastal plain willow (*Salix caroliniana*) was 39%, while the average percentage of nests in cypress was only 11%. In 2000 and 2001, however, willows were not used at all, while 5 out of 7 (67%) nests in the BCM were cypress. The other two substrates used were cabbage palm (*Sabal palmetto*) and pond apple (*Annona glabra*). Cypress (*Taxodium* spp.) was the most common nesting substrate statewide in the 2000 breeding season, while pond apple (*Annona glabra*) was the most common from 1996-1999. Cattail (*Typha* spp.) was the most common substrate used in 2001, due to 48 of the 49 nests having occurred in lakes, where other substrates are less available, particularly under low water conditions.

Nesting Success

Statewide nest success for 2000 was 35%, the highest success rate since 1997 (46%). This rate falls within the range of 32% (Snyder et al. 1989) to 50% (Sykes 1987b). Nest success in the BCM was only 16.7% (1 of 6 nests) in 2000, and in 2001 the single nest in the BCM was successful. The 2000 rates are higher than reported for 1998 in the BCM, though still well below the rates reported from 1991-1996 (Table 2).

Table2. *Nesting success of snail kites reported for Blue Cypress Marshes from 1991 to 2001.*

Year	n	Nest Success	# Fledged	Source
1991	39	20.5%	17	Toland 1991
1992	59	56.0%	68	Toland 1992
1993	43	32.5%	26	Toland 1994
1994	4	25.0%	2	Bennetts and Kitchens 1994
1995	20	20.0%	7	Bennetts et al. 1995
1996	16	44.0%	15	Dreitz et al. 1996
1997	26	18.0%	7	Dreitz et al. 1997
1998	9	11.0%	1	Dreitz et al. 1998
1999	12	16.7%	3	Dreitz et al. 1999
2000	6	16.7%	2	Welch et al. 2000
2001	1	100.0%	3	This study

Productivity

102 young were successfully fledged from the nests that were monitored in the 2000 breeding season, and only 16 were fledged in 2001. The productivity, or number of young fledged/successful nest, was 1.76 in 2000 and 1.78 in 2001; up from 1999 but well below the 1997-1998 levels (Table 3).

Table 3. *Productivity, or the number of young fledged/successful nest, for the 1997-2001 breeding seasons.*

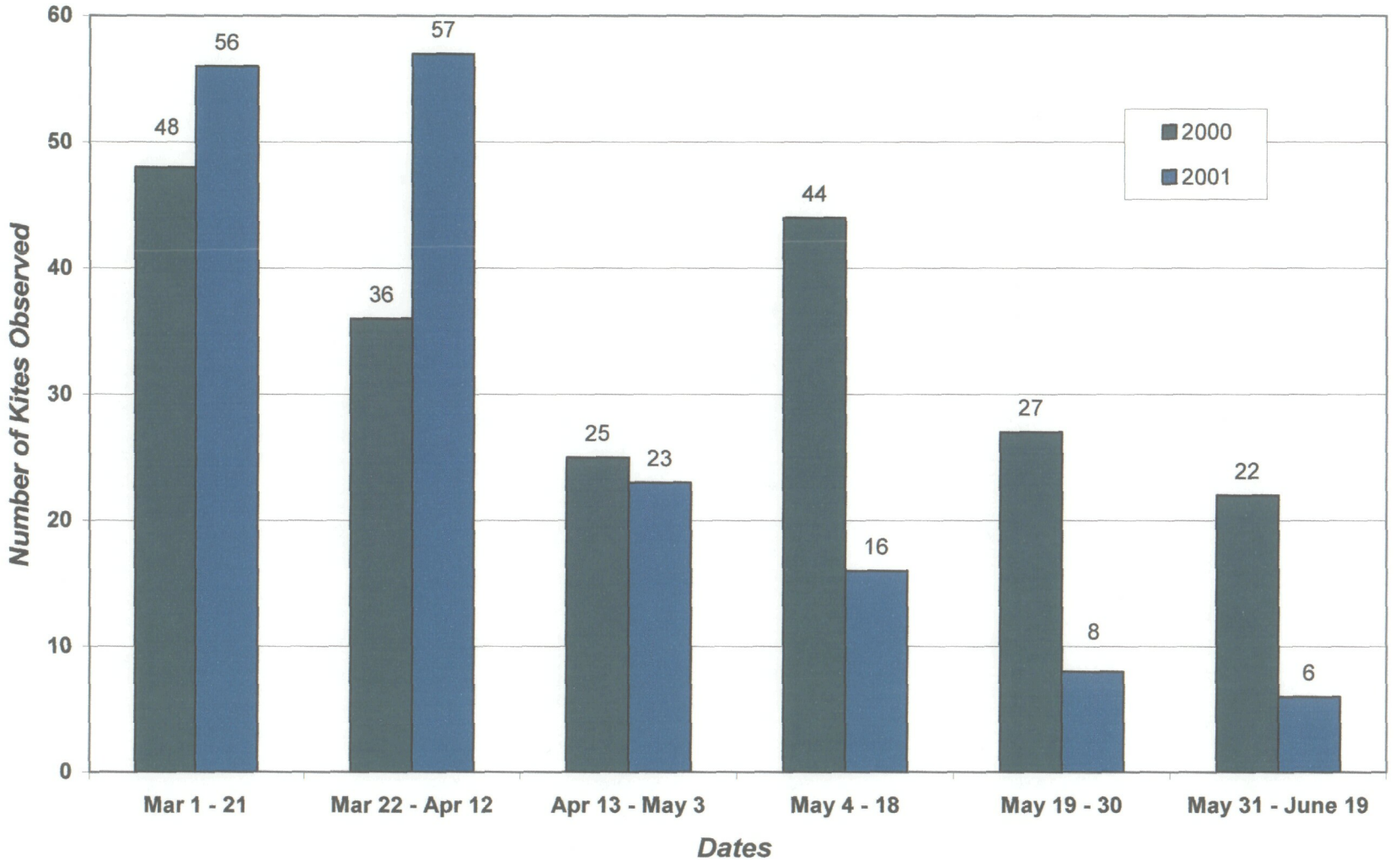
Year	Total Nests	Successful Nests	Total Individuals	Productivity
1997	344	157	340	2.17
1998	389	102	205	2.01
1999	92	18	25	1.39
2000	166	58	102	1.76
2001	49[1]	18[1]	28[1]	1.78[1]

[1] *These figures include data from Lake Kissimmee, while 1997-2000 do not*

Snail Kites Observed in the BCM and Other Surveyed Wetlands

Six surveys were conducted in the BCM from March 1 - June 5 of 2000 and six more from March 15 – June 15 of 2001. The number of kites counted ranged from 48 in March, 2000 to 22 in June, 2000 and from 56 in March, 2001 to 6 in June, 2001 (Figure 2). This range is similar to the ranges observed in previous years: 1999, 10-84 birds (Dreitz et. al. 1999); 1998, 18-51 (Dreitz et al. 1998); 1997, 31 to 129 (Dreitz et al. 1997); 1996, 20 to 74 (Dreitz et al. 1996); 1995 13 to 41 (Bennetts et al. 1995); and 1994, 7 to 30 (Bennetts and Kitchens 1994).

Figure 2. Snail kites observed on six surveys in the Blue Cypress Marshes during the 2000 and 2001 breeding seasons.



The largest number of kites observed in the statewide monitoring, or the combination of all the surveyed wetlands, was 526, observed from March 1 to March 20 (Figure 3). In 2001, the largest number of kites observed (474) was on the third survey, from April 7 to May 3. There was a sharp decline in the total number of birds as well as a shift in the distribution during the middle of the 2001 season (Figure 3). Statewide, the total number shifted from 474 to 277 birds from mid April to mid May, similar to the decline from 57 to 16 birds observed in the BCM during the same time period. The total number of birds observed in the Water Conservation Areas declined from 289 in mid April to 40 in mid May. The lake habitats, however, showed a different trend, as their totals went from 99 in mid April to 138 in mid May (Figure 4). Such a trend was not evident for the 2000 breeding season (Figure 5).

Figure 3. Snail Kites observed on six statewide surveys during the 2000 and 2001 breeding seasons.

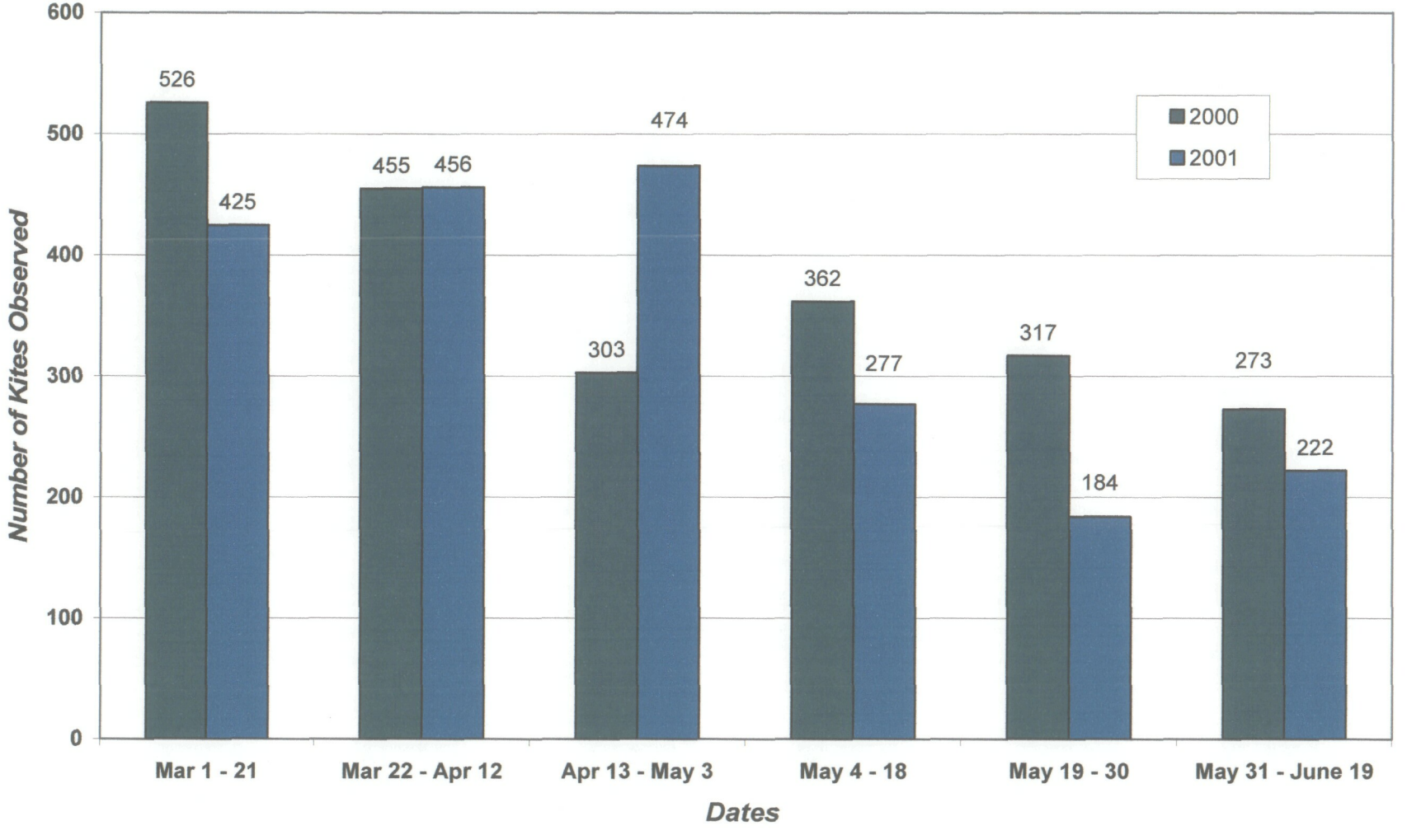


Figure 4. Snail Kites observed in Water Conservation Areas, Blue Cypress Marshes and Lakes (only Kissimmee and West Tohopekaliga) for the 2001 breeding season.

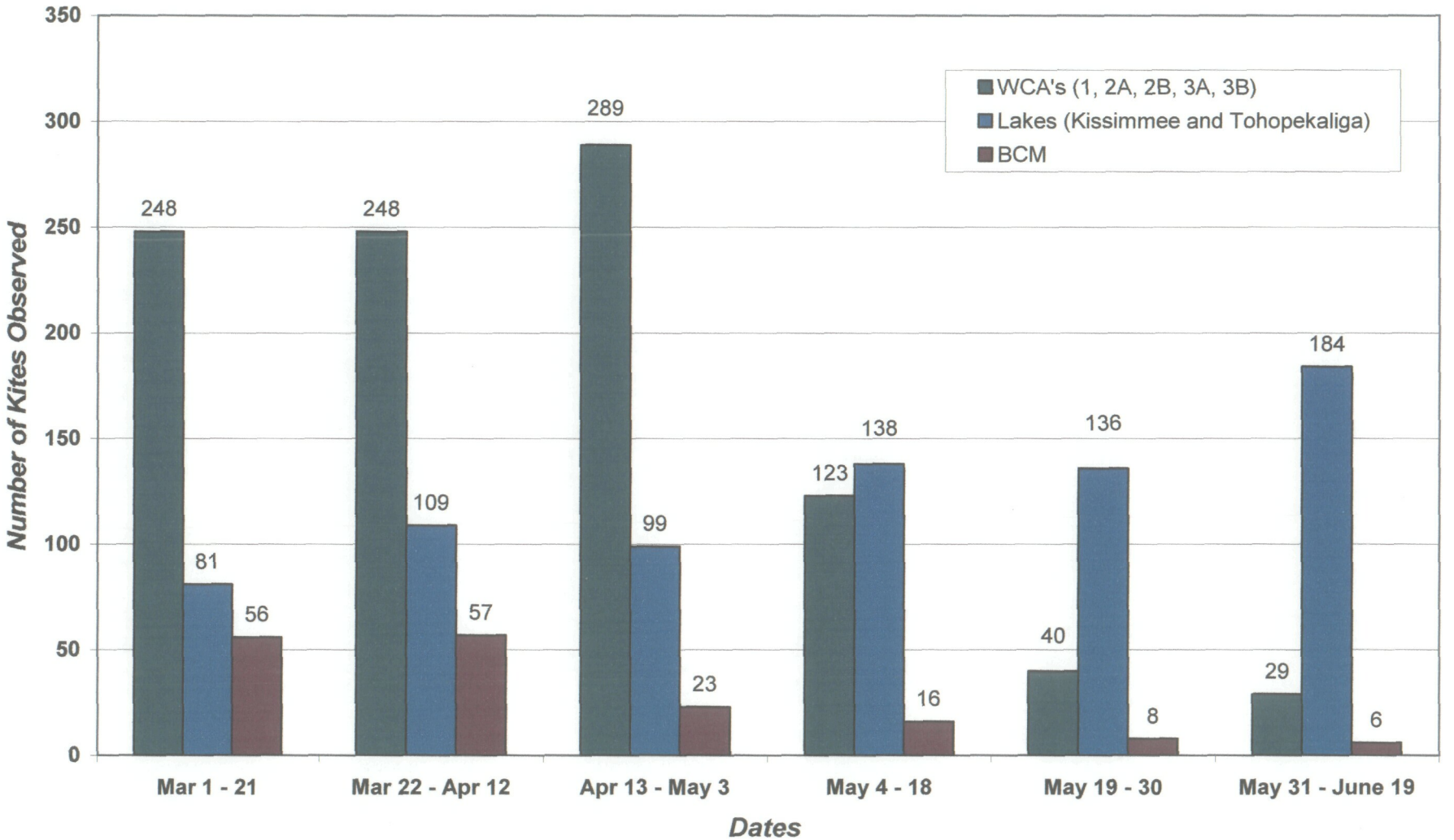
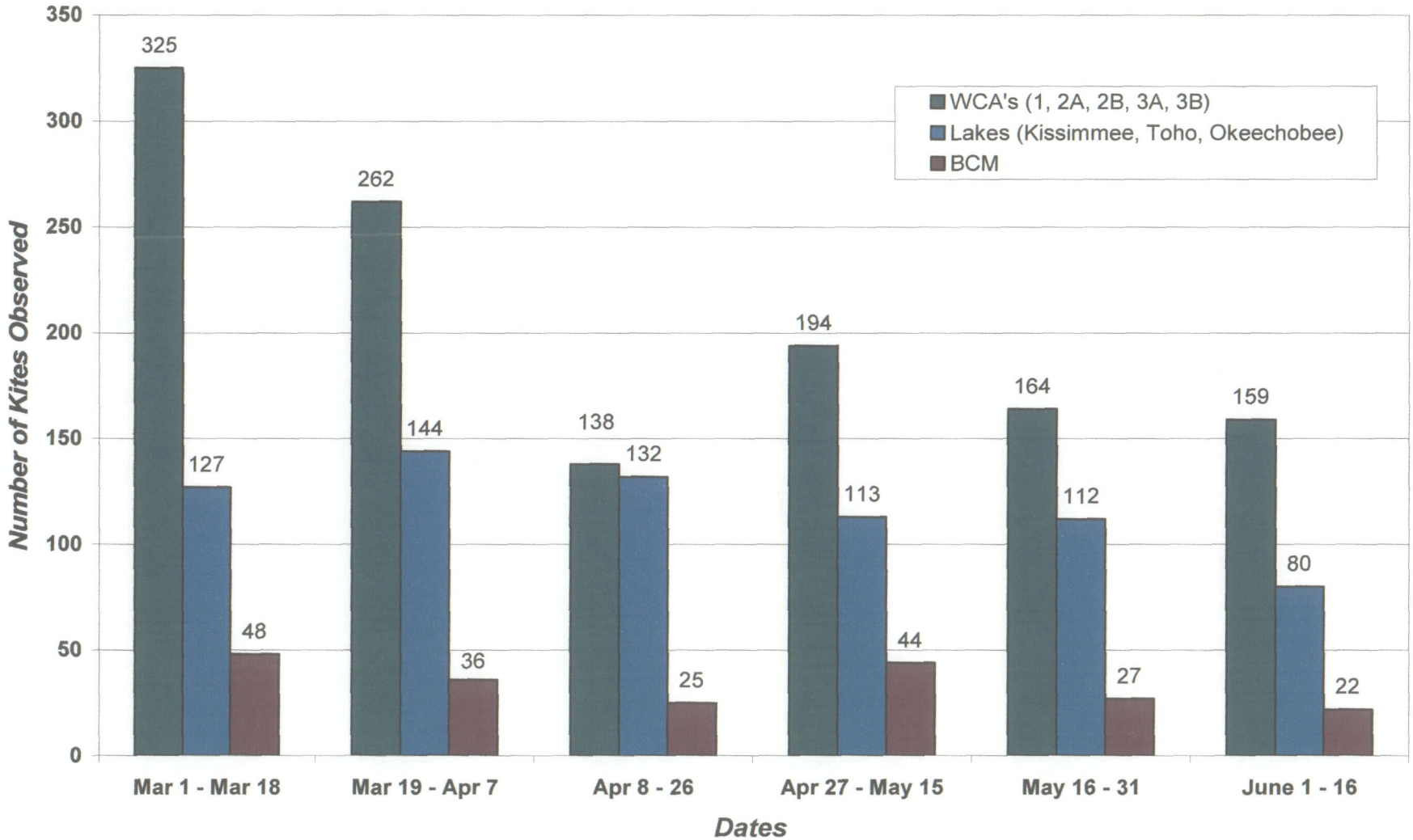


Figure 5. Snail Kites observed in Water Conservation Areas, Blue Cypress Marshes and Lakes (Kissimmee, West Tohopekaliga and Okeechobee) during the 2000 breeding season.



Sightings of Snail Kites Banded in Blue Cypress Marshes

Nineteen individual snail kites that were originally banded in the BCM either as juveniles or adults from 1991-1998 were seen throughout central and southern Florida in the 2000 and 2001 breeding seasons (Table 4). Most of the individuals observed were still in the BCM. Other wetland areas where BCM kites were observed included; West Palm Beach Water Catchment Area, Lake Kissimmee, Water Conservation Area 3A, and Northeast Shark River Slough (Everglades National Park).

Table 4. *Snail kites originally banded in the Blue Cypress Marshes and resighted during the 2000 or 2001 breeding seasons.*

YOB[1]	B_Age[2]	Sex	Band ID (Leg color #)	Location[3]	Date	Comments
.	AD[4]	F	R-BLUE-1V	Kissimmee	3/21/00	Also on 5/9/01, 5/25/01, 6/8/01
.	AD	F	R-BLUE-1Z	BCM	3/1/00	Also on 3/15/01, 4/5/01
.	AD	M	R-BLACK-6M	BCM	4/16/00	
.	AD	M	R-BLUE-4V	BCM	3/15/01	
97	JUV[5]	F	R-BLUE-32	NESRS	4/24/00	
92	JUV	F	L-BLUE-5B	NESRS	4/24/00	
96	JUV	M	R-BLUE-3X	BCM	3/1/00	
95	JUV	M	R-BLUE-1X	BCM	3/1/00	
95	JUV	M	R-BLUE-3Y	BCM	3/26/00	Also on 3/15/01, 4/5/01, 5/10/01
95	JUV	F	R-BLUE-5Z	BCM	3/26/00	Also on 4/5/01, 5/10/01
92	JUV	M	L-BLUE-6B	BCM	5/19/00	
92	JUV	F	R-BLUE-3A	BCM	3/1/00	
96	JUV	F	R-BLUE-3Z	WCA-3A	4/24/00	
92	JUV	F	R-BLUE-4B	Catchment	3/17/00	
96	JUV	M	R-BLUE-4V	BCM	3/15/01	

[1] *YOB=Year of Birth if known.*
[2] *B_Age=Age at the time of Banding*
[3] *Locations: BCM=Blue Cypress Marshes, Catchment=West Palm Beach Water Catchment Area, Kissimmee=Lake Kissimmee, WCA-3A=Water Conservation Area 3A, NESRS=Northeast Shark River Slough, Everglades Nat'l Park*
[4] *AD = Adult*
[5] *JUV = Juvenile*

DISCUSSION

Snail kites are known to be nomadic species, shifting their distributions in response to temperature (Sykes 1983a, Sykes et al. 1995, Bennetts and Kitchens 1997a), hydrology, food availability, vegetation growth, nutrient loads, or other habit changes (Beissinger and Takekawa 1983, Bennetts et al. 1988, 1994). Such spatial and temporal variation of kite distributions makes it important to consider the entire study area when making inferences of the population.

Considerable declines in the number of kites or number of successful nests in one area does not necessarily imply population declines, or even habitat degradation in that area. Some smaller wetlands, for example, may only see significant kite use during years that other larger wetland systems exhibit unfavorable conditions (Bennetts and Kitchens 1997a). Recent studies have also suggested that kites may actually increase their movement during times of food abundance, rather than under stressful conditions. (Bennetts et al. 2000). This exploratory behavior is probably important for kites in determining where available habitats are, so that they can quickly relocate when necessary.

The 2001 breeding season offered a unique opportunity to observe kite behavior in times of drought, as many of the primary wetland units were dry for the majority of the breeding season, including Lake Okeechobee, Everglades National Park, Big Cypress, WCA3B and even much of WCA1, WCA2A, WCA2B, WCA3A, and the BCM. The drying of these habitats was evident in the decline of the number of kites surveyed between mid April and mid May of 2001 (Figure 4). The two northern lake habitats (Kissimmee and Tohopekaliga), however, did not reflect the same decrease in surveyed kites throughout the season (Figure 4). These lakes maintained high enough water levels to provide refuge for kites, though many probably dispersed

to other peripheral habitats, like agricultural ditches and reservoirs (Bennetts and Kitchens 1997a).

The effects of the drought in 2001 were also evident in the BCM where nesting activity was lower than had been previously recorded (Table 1). The numbers of kites surveyed in the BCM also reflected the low water levels, dropping from 57 in mid April to 16 in mid May (Figure 4). Such a dramatic decline in numbers was not expressed in 2000, where over the same period of time the total birds surveyed in the BCM went from 25 to 27.

Although nesting activity in the BCM has basically declined since 1992, the exact cause cannot easily be determined. For example, the BCM may simply be used more as a refuge by the kites, only using it extensively when other areas are drier, or have lower food availability. This would not imply that the BCM are of less importance to the kite population, but rather they and other smaller, hydrologically disjunct wetlands are extremely important to kites during times of food scarcity, drought, or other factors that necessitate large scale shifts in distribution.

Had the drought in 2001 been more localized and restricted to the southern portions of the state and the BCM been less affected, more kites may have used the area, much as they used the northern lakes in the latter part of the 2001 season. There were a large number of kites foraging in West Ansin of the BCM early in the breeding season before our first survey; well over 50 within one cell (personal observation). However, as water levels decreased, the kites moved out of the area. It is possible that water levels were too low at the beginning of the breeding season for many of the kites to even attempt nesting. In WCA3A, where the majority of nesting activity took place in 2000, no nests or courtship activity (calls or displays) were ever observed in the 2001 breeding season. Additionally, the littoral marshes of Lake Okeechobee, WCA3B, and the Everglades National Park were mostly dry before March.

The recent decline in kite use and nesting activity in the BCM is not believed to be a result of a decreasing population. Recent studies by Dreitz et al. (2002) have been unable to discern any significant change in the total population of the snail kite in Florida (Figure 6) or the rate of population change (Figure 7). When the surveyed habitats dry down and the kites disperse, fewer nests are observed and marked birds are seen less frequently. Fewer marked birds were seen in 2001 than in 2000 or 1999, most likely as a result of dispersion to un-surveyed, peripheral habitats rather than population decline.

The fact that kites are still nesting in the BCM, albeit minimally, suggests that the habitat is at least sufficient for reproduction. During the 2000 and 2001 breeding season surveys, 10 of the kites banded in the BCM from 1992-1996, either as juveniles or adults, were still observed in the BCM (Table 4). Birds banded in other locations still frequent the BCM as well, which again suggests suitable habitat. Through 2000 and 2001 kites that were banded in WCA3A, WCA2B, Lake Okeechobee, Lake Tohopekaliga, Lake Jackson and Northeast Shark River Slough were observed in the BCM. It is very likely that kites from other areas also frequent the BCM, though without bands the quantity and origin of those birds are unknown. Also of interest, a snail kite banded as a juvenile in 1979 in WCA3A was seen in the BCM in 2001, one of the oldest birds ever reported (>22yrs).

Figure 6. Population estimates of the snail kite in Florida for 1997 to 2000 (Dreitz et al. 2002)

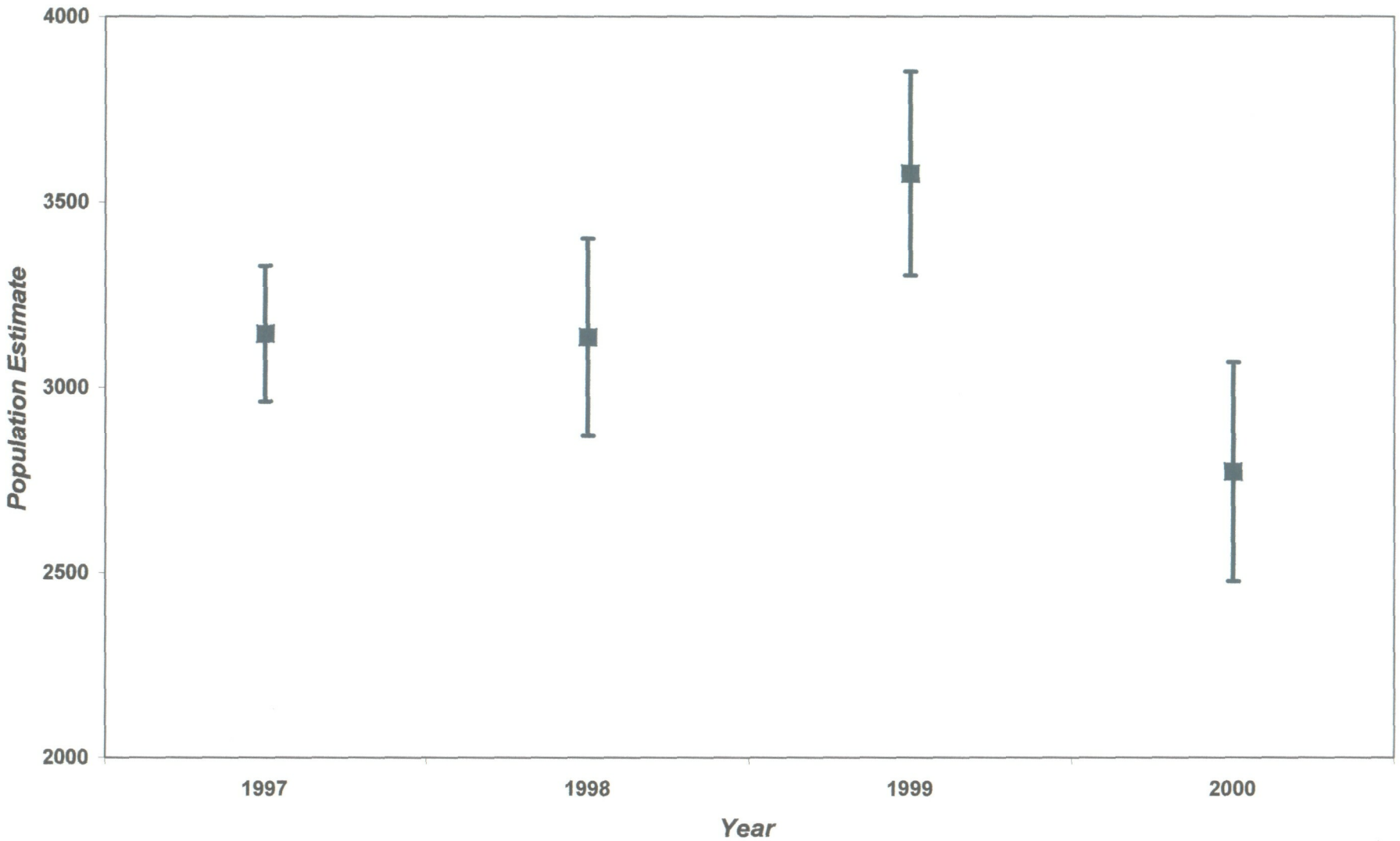
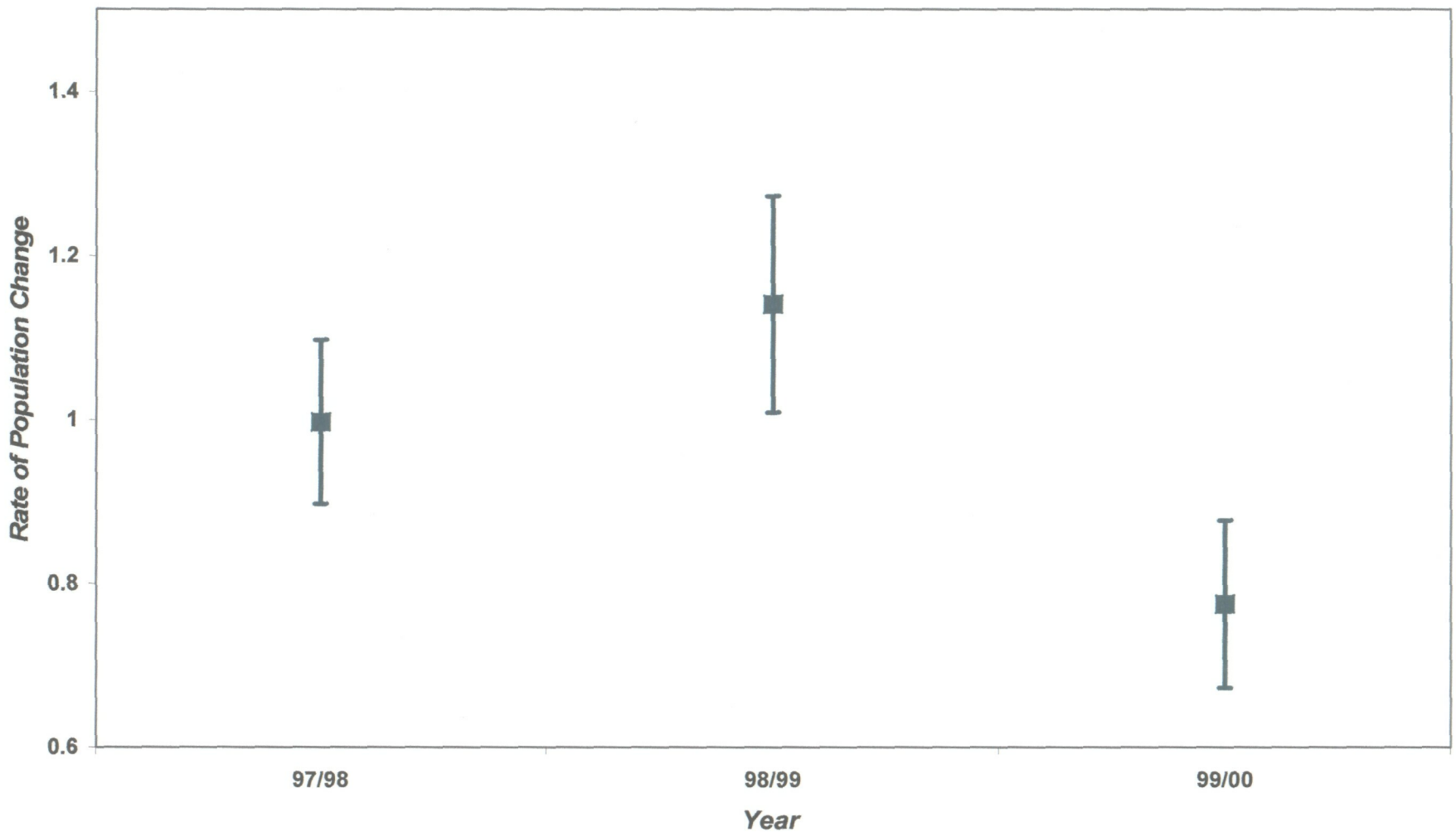


Figure 7. The annual rate of population change of the snail kite in Florida with 95% confidence intervals for 1997 to 2000 (Dreitz et al. 2002)



The overall (statewide) number of nests increased in the 2000 breeding season, after falling dramatically in 1999. Productivity and nest success also increased from 1999 lows. In 2001, however, nesting activity was basically nonexistent in every area surveyed other than East and West Lake Tohopekaliga and Lake Kissimmee. In fact, 48 of the 49 nests located in 2001 were on these three lakes. In contrast, of the 166 nests found in 2000, only 7 were on West Lake Tohopekaliga (2000 Kissimmee data unavailable). While higher water levels in general may have contributed to the higher estimates for the 2000 breeding season, Dreitz et al. (2001) suggested that annual minimum water levels in wetland units are not the major determinant of nest success. The temporal and spatial variations in the estimates of nest success are most likely a reflection of the dynamic environment snail kites inhabit. Not only do the hydrological conditions have to support significant apple snail densities, but they must also support the vegetative communities that make those snails available to the kites. Woody vegetation used as nesting substrate and graminoid species that are essential for foraging habitat require periodic drying to reproduce and/or survive (Craighead 1971, Gunderson and Loftus 1993, Gunderson 1994). Increased hydroperiods can lead to vegetative changes that reduce suitable nesting habitat (Kitchens et al. 2002) and when these short hydroperiod habitats do get dry, nesting and foraging activities are halted. Indeed, the very events that sustain the ecosystems that snail kites inhabit force the birds to leave periodically.

Given the fact that areas of concentrated nesting vary temporally as well as spatially, it is possible that during some years nesting may simply take place in areas not included in this study. Lake Kissimmee, for example, is monitored annually for nesting activity by Jim Rodgers (FFWCC) and the data for this area before 2001 have not been included in our analyses. Lake Istokpoga did have at least one successful nest in the 2001 breeding season (personal observation) though this area is not included in our normal monitoring. Other areas have

characteristics that simply do not permit airboat access to all potential kite habitats like the rocky substrates in Northeast Shark River Slough, or the laws denying off-trail access in Shark Valley Slough of the Everglades National Park.

The annual variation in snail kite nesting substrate further demonstrates the variation in areas of concentrated nesting activity. The most commonly used substrate in the 2000 breeding season was cypress (*Taxodium* spp.), a reflection of colonial activity in the cypress strands of western WCA3A. In 1996 and 1999, however, the most common substrate was pond apple (*Anona glabra*), reflecting more individual, isolated nest locations in central WCA3A. In 1998, *Melaleuca* was used most, due to the abundance of nests in Lake Okeechobee and WCA2B. In 2001, cattail (*Typha* spp.) was most common due to low water levels in the lake habitats, which reduces the amount of available woody substrate (i.e. overhanging water).

Habitat management for the snail kite should focus on the entire network of central and south Florida wetlands, rather than individual wetland units. A mosaic of hydrological regimes supports the variation that kites need during periods of drought. Management should focus on long-term trends in numbers and habitat quality, rather than short-term fluctuations that are a part of the snail kite's natural life history.

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Appendix A. Latitude and longitude coordinates of active Snail Kite nests found in the Blue Cypress Marshes during 2000 and 2001.

Year	Latitude	Longitude
2000	27 38 .678	80 38 .729
2000	27 38 .648	80 38 .782
2000	27 41 .259	80 38 .093
2000	27 40 .077	80 36 .713
2000	27 41 .659	80 37 .861
2000	27 40 .096	80 36 .694
2001	27 38 .689	80 38 .807