Everglade Snail Kite
Rostrhamus sociabilis plumbeus

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
South Florida Ecological Services Office
Vero Beach, Florida

5-YEAR REVIEW
Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: This review is based on monitoring reports, surveys, and other scientific and management information, augmented by conversations and comments from biologists familiar with the species. The review was conducted by the lead recovery biologist and other biologists with the South Florida Ecological Services Office. Literature and documents on file at the South Florida Ecological Services Office were used for this review. All recommendations resulting from this review are a result of thoroughly reviewing all available information on the Everglade snail kite. No part of the review was contracted to an outside party. Notice of this review was published July 27, 2006, with a 60 day public comment period. The draft document was also peer-reviewed prior to being finalized (see Appendix A).

B. Reviewers
Lead Region: Southeast Region, Kelly Bibb, (404) 679-7132

Lead Field Office: Tylan Dean, South Florida Ecological Services Office, (772) 562-3909, extension 284

C. Background

1. FR Notice citation announcing initiation of this review: September 27, 2006. 71 FR 56545.

2. Species status: Decreasing (2006 Recovery Data Call). The low level of nesting and nest success that has been reported does not appear sufficient to support the kite population in the long term. Hydrologic impacts to snail kite nesting habitat appear to be continuing throughout the kite's range and few improvements have been documented.

3. Recovery achieved: 2 (26-50% recovery objectives completed) (2006 Recovery Data Call)

4. Listing history
Original Listing
FR notice: 32 FR 4001
Date listed: March 11, 1967
Entity listed: Subspecies
Classification: Endangered

5. Associated rulemakings:
Critical Habitat Designation
FR notice: 42 FR 40685

Date: August 11, 1977

Critical Habitat Correction
FR notice: 42 FR 47840
Date: September 22, 1977

6. Review History:
Status Review
5-year review: May 21, 1979 (44 FR 29566)
5-year review: July 22, 1985 (50 FR 29901)
Notice of completion (no change) for review initiated in 1985 July 7, 1987 (52 FR 25522)
5-year review: November 6, 1991 (56 FR 56882), in this review different species were simultaneously evaluated with no species-specific in-depth assessment of the five factors, threats, etc. as they pertained to the species' recovery. The notices summarily listed these species and stated that no changes in the designation of these species were warranted at that time. In particular, no changes were proposed for the status of the Everglade snail kite.
Final Recovery Plan: 1999
Recovery Data Call: 2000, 2001, 2002, 2003, 2004, 2005, 2006

7. Species' Recovery Priority Number at start of review: 3c
A recovery priority number of "3c" reflects a subspecies with a high degree of threat and high degree of recovery potential and some degree of conflict between the species' recovery efforts and economic development.

8. Recovery Plan or Outline
Name of plan: South Florida Multi-Species Recovery Plan (MSRP)
Date issued: May 18, 1999
Dates of previous revisions: March 11, 1983 (original recovery plan). First revision September 9, 1986.

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

1. Is the species under review listed as a DPS? No.

2. Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with the 1996 policy? No.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes.

2. Adequacy of recovery criteria.

a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? No. The criteria that identify population size thresholds for downlisting were established using a count-based survey which was applied prior to 1999. A refined mark-resighting method of estimating population size was first applied in 1997-2000 (Dreitz 2000) and subsequently refined in 2002 (Dreitz et al. 2002). More accurate population estimates resulting from the mark- resighting methods are 2 to 3 times higher than those resulting from the count-based method. Because recovery criteria were developed using the count-based population estimates that underestimated actual population sizes, it is uncertain whether these numerical population size criteria are sufficient for reclassification to threatened. Some of the criteria cited, such as those referring to feeding range and nesting regularly occurring are also subjective and need further definition to allow objective evaluation.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? Yes.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors* are addressed by that criterion. If any of the 5 listing factors are not relevant to this species, please note that here.

Criteria for reclassification of Everglade snail kite from endangered to threatened:

1. The 10-year average for the total population size is estimated as greater than or equal to 650, with a coefficient of variation less than 20 percent for the pooled data over the 10-year period.

The criterion has not been met. Although the 10-year average for the total population is estimated to be 2,194 snail kites, which far exceeds the threshold of 650, the coefficient of variation for the pooled data over the 10-year period between 1997 and 2006 (Table 1) is 40 percent, indicating that a greater degree of variation in population size and less population stability has occurred than is identified in the criterion. The relatively high coefficient of variation observed resulted from a large decline in the kite population from 1999-2002 (see below).

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*A) Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

As described in section II.B.2.a. above, the 10-year average snail kite population estimate exceeds the established criterion of 650 individuals as a result of implementing a mark-resighting method of estimating population sizes from 1997 to present which results in larger estimates of population size (Dreitz et al. 2002). The population sizes identified in this recovery criterion were based on previous estimates generated using a simple count-based method. The new population size estimates explicitly address detection probability and incorporate corrections in estimates to account for variable detection probabilities that also occurred in previous surveys. New estimates should consequently provide a more accurate representation of population size. The current estimates are 2 to 3 times higher than those resulting from the previous count-based estimates. This numeric recovery criterion does not reflect the best available information and should be revised accordingly. This criterion addresses listing factors A, C, D, and E.

Table 1. Annual snail kite population estimates from 1997 through 2006 (Martin 2007).

Year	Abundance Estimate	Sampling Error Estimate	95% Confidence Interval
1997	3,145	183	2,800 – 3,533
1998	3,136	266	2,647 – 3,715
1999	3,577	275	3,068 – 4,171
2000	2,772	296	2,240 – 3,430
2001	2,027	143	1,761 – 2,334
2002	1,406	158	1,124 – 1,759
2003	1,162	136	920 – 1,467
2004	1,497	149	1,227 – 1,826
2005	1,566	91	1,394 – 1,759
2006	1,648	139	1,392 – 1,950

2. No annual population estimate is less than 500 in the 10-year period.

The criterion has been met using population estimates from 1997 through 2006 (Table 1) which range from 1,162 to 3,577 (Dreitz et al. 2002, Martin et al. 2007, Martin 2007). However, this criterion was established using count-based population estimates that did not address variable detection probability which affected these counts. Current population estimates (Dreitz et al. 2002, Martin et al. 2007), which explicitly address and correct for differences in detection probability, are 2 to 3 times higher than those resulting from the previous counts. However, the differences in these numbers do not represent an increase in snail kite population, but rather reflect differences in estimation methods. Since the current method of population estimation and its results were not available when this recovery criterion was developed, the validity of this criterion should be considered when assessing whether it has been met. This numeric recovery criterion does not reflect the best available information and should be revised accordingly. This criterion addresses listing factors A, C, D, and E.

3. The rate of increase of the population to be estimated annually or biannually, and over the 10-year period, will be greater than or equal to 1.0, sustained as a 3-year running average over 10 years.

The criterion has not been met. The rate of increase (RI) of the annual estimated population from 1997 though 2006 is not greater than or equal to 1.0 (Table 2), sustained as a 3-year running average. The rate of increase calculated from the estimated population (Dreitz et al. 2002, Martin 2007, Martin et al. 2007) is greater than 1.0 as a 3-year running average in 2005 and 2006 only. Over the past 10 years, the kite population has declined, and failure to meet this criterion reflects the declining trend. This criterion addresses listing factors A, C, D, and E.

Table 2. Rate of Increase[1] of the snail kite population from 1997 through 2006.

Year	Population Estimate	Rate of Increase (RI) [1]	3-Year Running Average of RI
1997	3145		
1998	3136	1.00	
1999	3577	1.14	
2000	2772	0.77	0.97
2001	2027	0.73	0.88
2002	1406	0.69	0.73
2003	1162	0.83	0.75
2004	1497	1.29	0.94
2005	1566	1.05	1.05
2006	1648	1.05	1.13

[1]Calculated as the Finite Rate of Increase (Lambda) between two years.

4. The feeding range of snail kites will not decrease from its current extent, including as a minimum, the St. Johns Marsh, the Kissimmee Chain of Lakes, Lake Okeechobee, Loxahatchee Slough, Loxahatchee National Wildlife Refuge, all of the Water Conservation Areas (WCA), Everglades National Park, Big Cypress National Preserve, Fakahatchee Strand, Okaloacoochee Slough, and marshes surrounding the Corkscrew Swamp.

This is a subjective criterion, and data to support a thorough evaluation are lacking. However, our assessment suggests that it has not been met. While kites may occasionally forage within some or all of these areas, we do not have evidence of regular use of all of these areas for foraging over the past 10 years. In particular, there has not been documentation of regular or routine use by foraging snail kites of the following areas: WCA-1 (Loxahatchee National Wildlife Refuge), Big Cypress National Preserve, Fakahatchee Strand, Okaloacoochee Slough, and the marshes surrounding Corkscrew Swamp. This may be partially a result of limited survey effort in these areas because survey effort in recent years has focused on kite nesting areas (Martin et al. 2006a, 2006b). All of these areas may support kite foraging under some conditions, such as drought, but it is unclear whether this is consistent with the definition of 'feeding range.'

Studies of Florida apple snail (*Pomacea paludosa*) abundance and occurrence within many of these areas also indicate that foraging conditions may be poor or have declined in recent years. Darby et al. (2005) reported that apple snail abundance has recently declined substantially within WCA-3A. Darby (2005a, 2005b) also reported that apple snail abundance remains relatively low in areas of traditional snail kite use within Lakes Kissimmee, Tohopekaliga, and Okeechobee in recent years. For example, changes in kite foraging habitat that have resulted from hydrologic management have occurred within the littoral zone of Lake Okeechobee. In this area, prolonged deep water has caused changes in vegetation that affect kites' ability to forage, and prolonged periods of high and low water have impacted the apple snail populations that the kites rely upon for food. Snail abundance in many of these areas is below that associated with use by foraging kites (Darby et al. 2006) and available data indicate declining trends in apple snail abundance (Darby 2007). This criterion addresses listing factor A.

5. Snail kite nesting regularly occurs over the 10-year period in the St. Johns Marsh, Kissimmee Chain of Lakes, Lake Okeechobee, and at least one of the present compartments of the water conservation areas.

This criterion does not define the rate of nest occurrence that constitutes "regular nesting." However, our assessment suggests that it has been met because nesting has occurred in each of the defined areas in more than half of the past 10 years, and kites have not ceased to nest in any of the areas. Snail kite nests have been monitored consistently in these areas during the occurrence of peak nesting activity from March to June (Bennetts and Kitchens 1997, Martin et al. 2007). We considered nesting to have occurred if a nest containing at least one egg was located. This measure does not include construction of nests where subsequent egg-laying was not documented. The presence/absence and number of nests is indicated in Tables 3 and 4, and was summarized from annual reports (Martin et al. 2002a, 2002b, 2003; Rodgers and Schwikert 2003; Martin et al. 2005, 2006a, 2007).

This measure does not address nest success rates (proportion of nests fledging at least one young) or the number of nests that occurred in each area. The abundance of nests and nest success within these areas in recent years suggests that the suitability of several of these nesting areas may have declined (Martin et al. 2007). Low productivity, resulting from both relatively low numbers of active nests and low nest success rates, suggests that conditions were poor for kite nesting in some of these areas and in some years (Martin et al. 2007). Relatively low juvenile survival rates in recent years also support the conclusion that conditions for kites in some of these areas have been relatively unfavorable due to a variety of factors such as low water levels and low prey availability (Martin et al. 2006b). This criterion addresses listing factors A, C, and D.

Table 3. Presence of active snail kite nests between 1996 and 2006 in specified regions.

Regions	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
St. Johns Marsh	x	x	x	x	x	x	x	x	x	x	x
Kissimmee Chain of Lakes	x	x	x	x	x	x	x	x	x	x	x
Lake Okeechobee	x	x	x					x	x	x	x
WCA 1		x	x								
WCA 2	x	x	x				x	x	x		x
WCA 3	x	x	x	x	x		x	x	x	x	x

Table 4. Number of active snail kite nests by wetland, 1996 through 2006.

Regions	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
WCA 1	-	1	14	-	-	-	0	-	-	-	2
WCA 2A	0	0	0	0	0	0	0	0	0	0	0
WCA 2B	3	25	125	0	0	0	11	17	18	0	2
WCA 3A	80	247	221	70	112	0	60	82	48	35	58
WCA 3B	0	0	3	5	26	0	3	2	6	0	17
Tohopekaliga	23	38	2	3	7	15	22	17	0	52	28
E. Tohopekaliga	-	-	-	-	-	4	4	1	1	1	1
St. John's Marsh	16	26	9	12	6	1	1	10	16	15	16
Kissimmee	0	6	5	39	3	29	4	12	8	14	1
Lake Okeechobee	34	4	8	0	0	0	0	5	8	33	10
West Palm/ Grassy Waters	0	2	3	0	3	0	-	3	0	18	1
Everglades National Park	5	0	0	0	12	0	-	-	-	0	22
Other	-	-	-	-	-	-	-	-	-	4	3
Total	161	343	385	90	166	49	105	149	105	172	161

Listing Factor B is not relevant to this species.

C. Updated Information and Current Species Status

1. Biology and Habitat –

a. Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate), or demographic trends: Refined population estimates were generated for the Everglade snail kite using mark-resighting methods from 1997 to present (Dreitz et al. 2002, Martin et al. 2007). These population estimates which explicitly address variable detection probability that affected previous count-based population estimates are higher than those resulting from the previous counts. The difference between previous estimates and the refined population size estimates do not indicate an increase in the snail kite population, but reflect improvements in the estimates. The refined estimates (Dreitz et al. 2002, Martin et al. 2007) represent the best available assessment of kite population size.

Based on the refined estimates, the snail kite population declined by approximately 50 percent over the past 10 years, and has shown little sign of recovery (Figure 1). The decline from 1999 to 2003 was due in large part to a regional drought that affected southern Florida during 2000 and 2001. During this period, nest success was generally low (Martin et al. 2006a; Figure 3), and demographic parameters estimated from mark-resighting methods also indicated that juvenile survival rates were low, and adult survival declined during 2001 (Martin et al, 2006b, Martin et al. 2007; Figure 3). However, following the end of the drought conditions in 2002 and a return to normal or wetter-than-normal hydrologic conditions from 2002 to 2006 that generally provide favorable snail kite nesting conditions, population estimates remained low, and nest success and juvenile survival rates also remained low (Martin et al. 2007) (Figures 1-3).

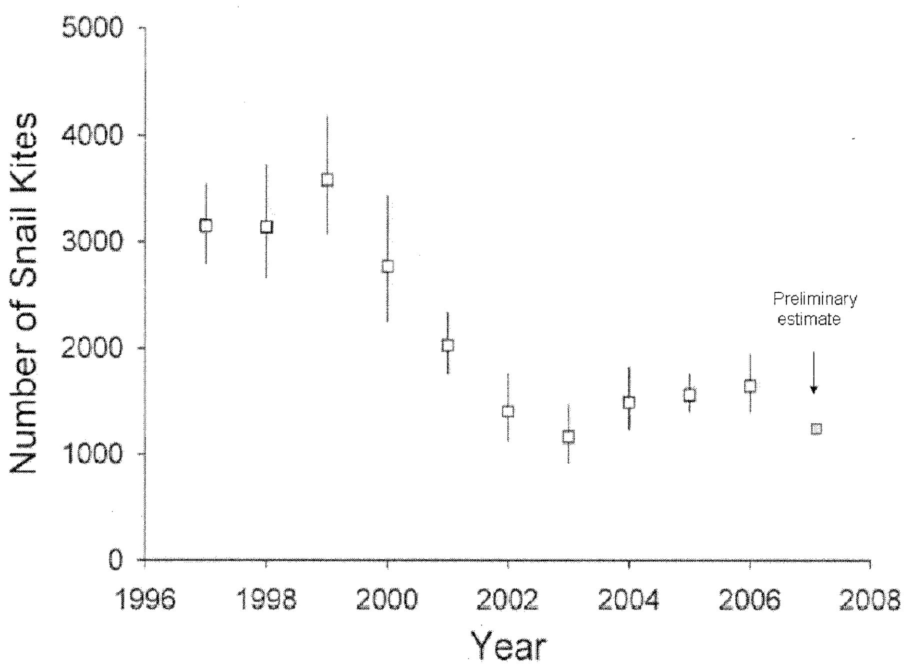

Figure 1. Estimates of state-wide snail kite population size between 1997 and 2007 (Martin et al. 2007).

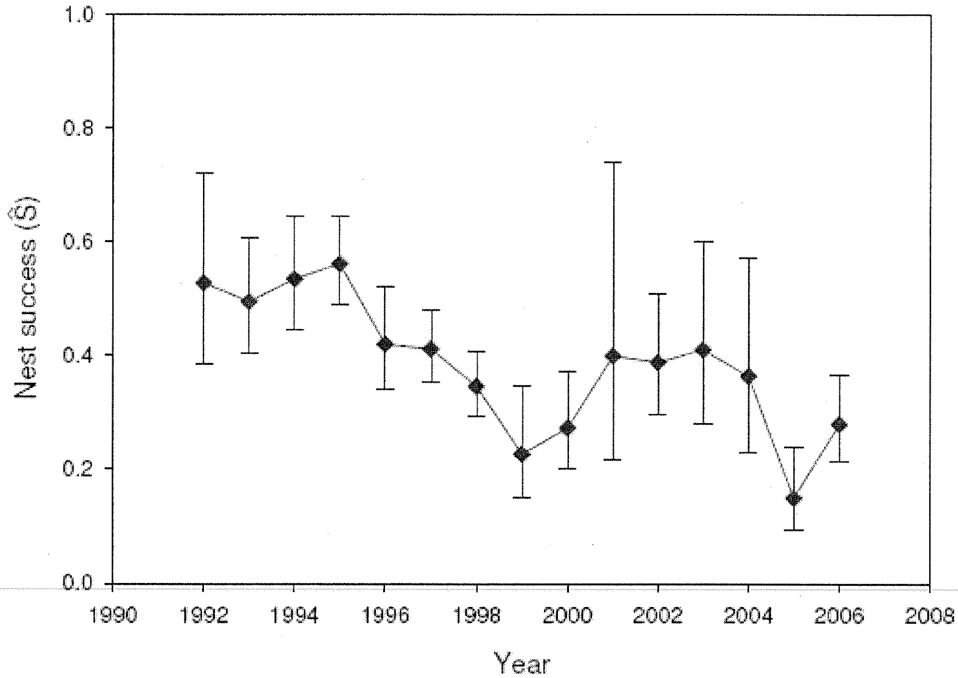

Figure 2. Nest success rate estimated from 1992 to 2007. Error bars represent 95 percent confidence intervals (Martin et al. 2007).

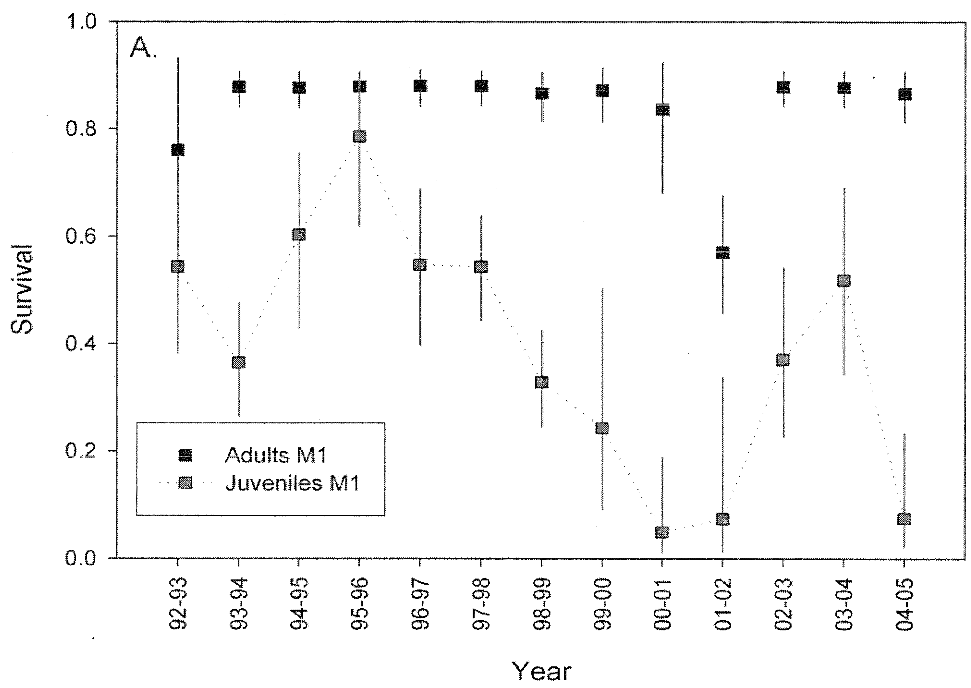

Figure 3. Model-averaged estimates of adult (black squares) and juvenile (green squares) survival between 1992 and 2005; error bars represent 95% confidence intervals (Martin et al. 2007).

While it is not possible to compare the current population size to those recorded from the 1970s through 1997 due to differences in sampling methods, several lines of evidence suggest that the current kite population has declined and may be continuing to decline. Population trends illustrated above and described in Martin et al. (2007) result from consistent survey and analysis methods. Declines in population size, as well as individual demographic parameters support the conclusion of a declining trend. There has, however, been a degree of annual variation in juvenile survival rates, with 2002-2004 showing comparatively high rates compared to 2000 (Martin et al. 2007).

As previously noted, however, adult survival has been relatively constant over time at a relatively high level (Bennetts et al. 1999, Martin et al. 2006b), with the exception of the 2001- 2002 drought (Martin et al. 2007). This demographic characteristic helps kites survive unfavorable conditions, and adults can either move to other areas with favorable conditions or wait out the unfavorable conditions. Under favorable environmental conditions, kites have the ability to achieve high reproductive rates (Beissinger 1986), and similarly, juvenile survival rates are generally higher under more favorable conditions.

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding): None.

c. Taxonomic classification or changes in nomenclature: None. The Integrated Taxonomic Information System (ITIS 2007) was checked while conducting this review.

d. Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range): The current distribution of the snail kite is limited to central and southern portions of Florida, though a kite may occasionally be reported outside of this area. Six large freshwater systems comprise the current range: Upper St. Johns marshes, Kissimmee Chain of Lakes, Lake Okeechobee, Loxahatchee Slough, the Everglades, and the Big Cypress basin (Beissinger and Takekawa 1983, Sykes 1984, Rodgers et al. 1988, Bennetts and Kitchens 1992, Rumbold and Mihalik 1994, Sykes et al. 1995).

In addition to the primary wetlands where most kite nesting has been documented, there are numerous records of kite occurrence and/or nesting within isolated wetlands in central and southern Florida. Takekawa and Beissinger (1989) identified numerous wetlands that they considered drought refugia which may provide kite foraging habitat when conditions in the larger, more traditionally occupied wetlands are unsuitable. During drought conditions of 2007, kites were reported from several small isolated areas within the kite's range (Service, unpublished data 2007). In addition to these areas, radio tracking of snail kites has revealed that the network of habitats used by the species includes many smaller, widely dispersed wetlands within this overall range (Bennetts and Kitchens 1997). Snail kites may use nearly any wetland within southern Florida under some conditions and during some portions of their life history. However, the majority of nesting continues to be concentrated within the large marsh and lake systems of the Greater Everglades and Upper St. John's marshes (Martin et al. 2007).

While fragmentation of habitats has not occurred in a traditional sense, fragmentation of wetland systems, defined as discontinuity in hydrological conditions among adjacent wetlands and additional spatial isolation of other wetlands suitable for kites may decrease juvenile survival rates (Martin et al. 2006b). The compartmentalization of Everglades' wetlands under the U.S. Army Corps of Engineer's (Corps) Central & Southern Florida (C&SF) Project, and subsequent hydrologic management of each of the compartments has reduced the connectivity of the wetland system upon which kites rely. Separate and independent management regimes for the different compartments have also impacted snail kites in some cases by allowing unfavorable conditions in adjacent wetland units at the same time. This functional fragmentation may reduce the likelihood of young birds locating suitable foraging conditions in other areas, especially during drought conditions.

e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem): Operation of the C&SF Project and other hydrologic management has a significant effect on hydrologic conditions within most of the areas occupied by snail kites. The Corps and the South Florida and St. Johns River Water Management Districts manage water levels in snail kite habitat in accord with many different local and regional water management plans and schedules. Water management plans affect water levels in marshes and lakes upon which snail kites rely, as well as the rates of water level recessions, and the timing of high and low water events. These factors directly affect snail kite habitat suitability and the abundance and availability of apple snails.

Changes in kite foraging habitat that have resulted from hydrologic management have occurred within southern WCA-3A. In these areas, prolonged deep water may have caused changes in vegetation that affect kites' ability to forage. These conditions may have also affected growth and survival of woody plants that kites use as perches. Data from vegetation monitoring within southern WCA-3A suggests that the vegetation community continues to change from *Eleocharis* wet prairie vegetation communities to open water slough communities (Martin et al. 2007). This change represents a reduction in the quality of foraging habitat for snail kites, and a reduction in the suitability of habitat to support abundant apple snails.

Extended periods of excessively low water may also cause negative effects on snail kite foraging habitat and affect apple snail abundance and availability. Drydowns result from hydrologic management, including both intentional drawdowns to aid in habitat restoration, such as those that have occurred on Lakes Kissimmee and Tohopekaliga, and drydowns that result from a combination of water management activities and unexpected environmental conditions, like those that have occurred within Lake Okeechobee.

Studies of apple snail abundance within traditional snail kite nesting areas indicate reduced snail abundance in recent years. Darby et al. (2005) reported that apple snail abundance declined substantially within WCA-3A in an area that had supported large numbers of kites. Darby (2005a, 2005b) reported that apple snail abundance remains relatively low in areas of traditional snail kite use within Lakes Kissimmee, Tohopekaliga, and Okeechobee following managed low water levels in these areas. These and other recent data on changes in snail abundance (Darby 2007) support the conclusion that availability of apple snails to kites may be declining, and snail densities may be lower than those that are favorable for kite foraging (Darby et al. 2006). The spread of non-native apple snails (e.g., *Pomacea insularum*) (Rawlings et al. 2007) may also represent a reduction in the suitability of habitat for kites. While they may be able to feed on this species, it may not be as available to kites due to its size, and this may result in food limitation, particularly for juvenile kites (Kitchens 2007).

f. Other: Disturbance to snail kite nesting as a result of human impacts has increased. Resource management activities, and aquatic plant management in particular, has resulted in incidental disturbance of nesting kites and even destruction of nests. Increasing recreational use in some areas has also resulted in increasing disturbance to nesting and foraging kites.

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms) -

a. Present or threatened destruction, modification or curtailment of its habitat or range: The principal threat to the snail kite is the loss or degradation of wetlands in central and southern Florida. Nearly half of the Everglades have been drained for agriculture and urban development (Davis and Ogden 1994). The C&SF Project encompasses 18,000 square miles from Orlando to Florida Bay and includes about 994 miles each of canals and levees, 150 water control structures, and 16 major pump stations. This system has disrupted the volume, timing, direction, and velocity of freshwater flow. Water management actions continue to modify the habitat amount, suitability, and availability to kites, as well as the abundance and availability of apple snails, their primary prey.

Increased water depth and duration of inundation within kite habitat, such as that which has occurred within southern WCA-3A, has resulted in changes from wet prairie vegetation to slough vegetation (Martin et al. 2007). This change represents a reduction in foraging suitability. Prolonged deep water may also result in impacts to apple snails as a result of reduced growth rates presumably caused by lower water temperature (Darby et al. 2005).

Managed drydowns such as those that have occurred in conjunction with lake restoration projects on Lakes Kissimmee and Tohopekaliga, in addition to natural droughts may also reduce the suitability of these areas for kites as a result of reductions in apple snail abundance. This effect may be further exacerbated by mechanical treatments that remove or kill apple snails (Darby et al. 2004). Declines in the abundance and occurrence of the native apple snail, the primary prey of the snail kite, have decreased the suitability of large areas of the snail kite's range and continues to pose a problem for maintaining or increasing kite numbers (Darby 2005a, 2005b; Darby et al. 2005; Darby 2007).

Within the past 10 years, the combination of prolonged high water, natural droughts at a regional scale, and managed drydowns to large areas of kite habitat have resulted in cumulative reductions in the suitability of habitats to support snail kites in many of the wetlands that kites occupy (Martin et al. 2006b, Martin et al. 2007). Vegetation communities and apple snail populations can recover following these events, and these changes do not represent a permanent reduction in kite habitat. However, the combination of timing and extent of these actions has resulted in reductions in nesting and foraging habitat suitability.

In addition to these temporary declines in kite habitat, several other factors affect suitability for kites. Degradation of water quality, particularly runoff of phosphorus from agricultural and urban sources, is another concern for the snail kite because it can cause rapid encroachment of cattail (*Typha* sp.) and other undesirable species into kite habitat, reducing its suitability for nesting and foraging. The Everglades was historically an oligotrophic system (i.e., lacking plant nutrients such as phosphorus, but having high levels of dissolved oxygen), but major portions have become eutrophic (i.e., rich in nutrients that promote excessive plant growth and deplete dissolved oxygen), primarily due to anthropogenic sources of phosphorus and nitrogen (cultural eutrophication).

Construction projects have caused degradation in kite habitat in some portions of the kite's range. Within the Kissimmee Chain of Lakes, residential development on lakeshores has resulted in altered littoral zone vegetation. Within this zone, construction of docks and maintenance of waterways that service residential developments has altered kite foraging habitat Within the Everglades marshes, residential construction has resulted in loss of some relatively small areas of snail kite habitat. Increasing recreational activity associated with increased development also affect the suitability of kite habitat. Boat and airboat traffic throughout snail kite habitat has caused some local vegetation changes, and can temporarily affect the suitability of kite foraging habitat.

Exotic and invasive aquatic plants have had an impact on snail kite habitat within lake systems and other areas. Species such as water hyacinth and water lettuce can grow rapidly within lake littoral zones, completely obscuring kite foraging areas, and can even affect littoral zone vegetation composition and cover by shading other species and competing for space. Hydrilla (*Hydrilla verticillata*) is a submerged aquatic invasive that has become the dominant submerged species in some lakes. Hydrilla infestations may cause changes in submerged plant species that will affect the abundance, sustainability, and availability of apple snails.

Efforts to control these invasive exotic plants have also affected snail kite habitat. In addition to controlling invasive plant species, which is beneficial to snail kites, application of herbicides often causes detrimental impacts to non-target species. Inadvertent application of herbicides to snail kite nesting substrates has occurred, and herbicide treatments within kite foraging habitat has caused impacts to many native littoral vegetation species. Hydrilla control activities have similarly caused temporary impacts to vegetation in areas where kites forage. Herbicides can also kill submerged aquatic plants, resulting in reduced suitability for apple snails.

There have been impacts to kites resulting from destruction, modification or curtailment of its habitat or range within the past 10 years, and these impacts have directly and indirectly resulted in reductions in the kite population. These same factors are anticipated to continue to threaten the kite population in coming years. In addition, threats such as increased disturbance and development appear to be increasing.

b. Overutilization for commercial, recreational, scientific, or educational purposes: This threat is not relevant to this species.

c. Disease or predation: Nest predation is a common cause of snail kite nest failure. While the occurrence of nest predation has increased, this is largely a result of hydrologic management in areas where kites nest. Rapid water level recession where kites are nesting can cause water levels under nests to drop rapidly, making nests vulnerable to mammalian nest predators. This threat will probably decrease as Everglades restoration efforts progress. Little additional information is available about the threat of disease or predation.

d. Inadequacy of existing regulatory mechanisms: In addition to its listing as endangered under the Endangered Species Act, the kite is listed as endangered by the Florida Fish and Wildlife Conservation Commission.

Because the snail kite occurs largely on public lands and waters owned and managed primarily for conservation purposes by Federal and State agencies, there are many regulatory mechanisms available to provide protection for kites. Hydrologic management actions that affect all areas occupied by kites, including hydrologic restoration projects, require Corps permits, and consequently require review and consultation, as appropriate, under the Endangered Species Act.

Snail kite nest avoidance guidelines and protocols initiated in late 2005 and further redefined in 2006 to reduce impacts to snail kite nesting that result from vegetation management activities have been largely successful. Additional measures to reduce the threat of human disturbance to kite nesting were implemented in 2007. Further measures may be necessary to achieve the level of threat reduction that is needed, but regulatory mechanisms appear to be available to address these threats. Therefore, threats resulting from the inadequacy of existing regulatory mechanisms are small.

II.C.2.e. Other natural or manmade factors affecting its continued existence: Non-native apple snails have been introduced into areas of kite habitat in Florida and have the potential to significantly alter native freshwater habitats, reduce native apple snail populations, and reduce the suitability of wetlands for snail kites. The magnitude of this potential threat remains poorly documented, but is potentially serious.

Collapse of nests constructed in herbaceous vegetation is cited as a cause of increased nest failure during low-water years. Similar to increases in nest predation, this threat may result from rapid water level recession caused by large-scale water management actions.

Increasing development and urbanization has also resulted in increased recreational use of some of the lakes where kites nest. An increase in boating in areas frequented by kites has led to increased nest disturbance. Development of lakeshore communities further increase this disturbance by facilitating boat access to the lakes and increasing the amount of human activity immediately adjacent to kite nesting areas.

D. Synthesis - The current recovery criteria do not reflect the best available and most up-to-date information on the biology of the species and its habitat. Despite the limitations and uncertainty in the current recovery criteria, the criteria have not been met. The changes in the overall snail kite population size over the past 10 years, in conjunction with reductions in demographic parameters such as survival and nest success, indicate a declining condition.

In addition to the population decline, documented declines in habitat amount and suitability and declines in abundance of apple snails have occurred throughout many portions of the kite's range. Water management has affected and will continue to affect these habitat characteristics, as well as others. As Everglades restoration plans are developed and implemented, more favorable hydrologic regimes are likely. Despite the fact that many of the observed habitat declines are reversible under favorable conditions and are expected to recover over time, these factors appear likely to continue to limit the snail kite population growth in the near future. Threats resulting from increasing development, exotic and invasive species, and human disturbance also appear likely to continue to affect the kite population, and these threats may continue to increase.

Although Everglades restoration projects are currently being planned that may improve hydrologic conditions for the kite, the species continues to meet the definition of endangered under the Endangered Species Act because there continues to be a variety of threats affecting the snail kite and its habitat, and the degree of threat is stable or increasing.

III. RESULTS

A. Recommended Classification:

_X__ **No change is needed**

IV. RECOMMENDATIONS FOR FUTURE ACTIONS -

- Conduct actions outlined in the MSRP (Service 1999).
- Revise the recovery plan to incorporate updates to information on factors affecting kites, their prey, and their habitat and incorporate refinements in population estimates and improvements in the understanding of the kite populations and the factors affecting it. Revise recovery criteria to include additional objective measures of recovery and correct or revise population threshold objectives.
- Implement a more extensive apple snail monitoring program to include all of the areas where snail kite surveys are being conducted. This program should be conducted annually for a minimum of 10 years in order to encompass long-term climate cycles.
- Continue to monitor and expand data collection and identification of the non-native apple snails and their effect on the native snail population and snail kite food availability.
- Continue or expand snail kite monitoring efforts to improve understanding of kite habitat use and demography throughout their range.
- Coordinate with researchers to analyze the data obtained from the Comprehensive Everglades Restoration Plan Monitor and Assessment Plan that pertain to Greater Everglades landscape pattern vegetation mapping. Vegetation mapping will monitor the spatial extent, pattern, and proportion of plant communities within major landscape regions of the Greater Everglades wetlands.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Everglade Snail Kite *(Rostrhamus sociabilis plumbeus)*

Current Classification _Endangered_________
Recommendation resulting from the 5-Year Review

_X__ **No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable _____

Review Conducted By _Tylan Dean_______________________________________

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve ________________________ Date 9-12-07

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

for **Lead Regional Director, Fish and Wildlife Service**

Approve Noreen E. Walsh Date 9/27/07

The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. If a change in classification is recommended, written concurrence from other regions is required.

Cooperating Regional Director, Fish and Wildlife Service

_____Concur _____ Do Not Concur

Signature________________________________Date_______

APPENDIX A: Summary of peer review for the 5-year review of Everglade snail kite (*Rostrhamus sociabilis plumbeus*)

A. Peer Review Method: The Service conducted an influential level of peer review (see attached peer review plan). Recommendations for peer reviewers were solicited from the Florida Fish and Wildlife Conservation Commission, the Miccosukee Tribe of Indians of Florida, and the South Florida Water Management District. Additionally, two peer reviewers were selected by the Service. A total of five peer reviewers were asked to participate in this review. Individual responses were requested, and responses were received from three peer reviewers.

B. Peer Review Charge: See attached guidance.

C. Summary of Peer Review Comments/Report: Peer reviews all expressed that the conclusions were generally supported by the information that was provided, and that the information appeared to be substantial and sufficient to support the conclusions. Reviewers provided recommendations for analytical methods that may provide additional insight into population trends and factors affecting the population. These comments ranged from evaluating nest search effort and its potential to affect conclusions about number of nests, attempting to re-evaluate older count data using more recently developed statistical methods, to incorporating estimates of precision into assessments of population change. Reviewers also recommended continuing to evaluate multiple metrics of population parameters to reach conclusions about overall trends to aid in verification that conclusions reached about trends are not based on parameters with relatively high levels of uncertainty.

D. Response to Peer Review: We agreed with nearly all of the peer reviewer comments. Because most of the comments involved recommendations for additional analyses of existing data sets, the recommendations will be provided to researchers that collect and analyze the snail kite data for further consideration or incorporation into standard procedures. The peer reviewer recommendations prompted us to re-evaluate summaries of data presented, but the recommendations did not result in any changes to the content or conclusions of the review.

Guidance for Peer Reviewers of Five-Year Status Reviews

U.S. Fish and Wildlife Service, South Florida Ecological Services Office

February 20, 2007

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with U.S. Fish and Wildlife Service (Service) policy.

Peer reviewers should:

1. Review all materials provided by the Service.

2. Identify, review, and provide other relevant data apparently not used by the Service.

3. Not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.

4. Provide written comments on:
   - Validity of any models, data, or analyses used or relied on in the review.
   - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
   - Oversights, omissions, and inconsistencies.
   - Reasonableness of judgments made from the scientific evidence.
   - Scientific uncertainties by ensuring that they are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear.
   - Strengths and limitation of the overall product.

5. Keep in mind the requirement that the Service must use the best available scientific data in determining the species' status. This does not mean the Service must have statistically significant data on population trends or data from all known populations.

All peer reviews and comments will be public documents and portions may be incorporated verbatim into the Service's final decision document with appropriate credit given to the author of the review.

Questions regarding this guidance, the peer review process, or other aspects of the Service's recovery planning process should be referred to Cindy Schulz, Endangered Species Supervisor, South Florida Ecological Services Office, at 772-562-3909, extension 305, email: Cindy_Schulz@fws.gov.