United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

November 17, 2006

Colonel Paul L. Grosskruger
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Consultation Code: 41420-2007-F-0045
Formal Consultation Initiation Date: July 10, 2006
Project: Interim Operational Plan

Dear Colonel Grosskruger:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed continuation of the Interim Operational Plan for the Protection of the Cape Sable Seaside Sparrow (IOP) located in Broward, Miami-Dade, and Monroe Counties, Florida and its effects on the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), and wood stork (*Mycteria americana*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). Your July 7, 2006, request for reinitiation of formal consultation was received on July 10, 2006. The U.S. Army Corps of Engineers (Corps) was ordered to prepare a Supplemental Environmental Impact Statement (SEIS) (EIS) on the IOP by the U.S. District Court for the Southern District of Florida for failure to include specific hydrologic modeling supporting the IOP selected alternative, Alternative 7R, in their Final 2002 EIS for the IOP. The Corps voluntarily reinitiated formal consultation under the Act in conjunction with the SEIS process.

This biological opinion is based on information provided in the July 7, 2006, Biological Assessment, the June 2006 Draft SEIS, telephone conversations, field investigations, and other sources of information. A complete administrative record of this consultation is being assembled by this office in anticipation of possible litigation under the jurisdiction of the U.S. District Court for the Southern District of Florida.

The Corps has determined that the proposed IOP will have "no effect" on the endangered red-cockaded woodpecker (*Picoides borealis*) and the endangered Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*). The Corps has determined that the proposed IOP "may affect, but is not likely to adversely affect" the endangered West Indian manatee (*Trichechus manatus latirostris*) or its designated critical habitat, the endangered Florida panther (*Puma* [=*Felis*] *concolor coryi*), the threatened bald eagle (*Haliaeetus leucocephalus*), the endangered American crocodile (*Crocodylus acutus*) or its designated critical habitat, the threatened eastern indigo snake (*Drymarchon corais couperi*), or the threatened Garber's spurge (*Chamaesyce garberi*). The Service concurs with these determinations.

The intent and overall effect of this biological opinion for the IOP is two-fold: (1) it supersedes the Service's original 1999 Final Biological Opinion for the Corps' Modified Water Deliveries (MWD) to Everglades National Park (ENP) Project, the Experimental Water Deliveries Program (Experimental Program), and the Canal 111 (C-111) Project, and (2) it also supersedes the Service's 2002 Amended Final Biological Opinion for the Corps' IOP for protection of the Cape Sable seaside sparrow.

Consultation History

Beginning in March 1983 the National Park Service's ENP management requested restorative action that would reduce the untimely (unseasonal deliveries of water during the dry season) and spatially restrictive (S-12 deliveries only) regulatory releases of water from Water Conservation Area 3A (WCA-3A) into ENP.

The Appropriations Act of 1984, Public Law 98-181 (Section 1302), which actually passed in November 1983, authorized the Secretary of the Army to conduct an experimental program of water deliveries to ENP. This allowed the Corps the authority to initiate a series of iterative field tests, with the South Florida Water Management District (District) and ENP concurrence, to collect and analyze hydrological and ecological data.

The Appropriations Act of 1984 authorized the Corps to implement the Experimental Program to ENP.

In 1989, the ENP Protection and Expansion Act incorporated northeast Shark River Slough (area east of the L-67 Extension) preservation under the protection of the National Park Service.

In 1990, the Corps issued a draft General Design Memorandum (GDM) on the MDW to ENP Project.

In February 1990, the Service issued a jeopardy Biological Opinion for the MWD to ENP Project with a reasonable and prudent alternative (RPA) to preclude jeopardy for the Everglade snail kite and concluded non-jeopardy for the wood stork.

In 1992, the Corps finalized the GDM on the MWD to ENP Project.

In 1993, the Corps implemented Test Iteration 6 of the Experimental Program to ENP.

In May 1994, the Corps issued a Final Integrated General Reevaluation Report and EIS on the C-111 Project.

In May 1994, the Service concurred with the Corps' determination of "no effect" on the C-111 Project for the Everglade snail kite, wood stork, bald eagle, eastern indigo snake, American crocodile, and Florida panther. However, the Service was unable to evaluate the effects on the Cape Sable seaside sparrow beyond construction features and, therefore, could not concur with a “no effect” determination until specific operational criterion was developed.

On June 3, 1994, (mistakenly dated 1993) the Service issued a non-jeopardy Biological Opinion on Test Iteration 6 of the Experimental Program to ENP for Cape Sable seaside sparrows.

In 1995, the Corps extended the duration of Test Iteration 6 of the Experimental Program to ENP

By letter dated September 22, 1995, the Service concluded that Test Iteration 7 of the Experimental Program to ENP was not likely to adversely affect the Florida panther, American crocodile, Everglade snail kite, and eastern indigo snake, but that implementation of Test Iteration 7 was likely to adversely affect the Cape Sable seaside sparrow and its designated critical habitat, and the wood stork.

On October 27, 1995, the Service issued a jeopardy Biological Opinion on Test Iteration 7 - Phase 1 of the Experimental Program to ENP for Cape Sable seaside sparrows with a RPA to preclude jeopardy and concluded non-jeopardy for the wood stork.

In 1995, the Corps implemented Test Iteration 7 - Phase 1 of the Experimental Program to ENP.

In 1995, the Corps initiated a hydrologic and ecological monitoring program for Test Iteration 7 of the Experimental Program to ENP.

On October 17, 1997, the Service requested that the Corps reinitiate consultation on the MWD to ENP Project, the Experimental Program to ENP, and the C-111 Project due to the interdependence and interrelatedness of the projects.

By letter dated November 4, 1997, the Corps agreed to reinitiate consultation on the MWD to ENP Project and the Experimental Program to ENP, but recommended consultation be deferred on the C-111 Project since specific operational criterion were still under development.

In 1998, the Corps implemented an emergency deviation from Test Iteration 7 – Phase 1 of the Experimental Program to ENP for the explicit purpose of protecting listed species in the action area.

On February 19, 1999, the Service issued a jeopardy/adverse modification Biological Opinion on the MWD to ENP Project, the Experimental Program to ENP, and the C-111 Project for Cape Sable seaside sparrows; non-jeopardy for the wood stork and Everglade snail kite; and not resulting in adverse modification of snail kite critical habitat. This consultation evaluated the effects of construction features only, given that specific operational criterion had not been developed for the three interrelated/interdependent projects.

In 1999, the Corps implemented an emergency deviation from Test Iteration 7 – Phase 1 of the Experimental Program to ENP for the explicit purpose of protecting listed species in the action area.

Between February 1999 and December 1999, numerous interagency meetings and conference calls were held between the Corps, Service, ENP, and District to discuss implementation of the Service's 1999 Biological Opinion's RPA.

In December 1999, interagency meetings were elevated to The White House Council on Environmental Quality (CEQ) to obtain guidance on National Environmental Policy Act (Public Law 91-190, 42 U.S.C. 4321-4347, as amended) (NEPA) coverage for emergency operations and to facilitate negotiations on points of disagreement between the Department of the Interior (DOI) and the Corps. These interagency meetings resulted in the development of the Interim Structural and Operational Plan, Emergency Deviation from Test Iteration 7 of the Experimental Program to ENP for protection of the Cape Sable seaside sparrow (ISOP 2000).

In 2000, the Corps implemented the ISOP 2000 emergency deviation.

In April 2000, the Service participated in interagency discussions on ISOP 2000 implementation. The Service made several recommendations in a planning aid letter to the Corps in an attempt to rectify these shortcomings. Further interagency discussions led to modifications of the ISOP 2000, resulting in ISOP 2001.

In October 2000, the Corps issued a draft Test Iteration 7 (years 1 through 4) hydrologic monitoring report.

In December 2000, the Corps issued a SEIS and Record of Decision (ROD) for the 8.5 Square Mile Area Project (SMA) portion of the MWD to ENP Project.

In 2001, the Corps implemented the ISOP 2001 emergency deviation.

In February 2001, at the suggestion of CEQ, the Corps, Service, ENP, and District engaged the services of the U.S. Institute for Environmental Conflict Resolution (USIECR) to facilitate and mediate the development of an improved hydrologic management plan.

In August 2001, because of the process provided by the USIECR, a collaborative agreement between the Corps, Service, ENP, and District was reached on a new alternative, the IOP.

In 2001, the Corps issued a draft EIS for the IOP.

In September 2001, the Corps issued a draft SEIS for the IOP.

In December 2001, the District withdrew its support for the IOP, citing flood control concerns. The Corps, District, ENP, and the Service continued to refine this alternative to satisfy the District's concerns.

In February 2002, the final recommended plan for the IOP was discussed with DOI at a meeting among the Corps, DOI, and the District.

On March 15, 2002, the Corps provided a determination that the IOP is "not likely to adversely affect" Cape Sable seaside sparrows, wood storks, and eastern indigo snakes; but "adverse effects" would occur to Everglade snail kites because of higher water levels in WCA-3A. Additionally, adverse effects would occur to Florida panthers due to the loss of habitat through the construction of a proposed 500 cubic-feet per second (cfs) pump station (S-332C) and three seepage reservoirs associated with S-332B, C, and D Pump Stations. The Corps' determination concerning Florida panthers noted that the overall ecological improvements to panthers elsewhere in the project area would likely counterbalance the habitat lost in the footprint of the proposed reservoirs. Finally, the Corps requested that the Service amend the February 19, 1999, Biological Opinion to consider the IOP as a second RPA to address jeopardy to Cape Sable seaside sparrows.

On March 28, 2002, the Service amended the 1999 Biological Opinion to include the IOP as a second RPA. The amendment clarified that IOP Alternative 7R represents an additional RPA for water-management actions to avoid jeopardy to the Cape Sable seaside sparrow and would not destroy or adversely modify designated critical habitat. Specifically, IOP Alternative 7R must be implemented in combination with all other RPA components contained in the February 19, 1999, Biological Opinion with the exception of component number 6, requiring the completion and operation of MWD by 2003. The conclusion of the 1999 consultation would still govern and formal consultation was therefore terminated for these particular species, under 50 CFR §402.14(l)(1) *Termination of consultation*.

The Service also concurred with the Corps' determination that the IOP would "adversely affect" Everglade snail kites and its designated critical habitat in WCA-3A. The Service determined that the IOP is not likely to jeopardize the continued existence of Everglade snail kites or result in the destruction or adverse modification of its designated critical habitat. The Service determined that the IOP is not likely to adversely affect Florida panthers.

On July 3, 2002, the Corps signed a ROD for the IOP.

On January 25, 2006, the Corps signed the ROD to bridge Tamiami Trail (US Highway 41), a component of MWD to ENP Project.

On May 5, 2006, the Corps published a Notice of Intent to prepare a SEIS.

On May 10, 2006, the Corps issued a letter initiating the preparation of a supplement to the 2002 Final EIS on the IOP following a March 2006 U.S. District Court order from the Southern District of Florida.

On June 23, 2006, the Service received the Corps' June 22, 2006, draft SEIS for protection of the Cape Sable seaside sparrow.

On July 7, 2006, the Corps issued a letter to the Service requesting reinitiation of consultation concerning the IOP Alternative 7R. This letter provided the Service the biological assessment on listed species in the project area necessary to initiate the formal consultation process under the Act for the IOP Project

On November 13, 2006, the Corps and the Service agreed via a conference call that proposed Cape Sable seaside sparrow critical habitat (October 31, 2006; 71 FR 63980) would not be adversely modified or destroyed by the proposed continuation of IOP.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The proposed action is the continuation of the IOP and the operations of the IOP structures and impoundments in the Central and Southern Florida Flood Control (C&SF) Project (Appendix A - map). The IOP, representing a RPA under the Service's 1999 jeopardy Biological Opinion, was developed to avoid jeopardy to the Cape Sable seaside sparrow while meeting other needs and constraints of the region including restoration of flows to ENP and maintenance of flood control in adjacent urban areas. Several projects are expected to provide more operational flexibility in the system over the next few years. The 8.5 SMA Project, expected to be completed in 2007, is expected to provide more operational flexibility to move water from WCA-3B to northeast Shark River Slough (NE Shark Slough) in order to restore a more natural distribution of flow across Tamiami Trail.

It is our understanding that the anticipated ROD date for the Combined Structural and Operational Plan (CSOP) is early 2008. The CSOP will not be fully implemented until completion of the MWD – Tamiami Trail Project, which is currently scheduled for late 2010 or early 2011. The IOP will be in place until the CSOP is fully implemented.

The C&SF Project is a system-wide network of canals and water-control structures and includes portions of several counties, ENP, Big Cypress National Preserve (BCNP), and adjacent areas. The IOP Project area includes some of the most significant wildlife habitat that remains in south Florida, and totals over 1.2 million acres. The primary areas in which hydrology and ecology could be affected include private and public lands served by the South Dade Conveyance System (SDCS), Shark River Slough, NE Shark Slough, western Shark River Slough, Florida Bay portions of ENP, eastern portions of BCNP, remaining privately owned lands in NE Shark Slough, and four other substantial areas of historic Everglades: WCA-3A, WCA-3B, WCA-2A, and WCA-2B. The IOP may have additional indirect impacts on Biscayne National Park and the C-111 basin.

The July 2006 reinitiation letter received from the Corps states that the Corps is continuing to operate under the 2002 IOP Alternative 7R plan. The letter further states that it is the understanding of the Corps that the 2002 amendment to the Service's 1999 Biological Opinion (including the RPA and incidental take authorization therein) remains in effect pending completion of further consultation.

Structural Features

Construction features of IOP were initially authorized by two separate projects: (1) the MWD to ENP Project as described in the 1992 GDM and EIS, and (2) the C-111 Project Integrated General Reevaluation Report and EIS. The 2002 Amended Biological Opinion addressed the construction of IOP features as related to these authorized projects. Prior to the construction of IOP features, the S-332B Pump Station (4.5 acres for the pump station and levee/pipeline system that delivers water to the detention area) and S-332B West Detention Area (141 acres of detention area and 14 acres of levee footprint for a total of 155 acres) were constructed as part of the 2000 ISOP efforts.

Two components of the MWD Project were addressed in the 2002 Amended Biological Opinion and have been constructed; (1) the interim pump station S-356 (500 cfs capacity) and, (2) the removal of the southern 4 miles of the L-67 Extension levee (levee and berm material were used to backfill adjacent borrow canal).

The 2002 Amended Biological Opinion also included components of the C-111 Project that addressed construction of a new temporary pump station S-332C (575 cfs capacity) and three separate detention systems:

1. S-332C North Detention Area (217 acres of detention area and 20 acres of levee footprint for a total of 237 acres);

2. S-332B to S-332D Detention Area incorporating the existing S-332B West Detention Area and extending south to the L-31W levee near S-332D (1,352 acres of detention area and 73 acres of levee footprint for a total of 1,425 acres); and

3. The Frog pond Detention Area (incorporates four cells) which receives its inflow from the existing S-332D Pump Station and provides water deliveries to Taylor Slough (2,200 acres of detention area and 50 acres of levee footprint for a total of 2,250 acres).

The S-332B North and the Frog pond Detention Areas were constructed as authorized. The construction of the S-332B to S-332D Detention Area was dependent upon Congress approving a landswap of lands between ENP and the District. This Congressional approval did not happen in time for the construction so an intermediate plan was developed that would construct detention areas within lands that were owned by the District. To this end, the S-332C Detention Area and the partial connector between S-332B West and S-332C Detention Areas were developed. The S-332B/332C partial connector area also had a real-estate conflict that required the splitting of the connector area into separate detention areas (north and south, with a detention area of 126 acres and 19 acres of levee footprint for a total of 145 acres).

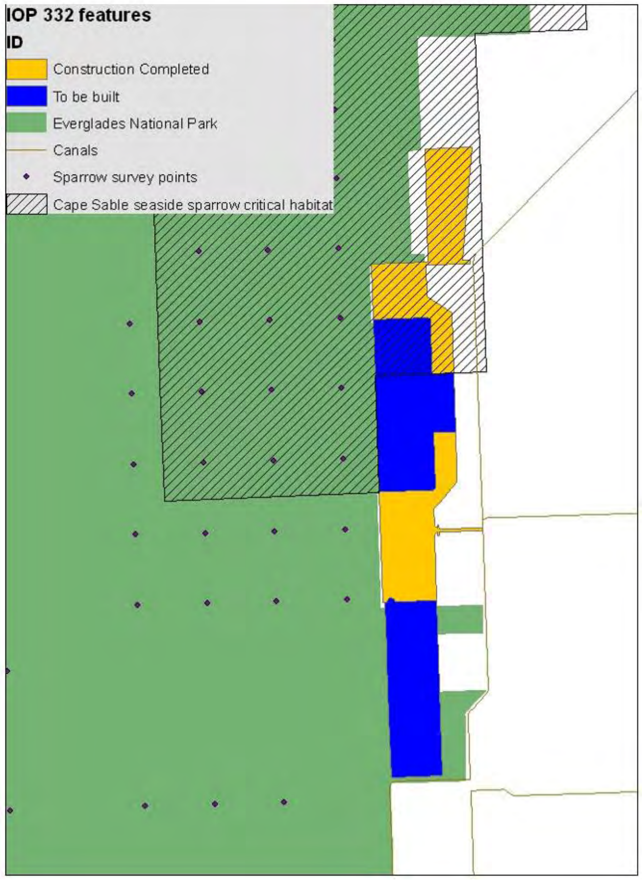

Figure 1. Completed and planned IOP 332 features.

Operational Features

For management of water levels in WCA-3A, the primary regulatory outlets are: S-12A, S-12B, S-12C, S-12D, S-343A, S-343B, S-344, S-333, and S-151. The IOP was implemented in June 2002 and requires that the S-12A, S-343A, S-343B, and S-344 structures be closed on November 1 each year, regardless of water levels within WCA-3A. Closure of S-12B follows on January 1 and of S-12C on February 1. There is no requirement to close S-12D. All structures may be reopened on July 15.

Consequently, IOP has two modes of operation: Column 1 and Column 2. The first mode of operations (Column 1) is designated as “No WCA-3A Regulatory Releases to SDCS or Shark Slough” operation and occurs when regulatory releases from WCA-3A can be met by normal operation of the WCA-3A regulatory outlets. During these times, the L-31N Canal will be maintained at Test 7 - Phase II, levels when there are no regulatory releases from WCA-3A routed through S-333 and S-334 to the SDCS. Some of these operational trigger levels are higher than those under ISOP 2001 and other IOP alternative levels, thereby addressing concerns of the Service and ENP that maintaining the L-31N Canal at ISOP levels would negatively affect ENP resources in NE Shark Slough, including designated Cape Sable seaside sparrow critical habitat. Outflow through the S-12, S-343, and S-344 structures may occur under these operations when outflows, as calculated through the WCA 3A rainfall formula, can be passed even with any closures and constraints that may be in effect.

The second mode of operations (Column 2), is designated as “WCA-3A Regulatory Releases to SDCS,” and occurs when regulatory releases from WCA-3A that would have passed through the S-12, S-343, and S-344 structures prior to IOP, are made via S-333 to L-29 and L-31N, the SDCS. Under these operations, as much water as feasible is diverted from L-29 into NE Shark Slough, but the amount is constrained by the requirement that stages at the G-3273 gauge remain below 6.8 feet (ft). If stages at G-3273 rise above 6.8 ft, operations limit inflows into the L-29 canal. This mode generally requires the use of pumping stations S-331, S-332B, S-332C, and S-332D.

During this operational phase, levels in the L-31N Canal are lowered to minimize potential flood impacts in the SDCS and, at the same time, provide the necessary downstream gradient to move some of WCA-3A regulatory releases through S-333 and S-334, down through the L-31N Canal, and into the SDCS. Routing regulatory releases from WCA-3A and ultimately to S-332B West, S-332B North, S-332C, S-332 B/C Connector, and S-332D (Frog pond) Detention Areas produces hydrological conditions that reduce overdrainage and improve habitat conditions while allowing for other project purposes. Re-hydration of these areas is intended to lessen the frequency of fire and to more effectively manage the invasion of exotics and other woody vegetation in these habitats until the CSOP is operational.

Water supply operations may occur when structures in the SDCS reach a trigger level that indicates that water supply is required. These water supply operations were included in the hydrologic modeling provided by the Corps. Therefore, the water supply operations are covered under this consultation based on the parameters included in the modeling.

The S-356 pumping is limited to the amount of seepage from NE Shark Slough to L-31N, between S-335 to G-211. Operations of the structure are also limited to periods that G-3273 is less than 6.8 ft National Geodetic Vertical Datum (NGVD). In addition, the L-29 stage constraint would be in effect. This structure is not scheduled to be used for pre-storm drawdowns for the SDCS. A technical team has been established to evaluate pumping limits and operations.

The operation of the S-356 Pump Station was previously modeled and included in Corps’ final 2002 EIS for the IOP. Similar to the MWD Project design, the maximum pump size was 500 cfs; however, the pumping rate was correlated to the seepage from ENP between S-335 and G-211. The amount of ENP seepage was first calculated by the model, and then used as a daily pumping amount up to the maximum of 500 cfs. The Corps identified the need and plans for future pump testing in the SEIS. The tests will be conducted within the limits specified in IOP to collect seepage entering the reach between S-335 and G-211.

Various S-356 pumps on/off trigger elevations were investigated for modeling. Associated with the L-31N stages, the triggers that were modeled included turning the pump on at 5.8 ft NGVD and turning the pump off at 5.5 ft NGVD. These trigger elevations were higher than the MWD design set (pump on at 5.5 ft NGVD and pump off at 5.0 ft NGVD). The modeled pump operation was also limited to times when the stage in the L-29 Canal was less than 9.0 ft NGVD. Furthermore, pumping would be suspended during times when G-3273 was at 6.8 ft NGVD or higher, and the G-3273 constraint generally required the suspension of S-356 pumping before the L-29 Canal constraint. The average annual pumping modeled for the initial IOP operations was expected to yield about 42 thousand acre-feet per year. It was anticipated that the initial IOP operations would be evaluated and adjusted over a period of years.

The S-335 will continue its primary function as a supplemental water deliveries structure with no change in operational triggers from Test 7 - Phase I, of the Experimental Program to ENP, except when making S-151 regulatory releases. The intent of operations when not making regulatory releases to the SDCS (IOP operational table-Column 1) is to limit the volume of water passed at S-335 to pre-ISOP conditions and not use S-332B, S-332C, or S-332D or other triggers to pass additional flows. It is recognized that under these conditions operations of the S-335 structure would be infrequent. When making regulatory releases through the S-151 structure, discharges are not to exceed inflows from the S-151/S337 flow path when making regulatory releases to the SDCS (IOP operational table-Column 2). Use of S-333/S-334 is priority before the use of S-335/S-151/S-337.

The IOP includes the WCA 3A deviation schedule of November 2000. This schedule includes both the partial removal of one zone and addition of a new zone to the WCA-3A regulation schedule. Zone D, the lower transition zone, is removed from week 48 (November 24-30) to week 6 (February 6-10). Zone E1 was added to the schedule, and effectively lowers Zone E beginning in week 6 and ends in week 29 (July 14-20) to offset reductions in outflows that may result from S-12 closures to protect sparrow nesting.

Marsh Operations

Developed after IOP was implemented in 2002, marsh operations define operations for the S-332B North and West Seepage Reservoirs, the S-332C Seepage Reservoir, the S-332B/ S-332C Connector, and associated pump stations. Normal operation of the reservoirs, intended to achieve marsh restoration, consist of a maximum depth of 2.0 ft. During flooding emergencies, the maximum depth can be raised to 4.0 ft. Once the S-332B/C Connector is complete and it is practical to do the construction necessary to raise the western emergency overflow weir of the S-332B West Detention Area, overflow events to ENP will cease. Additionally, pumping to capacity at the S-332B Pump Station will occur if limiting conditions within the Cape Sable seaside sparrow habitat are not exceeded. The IOP EIS documents include the following operational flexibility to vary from these operations:

1. S-332B North Seepage Reservoir – Inflows to the reservoir will occur through two 125-cfs pumps. A weir will discharge water from the reservoir to the east. The intent of reservoir operations is to achieve marsh restoration. The maximum water depth is 2.0 ft except during flooding emergencies when it is raised to 4.0 ft. Operations do not include a

requirement to maintain water levels in the detention areas during dry conditions by bringing water into the basin from areas outside the drainage basis.

2. S-332B West Seepage Reservoir – The reservoir is fed by two 125-cfs pumps and one 75-cfs pump. Overflow events into ENP may exist temporarily until the partial S-332B/ S-332C Connector is built and the western levee is raised. Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the detention areas during dry conditions by bringing water into the basin from areas outside the drainage basin. This detention area will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists, similar to an event like the no-name storm, the depth of water allowed would be increased to a maximum of 4.0 ft.

3. S-332C Seepage Reservoir – The reservoir has the same normal operations are the same as the S-332B West Reservoir except that the pump capacity at S-332C is temporary and may be modified as necessary to achieve restoration of Taylor Slough. Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the detention areas during dry conditions by bringing water into the basin from areas outside the drainage basin. This detention area will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists, similar to an event like the no-name storm, the depth of water allowed would be increased to a maximum of 4.0 ft.

4. S-332D (Frog Pond) Seepage Reservoir – The maximum depth of the reservoir is 2.0 ft. Once the S-332D Pump Station outlet elevation constraint is relieved, the maximum depth may be raised to 4.0 ft during flooding emergencies. The S-332D Pump Station operates at 500 cfs from July 16 (or the end of the Cape Sable seaside sparrow breeding season confirmed by the Service) to November 31; 325 cfs from December 1 to January 31; and 165 cfs from February 1 to July 15. The Corps plans to acquire new information and modify the 165 cfs criteria; however, the Service has not evaluated the effects of this potential change as part of this biological opinion.

In addition to the parameters outlined above, staff from ENP initially provided the Corps proposed criteria to be considered for marsh operations. Further evaluation through the interagency CSOP Team resulted in necessary refinements to the initially proposed criteria. The tentatively preferred operations relax the IOP’s 2-ft maximum depth criteria for the detention areas and raise it up to 2.5 ft. This is in conjunction with proposed operations under normal conditions that allow S-332B and S-332C Pump Stations to pump into the detention areas based on the gradient and water levels between the marsh in ENP and the detention areas. The target gradient is based on measured water levels ¼ mile and 4 miles from the detention areas. The gradient, or change in water level, should be less than 0.4 ft per mile. Pumping into the detention area can be continued until this gradient is exceeded. At this point, pumping would be reduced to a level that would maintain the target gradient or stages exceed 2.5 ft in the detention areas.

The tentatively preferred operations developed in the CSOP process also includes an override for these marsh operations based upon levels in the canal to provide for continued pumping into the detention areas in order to maintain flood control in the developed areas east of the canal and to reduce discharges south through the C-111 into Barnes Sound. The Corps intends to begin field testing these proposed operational criteria, in coordination with the Service and other agencies, to provide the information necessary to extrapolate model output to reflect actual conditions produced in the system under these operations.

The Corps is currently operating the C-111 detention areas at the 2-ft maximum depth and has installed the monitoring gages in the ENP required to test these operations. To monitor marsh effects of stage changes in the detention areas, the Corps, in coordination with the Service and other agencies, plans to begin testing at stages varying from the 2-ft default and working towards the operational criteria developed in CSOP while targeting the 0.4 ft per mile gradient between the detention areas and adjacent marsh. This testing will be coordinated and congruent with the build out of the full detention areas included in Alterative 7R. The Service will work closely with the Corps and review impacts to listed species prior to the testing. Completion of the build out of the C-111 detention areas included in Alterative 7R is contingent on Congressional funding and is scheduled for construction after Fiscal Year 2008.

Operational Constraints

While there are several operational constraints, two operational constraints have a large effect on IOP operations. The first occurs when the stage at G-3273 reaches 6.8 ft NGVD. The second constraint occurs when the canal level in L-29 reaches 9.0 ft NGVD. The 6.8 ft level at G-3273 tends to occur before the 9.0 ft canal level constraint occurs in the L-29. Both of these constraints limit the amount of water that can be delivered into NE Shark Slough. It is expected that the G-3273 constraint will be removed upon completion of the 8.5 SMA Project in 2007, and the Corps will coordinate with the Service and other agencies to optimize benefits from the removal of this constraint consult on any potential impacts to threatened and endangered species, as needed.

Pre-Storm Drawdowns

The IOP table of operations may be modified for other than named events. In this situation, the District and Corps will monitor antecedent conditions, groundwater levels, canal levels, and rainfall. If these conditions indicate a likelihood of flooding, District will make a recommendation to the Corps to initiate pre-storm operations. The Corps will review the data, advise ENP and the Service of the conditions, consult with the Miccosukee Tribe of Indians of Florida (Tribe) and make a decision whether to implement pre-storm drawdown or otherwise alter system-wide operations from those contained in the table. The Corps estimated that out of the 31-year period of record, 44 tropical storms could have initiated pre-storm drawdowns (3-day events each) if other conditions were appropriate. These pre-storm operations with these specific parameters were included in the hydrologic modeling provided by the Corps and therefore analyzed in this biological opinion.

Modifications to the operations may also occur for other purposes than named storm events. The Chairman of the Tribe or his/her designated representatives, will monitor the conditions in WCA-3A and other tribal lands and predicted rainfall. If the Tribe determines these conditions indicate jeopardy to the health or safety of the Tribe, the Chairman will make a recommendation to the Corps to change the operations of the S-12 structures or other parts of the system. The Corps will review the data and advise appropriate agencies of the conditions, and the Corps' District Commander will personally consult with the Chairman of the Tribe prior to making a decision whether to implement changes to the S-12 operations. These changes in S-12 operations were not included in model simulations or evaluations of effects to listed species. Because the Service does not have information on the scope of these changes, this biological opinion does not cover potential changes to the S-12 operations as described in this paragraph.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project (Figure 2) includes the entire range of the Everglade snail kite and the Cape Sable seaside sparrow. For the wood stork, the action area includes all of WCA-3 and ENP, and an area encompassing 18.6 miles around any wood stork nesting colony that has been active within the past 10 years and occurs within 18.6 miles of WCA-3 or ENP.

Table 1. Alternative 7R Operations.

	No WCA-3A Regulatory Releases to SDCS or Shark Slough	**WCA-3A Regulatory Releases to SDCS**
Regulation Schedule	Deviation schedule for WCA-3A, November 2000 WCA-3A interim regulation schedule as specified by Corps including raising Zone D to Zone C from Nov 1 to Feb 11. No deviation in WCA-2A regulation schedule.	Deviation schedule for WCA-3A, November 2000 WCA-3A interim regulation schedule as specified by Corps including raising Zone D to Zone C from Nov 1 to Feb 11. No deviation in WCA-2A regulation schedule.
S-343 A/B and S-344	Closed Nov 1 to July 15 independent of WCA-3A levels	Closed Nov 1 to July 15 independent of WCA-3A levels
S-12A/B/C/D Sandbag culverts under Tram Road by 1 Feb if necessary	S-12A closed Nov 1 to Jul 15 S-12B closed Jan 1 to Jul 15 S-12C closed Feb 1 to Jul 15 S-12D no closure dates Follow WCA-3A regulation schedule after Jul 15 Note: If closure requires regulatory releases to SDCS then switch to operations for regulatory releases to SDCS.	S-12A closed Nov 1 to Jul 15 S-12B closed Jan 1 to Jul 15 S-12C closed Feb 1 to Jul 15 S-12D no closure dates Follow WCA-3A regulation schedule after Jul 15
S-333: G-3273 < 6.8' NGVD Degrade the lower 4 miles of the L-67 Extension	55 percent of the rainfall plan target to NE Shark Slough and 45 percent through the S-12 structures. When WCA-3A is in Zone E1 or above, maximum practicable through S-333 to NE Shark Slough per WCA-3A deviation schedule.	55 percent of the rainfall plan target to NE Shark Slough, plus as much of the remaining 45 percent that the S-12 structures cannot discharge to be passed through S-334; and subject to capacity constraints, which are 1350 cfs at S-333, L-29 maximum stage limit, and canal stage limits downstream of S-334. When WCA-3A is in Zone E1 or above, maximum practicable through S-333 to NE Shark Slough per WCA-3A deviation schedule.
S-333: G-3273 > 6.8' NGVD	Closed	Match S-333 with S-334 flows
L-29 constraint	9.0 ft	9.0 ft
S-355A&B	Follow the same constraints as S-333. Open whenever gradient allows southerly flow.	Follow the same constraints as S-333. Open whenever gradient allows southerly flow.
S-337	Water Supply	Regulatory releases as per WCA-3A deviation schedule.
S-151	Water Supply	Regulatory releases as per WCA-3A deviation schedule.

	No WCA-3A Regulatory Releases to SDCS or Shark Slough	**WCA-3A Regulatory Releases to SDCS**
S-335	Water Supply The intent is to limit the volume of water passed at S335 to pre-ISOP conditions and not use S332B, S332C, or S332D or other triggers to pass additional flows. Note: It is recognized that under these conditions operations of S-335 would be infrequent.	When making regulatory releases through S-151, limit S-335 outflows to not exceed inflows from the S-151/S-337 path. Use S-333/S-334 before S-335/S-151/S-337
S-334	Water Supply	Pass all or partial S-333 flows Depending on stage at G-3273
S-338	Open 5.8 Close 5.5	Open 5.8 Close 5.4
G-211 Tailwater constraint 5.3	Open 6.0 Close 5.5	Open 5.7 Close 5.3
S-331	<u>Angel's Criteria</u> – If Angel's well is <5.5 ft, then no limit on S-331 hw level. If Angel's well is 5.5-6.0 ft, S-331 avg. daily is between 5.0–4.5 If Angel's well is above 6.0 ft, S-331 avg. daily is between 4.5–4.0 until Angel's well is 5.7	<u>Angel's Criteria</u> – If Angel's well is <5.5 ft, then no limit on S-331 hw level. If Angel's well is 5.5-6.0 ft, S-331 avg. daily is between 5.0–4.5 If Angel's well is above 6.0 ft, S-331 avg. daily is between 4.5 – 4.0 until Angel's well is 5.7
S-332B Note 1: There will be two 125-cfs pumps and one 75-cfs pump directed to the west seepage reservoir. The remaining two 125-cfs pumps will be directed to the north seepage reservoir. Note 2: A new indicator will be established for Subpopulation F. Operations will be modified as necessary to achieve desired habitat conditions consistent with the restoration purposes outlined in the C-111 General Reevaluation Report (GRR).	Pumped up to 575 cfs* On 5.0 Off 4.7** *Pump to capacity if limiting conditions within the Sparrow habitat are not exceeded. There will be no overflow into the ENP when the project (*i.e.*, the S-332B North Seepage reservoir and the partial S-332B/S-332C Connector) is complete and when it is practical to do the construction necessary to raise the western levee. There may be overflow during emergency events until the project is complete and the western levee is raised. **If, after the first 30 days of operation, there is no observed drawdown at the pump, this stage level will be raised to 4.8	Pumped up to 575 cfs* On 4.8 Off 4.5 *Pump to capacity if limiting conditions within the Sparrow habitat are not exceeded. There will be no overflow into the ENP when the project (*i.e.*, the S-332B North Seepage Reservoir and the partial S-332B/S-332C Connector) is complete and when it is practical to do the construction necessary to raise the western levee. There may be overflow during emergency events until the project is complete and the western levee is raised.

	No WCA-3A Regulatory Releases to SDCS or Shark Slough	WCA-3A Regulatory Releases to SDCS
S-332B North Seepage Reservoir	The north reservoir is the new 240-acre reservoir located to the north of the pump station with a weir discharging to the east. Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists similar to an event like the "No Name" storm, the depth of water would be increased to 4.0 ft when possible.	The north reservoir is the new 240-acre reservoir located to the north of the pump station with a weir discharging to the east. Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists similar to an event like the "No Name" storm, the depth of water would be increased to 4.0 ft when possible.
S-332B West Seepage Reservoir	The west reservoir is the existing 160-acre reservoir and is to the west of the pump station. There will be no overflow into the ENP when the project (*i.e.*, the S-332B North Seepage reservoir and the partial S-332B/S-332C Connector) is complete and when it is practical to do the construction necessary to raise the western levee. There may be overflow during emergency events until the project is complete and the western levee is raised. Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists similar to an event like the "No Name" storm, the depth of water would be increased to 4.0 ft.	The west reservoir is the existing 160-acre reservoir and is to the west of the pump station. There will be no overflow into the ENP when the project (*i.e.*, the S-332B North Seepage Reservoir and the partial S-332B/S-332C Connector) is complete and when it is practical to do the construction necessary to raise the western levee. There may be overflow during emergency events until the project is complete and the western levee is raised. Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists similar to an event like the "No Name" storm, the depth of water would be increased to 4.0 ft.

	No WCA-3A Regulatory Releases to SDCS or Shark Slough	WCA-3A Regulatory Releases to SDCS
S332C The S-332C pump capacity is temporary. A new indicator will be established and a new gauge will be installed in Rocky Glades. Operations will be modified as necessary to achieve desired habitat conditions consistent with the restoration of Taylor Slough based on the C-111 GRR.	Pumped up to 575 cfs* On 5.00 Off 4.70** * Pump to capacity unless habitat conditions are not being achieved within the Rocky Glades. There will be no overflow into the ENP. **If, after the first 30 days of operation, there is no observed drawdown at the pump, this stage level will be raised to 4.8	Pumped up to 575 cfs* On 4.8 Off 4.5 * Pump to capacity unless habitat conditions are not being achieved within the Rocky Glades. There will be no overflow into the ENP.
S-332C Seepage Reservoir	300 acres with overflow to the east Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists similar to an event like the “No Name” storm, the depth of water would be increased to 4.0 ft.	300 acres with overflow to the east Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if the Corps determines that a flood emergency exists similar to an event like the “No Name” storm, the depth of water would be increased to 4.0 ft.

	No WCA-3A Regulatory Releases to SDCS or Shark Slough	WCA-3A Regulatory Releases to SDCS
S-332B/S-332C Connector	141 acres partial 206 acres full 1,262 acres with the land swap Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if Corps determines that a flood emergency exists similar to an event like the “No Name” storm, the depth of water would be increased to 4.0 ft. The Corps, Service, ENP, and District will jointly develop a rule for emergency operations that is consistent with C-111 Project purposes before the land swap B/C connector is used.	141 acres partial 206 acres full 1,262 acres with the land swap Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if Corps determines that a flood emergency exists similar to an event like the “No Name” storm, the depth of water would be increased to 4.0 ft. The Corps, Service, ENP, and District will jointly develop a rule for emergency operations that is consistent with C-111 project purposes before the land swap B/C connector is used.
S-332D	Pumped up to 500 cfs from Jul 16 (or the end of the breeding season, as confirmed by Service) to Nov 31; 325 cfs from Dec 1 to Jan 31; and 165 cfs* from Feb 1 to Jul 15. Meet Taylor Slough Rainfall formula consistent with marsh restoration (No L-31W constraint). On 4.85 Off 4.65 *New information will be sought to evaluate the feasibility of modifying the 165 cfs constraint.	Pumped up to 500 cfs from Jul 16 (or the end of the breeding season, as confirmed by Service) to Nov 31; 325 cfs from Dec 1 to Jan 31; and 165 cfs* from Feb 1 to Jul 15. Meet Taylor Slough Rainfall formula consistent with marsh restoration (No L-31W constraint). On 4.7 Off 4.5 *New information will be sought to evaluate the feasibility of modifying the 165 cfs constraint.

	No WCA-3A Regulatory Releases to SDCS or Shark Slough	WCA-3A Regulatory Releases to SDCS
Frog Pond Seepage Reservoir	810 acres with overflow into Taylor Slough Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if Corps determines that a flood emergency exists similar to an event like the "No Name" storm, the depth of water would be increased to a maximum of 4.0 ft. However, a depth of 4.0 ft in the Frog Pond is not possible at this time due to the constraint of the S-332D Pump Station outlet elevation.	810 acres with overflow into Taylor Slough Normal operations will be targeted to achieve marsh restoration and phased in over a period of years. However, this provision does not include a requirement to maintain water levels in the reservoirs during dry conditions by bringing water in from outside the drainage basin. This seepage reservoir will have a normal maximum depth of water of 2.0 ft. However, if Corps determines a flood emergency exists similar to an event like the "No Name" storm, the depth of water would be increased to a maximum of 4.0 ft. However, a depth of 4.0 ft in the Frog Pond is not possible at this time due to the constraint of the S-332D Pump Station outlet elevation.
S-332	Closed	Closed
S-175	Closed	Closed
S-194	Open 5.5 Close 4.8	Operated to maximize flood control discharges to coast Open 4.9 Close 4.5
S-196	Open 5.5 Close 4.8	Operated to maximize flood control discharges to coast Open 4.9 Close 4.5
S-176	Open 5.0 Close 4.75	Open 4.9 Close 4.7
S-177	Open 4.2 (see S-197 open) Close 3.6	Open 4.2 (see S-197 open) Close 3.6
S-18C	Open 2.6 Close 2.3	Open 2.25 Close 2.00

	No WCA-3A Regulatory Releases to SDCS or Shark Slough	WCA-3A Regulatory Releases to SDCS
S-197	If S-177 headwater is greater than 4.1 or S-18C headwater is greater than 2.8 open 3 culverts If S-177 headwater is greater than 4.2 for 24 hours or S-18C headwater is greater than 3.1 open 7 culverts. If S-177 headwater is greater than 4.3 or S-18C headwater is greater than 3.3 open 13 culverts. Close gates when all the following conditions are met: 1. S-176 headwater is less than 5.2 and S-177 headwater is less than 4.2. 2. Storm has moved away from the basin. 3. After Conditions 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176. All culverts should be closed if S-177 headwater is less than 4.1 after all conditions are satisfied.	If S-177 headwater is greater than 4.1 or S-18C headwater is greater than 2.8 open 3 culverts. If S-177 headwater is greater than 4.2 for 24 hours or S-18C headwater is greater than 3.1 open 7 culverts. If S-177 headwater is greater than 4.3 or S-18C headwater is greater than 3.3 open 13 culverts. Close gates when all the following conditions are met: 1. S-176 headwater is less than 5.2 and S-177 headwater is less than 4.2. 2. Storm has moved away from the basin. 3. After Conditions 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176. All culverts should be closed if S-177 headwater is less than 4.1 after all conditions are satisfied.
S-356	When conditions permit (*i.e.*, G-3273 and L-29 Constraints), discharges from S-356 will go into L-29. Pumping will be limited to the amount of seepage into L-31N in the reach between S-335 and G-211. A technical team will evaluate pumping limits and operations. The pumps will be operated accordingly.	When conditions permit (*i.e.*, no S-334 regulatory releases and G-3273 and L-29 Constraints), discharges from S-356 will go into L-29. Pumping will be limited to the amount of seepage into L-31N in the reach between S-335 and G-211. A technical team will evaluate pumping limits and operations. The pumps will be operated accordingly.

* Operations for other than named events: District will monitor antecedent conditions, groundwater levels, canal levels and rainfall. If these conditions indicate a strong likelihood of flooding, District will make a recommendation to the Corps to initiate pre-storm operations. The Corps will review the data, advise ENP and Service of the conditions, consult with the Tribe and make a decision whether to implement pre-storm drawdown or otherwise alter system-wide operations from those contained in the table.

** Note: The Chairman of the Tribe or his designated representatives, will monitor the conditions in WCA-3A and other tribal lands and predicted rainfall. If the Tribe determines these conditions indicate jeopardy to the health or safety of the Tribe, the Chairman will make a recommendation to the Corps to change the operations of the S-12 structures or other parts of the system. The Corps will review the data, advise appropriate agencies of the conditions, and the Corps' District Commander will personally consult with the Chairman of the Tribe prior to making a decision whether to implement changes to the S-12 operations.

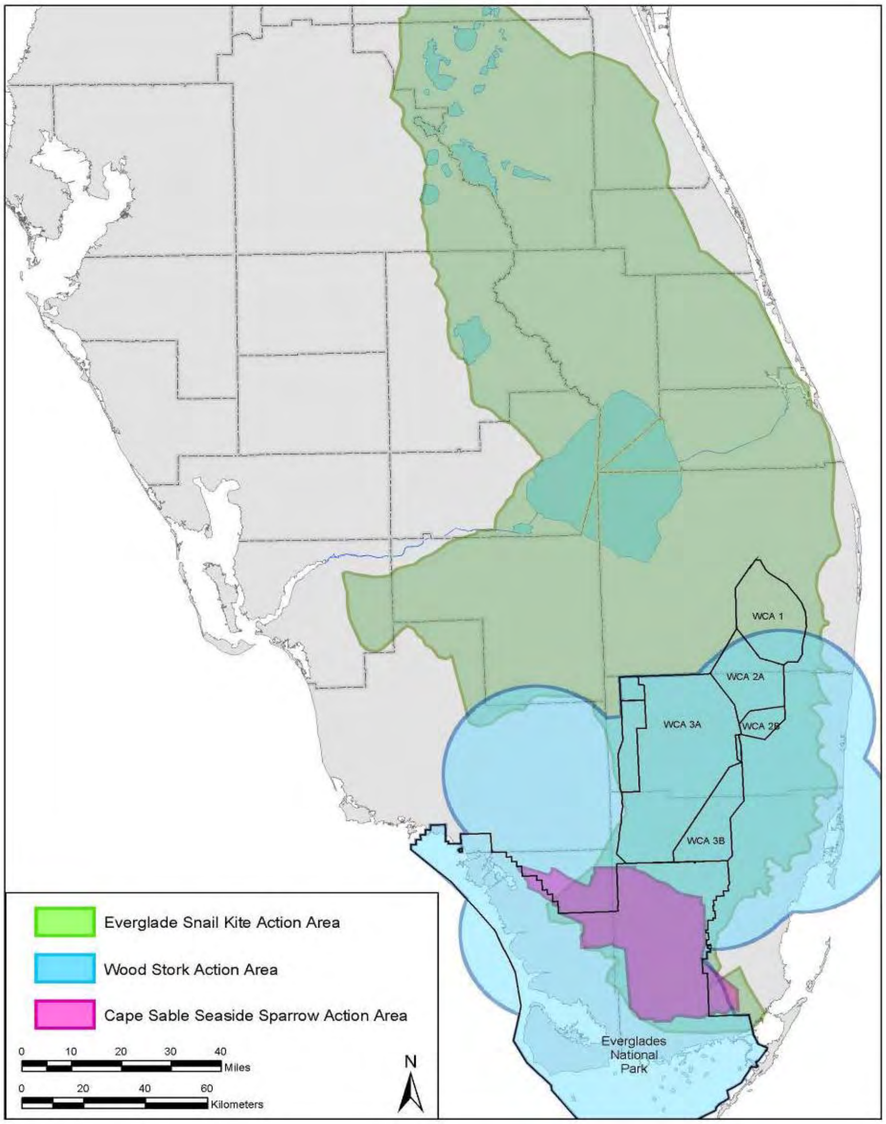

Figure 2. Action area.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/Critical Habitat Description

Cape Sable Seaside Sparrow

The Cape Sable seaside sparrow is one of eight extant subspecies of seaside sparrow in North America. Its distribution is limited to the short-hydroperiod wetlands at the bottom of the greater Everglades system, on the southern tip of mainland Florida. The Cape Sable seaside sparrow was first provided protection when it was listed on March 11, 1967, under the Endangered

Species Preservation Act of 1967 (Service 1967). That protection was continued under the Endangered Species Conservation Act of 1969 and the Act of 1973. The sparrow and all other species listed under the Endangered Species Conservation Act were the first species protected under the Act of 1973, as amended, and all of these species were given the ‘endangered’ designation.

Species Description

The Cape Sable seaside sparrow is a medium-sized sparrow, 5.1 to 5.5 inches (13 to 14 centimeters [cm]) in length (Werner 1975). Of all the seaside sparrows, it is the lightest in color (Curnutt 1996). The dorsal surface is dark olive-grey; and the tail and wings are olive-brown (Werner 1975). Adult sparrows are light grey to white ventrally, with dark olive-grey streaks on the breast and sides. The throat is white with a dark olive-grey or black whisker on each side. Above the whisker is a white line along the lower jaw. A grey ear patch outlined by a dark line sits behind each eye. The lores of the head are yellow. The leading edge of each wing has a small yellow patch near the alula. The legs and bill are grey (Curnutt 1996). There are no noticeable differences in markings between the sexes. However, there are significant differences in the sizes of specific body parts between the sexes (Werner 1975), but these differences are not consistent enough to conclusively determine gender. Gender can be determined in adult sparrows during the breeding season by the presence of a brood patch (female) or a cloacal protuberance (male). The plumage of young sparrows differ from adults in that they do not have whisker marks, lack the yellow lores, and have brown streaking on the chest and an overall more brownish plumage coloration.

Critical Habitat

Critical habitat for the Cape Sable seaside sparrow was designated on August 11, 1977 (Service 1977a). Currently, the critical habitat includes areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Miami-Dade, and Monroe Counties. Much of this area is within the boundaries of ENP. Because this was one of the first critical habitat designations under the Act, there were no primary constituent elements defined. The designated area encompasses about 197,260 acres, and includes portions of Subpopulations B through F. Subpopulation A is the only area occupied by sparrows that does not have associated designated critical habitat.

Because the majority of designated critical habitat lies within ENP, there have been relatively few impacts. However, about 471.5 acres (190.8 hectares) of critical habitat were altered during construction of the S-332B Detention Area and a portion of the B-C Connector. No other permanent alteration of critical habitat is known. Degradation of critical habitat has resulted from flooding within the area of Subpopulation D, and frequent fires and woody vegetation encroachment in overdrained areas near sparrow Subpopulations C and F. Degradation of these habitats is not permanent, and they may improve through restoration efforts. The current critical habitat designation includes many areas of habitat that are not suitable for sparrows, including the pinelands and abandoned agricultural areas. The 471.5 acres (190.8 hectares) of impacts to critical habitat occurred within abandoned agricultural areas that did not closely resemble suitable sparrow habitat.

On October 31, 2006, the Service proposed revisions to a critical habitat designation for the Cape Sable seaside sparrow. The proposed revision will reduce the total acreage of critical habitat from 197,260 acres to approximately 156,350 acres. The Service proposes to designate seven units as critical habitat for the sparrow in southern Florida, which includes critical habitat for Subpopulation A that previously was not designated. On November 13, 2006, the Corps and the Service agreed via a conference call that proposed Cape Sable seaside sparrow critical habitat (October 31, 2006; 71 FR 63980) would not be adversely modified or destroyed by the proposed continuation of IOP.

Life History

Unlike most other subspecies of seaside sparrow, which occupy primarily brackish tidal systems (Post and Greenlaw 1994), the Cape Sable seaside sparrow currently occurs primarily in the short-hydroperiod wet prairies, also referred to as marl prairies, though it still occupies brackish marshes in some areas. The now-extinct dusky seaside sparrow (*A. m. nigrescens*) was the only other subspecies that persisted in freshwater wetlands (Post and Greenlaw 1994; Pimm et al. 2002).

The Cape Sable seaside sparrow is generally sedentary, secretive, and non-migratory, occupying the marl prairies of southern Florida year-round. During the breeding season (March to August), male sparrows establish and defend territories that are variable in size, ranging from 0.7 to 16.8 acres (Werner 1975), with reported average sizes ranging from 2.2 to 8.9 acres within different sites and years (Werner and Woolfenden 1983; Pimm et al. 2002).

Sparrows are thought to be generally monogamous (Post and Greenlaw 1994), with a single female occurring within a male's breeding territory. However, recent information indicates that sparrows may be polygamous under some circumstances, such as within small populations, and it is unknown whether the birds are simultaneously or sequentially polygamous (Lockwood et al. 2006). Throughout the breeding season, the majority of a sparrow pair's activities occur within this territory, including breeding, feeding, and sheltering. Within an area of suitable habitat, territories do not appear to be tightly packed (Werner 1975), and there are gaps between defended boundaries of adjacent males. It is likely that sparrows venture into these "unclaimed areas" during the breeding season.

Sparrows generally begin nesting in early March (Lockwood et al. 2001), but may begin territorial behavior, courtship, and nest-building in late February (Werner and Woolfenden 1983; Lockwood et al. 1997). This timing coincides with the dry season, and most areas within the marl prairies are either dry or only shallowly inundated at the beginning of the breeding season. During the dry portion of the breeding season (March to May), sparrows build nests above the ground in the vegetation 6.7 to 7.1 inches above the ground (Werner 1975; Lockwood et al. 2001). Nests are woven into clumps of dense vegetation and are well-concealed (Werner 1975, Post and Greenlaw 1994). Nest cups are consistently concealed from above (Post and Greenlaw 1994), either through construction of a domed cover or through modifying vegetation in the vicinity (Werner 1975, Post and Greenlaw 1994). During the wet portion of the sparrow breeding season (June to August), sparrows build their nests higher in the vegetation than during dry periods, an average of 8.3 inches above the ground surface (Lockwood et al. 2001). Wet-season nests probably occur in taller vegetation than during the dry season because even at the nest height, there must be sufficient height and density of vegetation to cover and conceal nests.

Pimm et al. (2002) suggest that nesting will not be initiated if water depths are greater than 4 inches during the breeding season. For many years, rising water levels resulting from the onset of summer rains were thought to end the breeding season (Werner 1975). While these statements are true, the sparrows may respond to changes in hydrologic conditions as long as water levels are not prohibitively high. Large rainfall events early in the wet season may cause some nest failure and sparrows generally cease breeding when water levels rise above the mean height of the nests from the ground (Lockwood et al. 1997). However, if water levels subsequently drop, sparrows may again initiate breeding activity. The initiation of molt, which usually occurs in early September, is probably the best indicator of the true end of breeding season.

The sparrow nesting cycle, from nest construction to independence of young, lasts about 30 to 50 days (Werner 1975; Lockwood et al. 2001), and sparrows may renest following both successful and failed nesting attempts (Werner 1975; Post and Greenlaw 1994; Lockwood et al. 2001). Both parents rear and feed the young birds and may do so for an additional 10 to 20 days after the young fledge (Woolfenden 1956 1968; Trost 1968). They are incapable of flight until they are about 17 days of age; when approached flightless fledglings will freeze on a perch until the threat is less than a 3 ft away, and then run along the ground (Werner 1975; Lockwood et al. 1997).

Because of the long breeding season in southern Florida, sparrows regularly nest several times within a year, and may be capable of successfully fledging 2 to 4 clutches, though few sparrows probably reach this level of success (Lockwood et al. 2001). Second and third nesting attempts may occur during the early portion of the wet season, and nests later in the season usually occur over water.

Nest success rates vary among years, and range from 12 to 53 percent (Lockwood et al. 2001). Nest predation is the primary cause of nest failure that is documented (Pimm et al. 2002), accounting for more than 75 percent of all nest failures (Lockwood et al. 1997). As water levels begin to rise above ground surface with the onset of the summer rains in May to June, nest predation rates also rise. Nests that are active after June 1, when water levels are above ground, are more than twice as likely to fail as nests during drier periods (Lockwood et al. 2001). This effect appears to be a result of both increased likelihood of nests being flooded and an increased likelihood of predation (Lockwood et al. 1997, 2001; Pimm et al. 2002).

Outside of the breeding season, sparrows generally remain sedentary in the general vicinity of their breeding territories, but expand the area that they use compared to the breeding season territory (Dean and Morrison 2001). Average non-breeding season home range size was about 42.1 acres in size, and ranged from 14.1 to 137.1 acres (Dean and Morrison 2001). Some individuals make exploratory movements away from the area of their territories, and may occasionally relocate their territories and home ranges before resuming a sedentary movement pattern (Dean and Morrison 2001).

Sparrows are generally short-lived, with an average individual annual survival rate of 66 percent (Lockwood et al. 2001). The average lifespan is probably 2-3 years. Consequently, a sparrow population requires favorable breeding conditions in most years to be self-sustaining, and cannot persist under poor conditions for extended periods (Lockwood et al. 1997, 2001; Pimm et al. 2002).

While detailed information about the diet of sparrows is not known, invertebrates comprise the majority of their diet, though sparrows may also consume seeds when they are available (Werner 1975; Post and Greenlaw 1994). Howell (1932) identified the contents of 15 sparrow stomachs and found remains of primarily insects and spiders, as well as amphipods, mollusks, and plant matter. Primary prey items that are fed to nestlings during the breeding season include grasshoppers (Orthoptera), moths and butterflies (Lepidoptera), dragonflies (Odonata), and other common large insects (Post and Greenlaw 1994; Lockwood et al. 1997). Adult sparrows probably consume mainly the same species during the nesting season. Sparrows may consume different proportions of different species over time and among sites, suggesting that they are dietary generalists (Pimm et al. 2002). During the non-breeding season, preliminary information from evaluation of fecal collections suggests that a variety of small invertebrates, including weevils and small mollusks are regularly consumed (Dean and Morrison 2001). Evidence of seed consumption was only present in four percent of samples (Dean and Morrison 2001). These non-breeding season samples may not be representative of the foods most frequently consumed during that season and may only represent a portion of the items ingested.

While the sparrow appears to be a dietary generalist, an important characteristic of sparrow habitat is its ability to support a diverse array of insect fauna. In addition, these food items must be available to sparrows both during periods when there is dry ground and during extended periods of inundation. The specific foraging substrates used are unknown, but they probably vary throughout the year in response to hydrologic conditions.

Sparrow subpopulations require patches of contiguous open habitat 4,000 acres or larger. The minimum area required to support a population has not been specifically determined, but the smallest area that has remained occupied by Cape Sable seaside sparrows for an extended period is this size. Individual sparrows are area-sensitive, and generally avoid the edges where other habitat types meet the marl prairies. They will only occupy patches less than 100 acres of marl prairie vegetation when they occur within large, expansive areas and are not close to forested boundaries (Dean and Morrison 2001). Once sparrows establish a breeding territory, they exhibit high site fidelity, and each individual sparrow may only occupy small area for the majority of their lives. Because sparrows are generally sedentary and avoid forested areas, they are not likely to travel great distances to find mates or to find outlying patches of suitable habitat. The occurrence of sparrows over time within each of the subpopulations shows a centrality, in which sparrows most consistently occur and are most abundant near the center of the patch of habitat in which they occur.

Within a patch of occupied suitable habitat, sparrow breeding territories do not generally saturate the entire area. Even when sparrows occur at high densities, small areas usually remain between adjacent territories, though some territories also appear to overlap. In addition, some gaps remain unclaimed by territorial birds that may appear to be suitable habitat (Werner 1975). In many cases, areas that appear to be suitable for sparrow occupancy may not be suitable during certain environmental conditions and this may cause sparrow territories to appear to be widely separated from neighboring territories.

Throughout the history of the Cape Sable seaside sparrow, the species has been recognized to have been associated with either of two vegetation communities: (1) the cordgrass marshes that are partly tidally influenced and occur within a narrow band of the coast just landward from the mangrove communities, and (2) within the short-hydroperiod freshwater marl prairies of the southern Everglades that flank the deeper sloughs.

The tidally influenced cordgrass marshes constitute typical seaside sparrow habitat and closely resemble areas occupied by other seaside sparrow subspecies (Post and Greenlaw 1994). Occurrence year-round within the freshwater marl prairies is relatively unique among seaside sparrows, with only the now-extinct dusky seaside sparrow exhibiting a similar habitat affinity, and in those freshwater areas occupied by the dusky seaside sparrow; the habitat was still primarily composed of cordgrass (Post and Greenlaw 1984). The freshwater habitats occupied by the Cape Sable seaside sparrow are not dominated by cordgrass and the most commonly associated species is reported as muhly grass (*Muhlenbergia filipes*) (Werner 1975; Kushlan and Bass 1983; Werner and Woolfenden 1983; Post and Greenlaw 1994). However, a variety of vegetation species occurs within the freshwater marl prairies occupied by sparrows, including vegetation from which *Muhlenbergia* is absent (Ross et al. 2006). Other dominant species that occur in these prairies include sawgrass (*Cladium jamaicense*), (*Schizachyrium rhizomatum*), black-topped sedge (*Schoenus nigricans*), and beak rushes (*Rhynchospora* spp.) (Werner and Woolfenden 1983; Ross et al. 2006).

Sparrows occupy these communities year-round, and the vegetation must support all sparrow life stages. During periods when the communities are dry, usually coinciding with the late winter and early spring (December to May), sparrows travel across the ground surface beneath the grasses, and only occasionally perch within the vegetation. During the wet season (June to November), these areas are continually inundated, with peak water depths occasionally exceeding 2 ft (Nott et al. 1998). During these periods, sparrows travel within the grass, perching low in the clumps, hopping among the bases of dense grass clumps, and walking over matted grass litter. They fly more frequently, and regularly perch low in the vegetation, but generally remain inconspicuous (Dean and Morrison 2001).

Small tree islands and individual trees and shrubs occur throughout the areas occupied by the sparrows, but at a very low density. Sparrows do not appear to require woody vegetation during any aspect of their normal behavior, and generally avoid areas where shrubs and trees are either dense or evenly distributed. However, the small tree islands and scattered shrubs and trees may serve as refugia during extreme environmental conditions, and may be used as escape cover when fleeing from potential predators (Dean and Morrison 2001). Because of their general aversion to dense trees and woody vegetation, encroaching trees and shrubs can quickly degrade potential habitat.

Hydrologic conditions have significant effects on sparrows both directly and indirectly. First, depth of inundation within sparrow habitat is directly related to the sparrow's ability to move, forage, nest, and find shelter and cover from predators and harsh environmental conditions.

Average annual rainfall in the Everglades is about 56 inches per year (ENP 2005), with the majority of this falling within the summer months, which coincides with the latter half of the sparrow nesting season. This rainfall has a strong influence on the hydrologic characteristics of the marl prairies. However, throughout southern Florida, including sparrow habitat, hydrologic conditions are influenced by water management actions. The operation of a system of canals, levees, pumps, and other water management structures, can have profound impacts on the hydrologic conditions throughout much of the remaining marl prairies (Johnson et al. 1988; Van Lent and Johnson 1993; Pimm et al. 2002).

At water levels over 2 ft above ground surface, occurring in October 1995, even the majority of the vegetation in sparrow habitat is completely inundated, leaving sparrows with very few refugia. Conditions such as these may result in significant impacts to sparrow survival, and if they occur during the breeding season, these water levels will cause flooding and loss of sparrow nests (Nott et al. 1998; Pimm and Bass 2002). Even water of 6 inches may sufficiently inundate some habitat such that sparrows are incapable of finding shelter and moving around within limited areas. These water levels, when they occur during sparrow nesting season, result in increased rates of nest failure due to depredation (Lockwood et al. 1997). While there is relatively little elevation variation within the Everglades, differences in elevation as small as 1 ft can result in very different habitat characteristics.

The vegetation species composition and density in the Everglades are largely influenced by hydroperiods. Hydroperiods that range from 60 to 270 days support the full variety of vegetation conditions that are generally suitable for sparrows (Ross et al. 2006), though the vegetation composition and structure may vary significantly. Persistent increases in hydroperiod may quickly result in changes in vegetation communities from marl prairies or mixed prairies to sawgrass-dominated communities resembling sawgrass marshes (Nott et al. 1998). Average hydroperiods that extend much beyond 240 days/year will more closely resemble sawgrass marsh communities (Ross et al. 2006) which are unlikely to support sparrows in the long term.

Conversely, areas that are subjected to short hydroperiods generally have higher fire frequency than longer-hydroperiod areas (Lockwood et al. 2003; Ross et al. 2006), and are readily invaded by woody shrubs and trees (Werner 1975; Davis et al. 2005). Both an increased incidence of fire and an increased density and occurrence of shrubs detract from the suitability of an area as sparrow habitat.

The local variability across the landscape within areas where sparrows occur produces a heterogeneous arrangement of different vegetation conditions that all provide habitat for sparrows during some environmental conditions. A complex relationship between hydrologic conditions, fire history, and soil depth determine the specific vegetation conditions at a site, and variation in these characteristics may result in a complex mosaic of vegetation characteristics (Taylor 1983; Ross et al. 2006). This variability is characteristic of the habitats that support sparrows.

Sparrows do not regularly occupy burned areas for 2 to 3 years following fires (Pimm et al 2002; Lockwood et al. 2005), though they can re-occupy areas after only one year under some conditions (Taylor 1983; Werner and Woolfenden 1983). This is probably because of the sparrow's dependence on some level of structural complexity that must develop to provide cover, support nests, and allow them to move through the habitat during wet periods. Fire is not uncommon within the areas occupied by sparrows, and nearly all areas where sparrows currently occur have been burned within the past 10 to 20 years (Lockwood et al. 2003). A combination of naturally ignited and human-ignited (both prescribed and arson/accidental ignitions) fires have resulted in very different fire frequencies in different portions of the sparrow's range. Most of the vegetation species that occur within sparrow habitat are fire-adapted and respond quickly following fire (Snyder 2003). Several of the dominant grass species, including *Muhlenbergia*, also flower primarily following fires during the growing season (Main and Barry 2002). Under normal conditions, fires do not kill the individual plants that make up the dominant species in sparrow habitat, and fires only remove the above-ground growth and leaf litter (Snyder and Schaeffer 2004). The plant species rapidly respond, sprout quickly following fire, and grow rapidly. Many of the dominant grasses may grow more than 15 inches after only a few weeks (Steward and Ornes 1975; Snyder 2003). For this reason, the species composition and even the general structural characteristics of the vegetation may be nearly indistinguishable from unburned areas only 2 to 3 years after burning (Lockwood et al. 2005).

The interaction of fire and flooding strongly influence the suitability of habitat for sparrows. In the most extreme case, the vegetation in any areas that burn and are subsequently flooded within 1 to 3 weeks, either because of a natural rainfall event or human-caused hydrologic changes, may not recover for up to 10 or more years (Ross, personal communication 2006). Alternatively, if water levels overtop the sprouting grasses, the grasses may die, resulting in an absence of vegetation. Recovery of vegetation from these circumstances has to result from seed germination, which requires a longer time for recovery, and may result in a different plant species composition and structure from the vegetation that was present prior to the fire. Under less extreme conditions, vegetation may recover following fire more quickly when water levels are near the soil surface, providing ample water for the plants.

Population Dynamics

The first comprehensive, range-wide sparrow survey was conducted in 1981. After this initial survey, it was not surveyed again until 1992, but has been surveyed every year since 1992, including twice in 2000 (Pimm et al. 2002). Over this period, there have been substantial changes in most of the six populations. In 1981, there was an estimated 6,656 sparrows distributed among the six subpopulations, with most of the sparrows occurring within three large subpopulations (A, B, and E), and three smaller subpopulations (C, D, and F) (Table 2). Subpopulation A occurred within the marl prairies west of Shark River Slough extending into

BCNP, and supported an estimated 2,688 individuals. Subpopulation B contained about 2,352 sparrows inhabiting the marl prairies southeast of Shark River Slough near the center of ENP. Subpopulation B remains one of the most abundant subpopulations, with estimated size remaining relatively stable. Subpopulation E, north of Subpopulation B and also east of Shark River Slough, contained about 672 sparrows, while Subpopulation C, located near Taylor Slough and along the eastern boundary of ENP, and subpopulation D, just to the southeast of Subpopulation C, held about 400 sparrows each. Subpopulation F, located between Shark River Slough and the western edge of the Atlantic coastal ridge along the boundary of ENP, was the smallest subpopulation, and contained an estimated 112 sparrows.

Table 2. Estimated Total Numbers of Cape Sable Seaside Sparrows within six subpopulations, A through F from 1981 to Present (Two Surveys Conducted in 2000).

Year	Subpopulation						Total
	A	B	C	D	E	F	
1981	2,688	2,352	432	400	672	112	6,656
1992	2,608	3,184	48	112	592	32	6,576
1993	432	2,464	0	96	320	0	3,312
1994	80	2,224	NE	NE	NE	NE	2,416
1995	240	2,128	0	0	352	0	2,720
1996	384	1,888	48	80	208	NE	2,624
1997	272	2,832	48	48	832	16	4,048
1998	192	1,808	80	48	912	16	3,056
1999	400	2,048	144	176	768	16	3,552
2000a	448	1,824	112	64	1,040	0	3,488
2000b	400	2,448	64	16	704	112	3,744
2001	128	2,128	96	32	848	32	3,264
2002	96	1,904	112	0	576	16	2,704
2003	128	2,368	96	0	592	32	3,216
2004	16	2,784	128	0	640	16	3,854
2005	96	2,272	80	48	576	32	3,104
2006	112	2,080	160	0	704	32	3,088

NE = not estimated.

In 1981 and 1992, the area west of Shark River Slough, where Subpopulation A occurs, supported nearly half of the total Cape Sable seaside sparrow population (Table 2). Subpopulation A has suffered the most dramatic sparrow population change observed, declining from more than 2,600 birds in 1992 to 432 birds, in 1993 a decrease of 84 percent (Pimm et al. 2002). This subpopulation has remained at a low level since then. In 2001, Subpopulation A declined again, from an estimated 400 to 448 birds in 2000 to 128 in 2001, or about a 68 percent decline. Since that time, subpopulation has remained at or below this level. More recently, Subpopulation A declined from an estimated 128 birds in 2003 to 16 birds in 2004. The population then showed some resilience and rebounded slightly in 2005 and 2006 to levels observed from 2001 to 2003. Small populations are particularly at risk from a catastrophic event or events such as fire and significant rainfall during the breeding season. Despite the relatively low population size, the Service estimates Subpopulation A includes enough habitat to support roughly 1,000 birds.

In analyses of the reported population changes that have been recorded, Pimm et al. (2002) determined that the declines reported are not only remarkable, but also unprecedented. Pimm et al. (2002) attributed the changes to the flooding events that occurred from 1993 to 1995, which were longer and larger than those recorded previously. Subpopulation A is the population that is most severely impacted by water management practices.

Subpopulation B has remained relatively constant over time. From 1981 to 2006, estimated population sizes have ranged from 1,888 to 3,184. While these numbers still span a range that is nearly a third of the total population size, there have not been consistent trends, either increases or declines.

In addition to the declines recorded in Subpopulation A, by the 1992 survey, Subpopulation C had declined to about 11 percent of its 1981 estimated size (Table 2). After at least 2 years with no sparrows, 48 sparrows were estimated in this area in 1996 and 1997, and 80 sparrows were estimated in 1998. Since then, this subpopulation has remained relatively stable, and recent estimates may suggest a slight increase (160 sparrows estimated in 2006, but see qualifier below).

Subpopulation D declined by about 76 percent from 1981 to 1993 (Table 2). Although no sparrows were found in 1995, the population was estimated at 80 sparrows in 1996 and 176 in 1999. Numbers have decreased since 1999 with 32 sparrows estimated in 2001. No sparrows were identified within Subpopulation D from 2002 through 2004, but they re-appeared in 2005. This area, like Subpopulation A, has suffered high water levels that have precluded birds from nesting there successfully, and remains at a low level that is vulnerable to extirpation from a significant event or series of events (*e.g.*, major rainfall during key parts of the breeding season).

Subpopulation E is the only other subpopulation, besides B, that has remained relatively stable. The population has fluctuated more than Subpopulation B, varying by as much as 60 percent of its current population size, but it has rebounded following declines, and has appeared to show a slight increasing trend from 2002, when the Lopez fire burned through a portion of the subpopulation's habitat, to present.

Estimates for Subpopulation F declined by about 71 percent from 1981 to 1992 (Table 2). No sparrows were observed in 1993 or 1995. Only 16 sparrows were estimated for each year from 1997 to 1999. The population increased in 2000 to an estimated 112 sparrows, but only 16 sparrows were estimated in 2004, when on-the-ground surveys did not detect evidence of successful breeding, even late in the breeding season when females and young were readily detected in the larger subpopulations (ENP 2004).

Overall, there have been many large population declines recorded among all of the subpopulations, and relatively few population increases. These population changes suggest that while declines can occur rapidly, it may take many years of favorable conditions to return a sparrow population that has declined to its previous status.

New information indicates that sparrow Subpopulations C, D, and F may support fewer sparrows than has been previously estimated, and the demographics of these subpopulations may differ from the larger subpopulations (Lockwood et al. 2006). This information affects our assessment of the likelihood of the persistence of these subpopulations and the overall probability of persistence for the sparrow. With lower population sizes in these smaller subpopulations than was previously assessed, the relative significance of Subpopulations B and E with respect to maintaining a viable overall sparrow population has increased. Similarly, our evaluations of the potential contributions of the small subpopulations to maintaining the overall sparrow population and buffering it from potential catastrophic events such as widespread fire are reduced. Subpopulation A, with its potential to support roughly 1,000 sparrows despite its current population size, remains particularly important.

Status and Distribution

The Cape Sable seaside sparrow was first discovered in the cordgrass (*Spartina* sp.) marshes on Cape Sable in 1918 and was originally thought to be limited in distribution to Cape Sable (Howell 1919). On September 2, 1935, a severe hurricane struck the Keys and southern Florida, with the hurricane's center passing within a few miles of Cape Sable (Stimson 1956). Post-hurricane observations suggest that in the vicinity of Cape Sable water levels resulting from the storm surge rose about 8 ft above normal water levels, and the sparrow was thought to have disappeared from the area because of the storm, despite occasional reports of sparrows that could not be verified (Stimson 1956). Between 1935 and the 1950s, searches on Cape Sable failed to locate sparrows (Stimson 1956). Despite the fact that sparrows were again reported on Cape Sable in 1970 (Kushlan and Bass 1983; Werner and Woolfenden 1983), the habitat in the area had been changing significantly from cordgrass marshes to mangroves and mud flats since the 1935 hurricane, and sparrows are considered to have been extirpated from this area since 1981 (Kushlan and Bass 1983).

In 1928, Cape Sable seaside sparrows were reported to the northwest of Pinecrest, along the mainland coast of Florida, near what is today Everglades City (Nicholson 1928). The location of this mainland record was improperly reported, and the true location was not accurately reported until 1954 (Sprunt 1954). Stimson conducted extensive searches on the Florida mainland in the vicinity of the corrected 1928 sparrow observation, and found sparrows to be very widespread throughout both coastal cordgrass (Werner and Woolfenden 1983) marshes and freshwater prairies along the western edge of the Everglades (Stimson 1956). However, by 1968, Stimson (1968) concluded that widespread fires in this region had severely impacted the sparrows in that area, and he expected them to be extirpated from the area as a result.

In the early 1940s, Anderson (1942) reported sparrows in the coastal cordgrass marshes near Ochopee. Subsequent searches revealed that sparrows occurred south of Ochopee along the coastal marshes landward of the mangrove zone (Stimson 1956). Werner (1975) reported that habitat occupied by sparrows in the Ochopee area was changing from cordgrass marshes to other species, and mangroves were encroaching into the area. Werner's searches in the area from 1970 through 1975 (Werner 1975) revealed a decline in the number of sparrows and the amount of habitat available in the area. Sparrows were extirpated from this area by 1981 (Kushlan and Bass 1983), and there is little or no remaining suitable habitat in the area.

In 1972, Cape Sable seaside sparrows were discovered near Taylor Slough, east of the true Everglades (Ogden 1972). Subsequent investigation revealed that a sparrow had been reported to ENP in this area in 1958, but the observation was never verified (Werner 1975; Pimm et al. 2002). Surveys conducted with the use of a helicopter by Werner in 1974 and 1975 sought to characterize the distribution and abundance of sparrows in this region. These initial surveys revealed that sparrows were widely distributed and abundant (Werner 1975). They occupied an area of about 21,745 to 31,629 acres, and the number of sparrows occurring within this area was estimated to range from 1,500 to 26,300 individuals (Werner 1975). Because of the magnitude of the area occupied and the large estimates of population size, ecologists concluded that sparrows probably occurred within this area for many years. The difficulty in accessing the areas and the vastness of the areas (Kushlan and Bass 1983), as well as the secretiveness of the sparrow, all contributed to the failure to document the sparrow's occurrence in the area previously. The sparrow populations within these areas probably fluctuated over time in response to changes in habitat suitability resulting from fires and hydrologic conditions (Taylor 1983; Kushlan and Bass 1983). These fluctuations may have also contributed to the lack of sparrow detections in these areas previously.

The 1981 sparrow survey provided a good baseline on the distribution and abundance of sparrows at that time, and the 1992 survey results were remarkably similar, though there is no information available about how the population may have changed over the intervening 12 years.

Since 1992, the decline in the overall sparrow population has been dramatic, and there has been no evidence of significant improvements. Subpopulations B and E have remained relatively stable, although notable annual variances have been observed. In addition, Subpopulation A continues to have a small number of sparrows, but the Service estimates the habitat is available to support up to 1,000 birds, making it a critical location in the sparrow's range. In addition to the decline in overall numbers, the distribution has declined. The sparrow subpopulations that have declined have mostly contracted toward the center of the remaining habitat patches.

Small populations are particularly at risk from a catastrophic event or series of events, such as fire or major rainfall during the key parts of the breeding season. About two thirds of the remaining Cape Sable seaside sparrows currently occur within Subpopulation B, which has fortunately remained relatively stable. However, if a large fire were to occur, there is a possibility the entire remaining Cape Sable seaside sparrow population may be reduced by 60 percent or more, and it has been over a decade since most of that area has burned well.

Maintaining and restoring habitat within the existing subpopulations appear to be the best means to reduce the likelihood of extirpation over time. Pimm et al. (2002) and Walters et al. (2000) suggested that three breeding subpopulations are critical to the long-term survival of the Cape Sable seaside sparrow. This number helps safeguard the overall species condition from a catastrophic event that could dramatically impact one subpopulation. Besides the currently occupied areas, there are no remaining unoccupied areas of potential habitat that can be restored within the next 10 to 20 years. Though controlled propagation has a supportive role in the recovery of some listed species, the intent of the Act is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." Controlled propagation is not a substitute for addressing factors responsible for an endangered or threatened species' decline. Therefore, our first priority is to recover wild populations in their natural habitat wherever possible, without resorting to the use of controlled propagation.

Species/Critical Habitat Description

Everglade Snail Kite

The Everglade snail kite is one of three subspecies of snail kite, a wide-ranging New World raptor found primarily in lowland freshwater marshes in tropical and subtropical America from Florida, Cuba, and Mexico south to Argentina and Peru. The Everglade subspecies occurs in Florida and Cuba, though only the Florida population is listed. The Florida population was first listed under the Endangered Species Preservation Act in 1967, and protection was continued under the Endangered Species Conservation Act of 1969. The Everglade snail kite, and all other species listed under the Endangered Species Conservation Act were the first species protected under the Act of 1973, as amended, and all of these species were given the 'endangered' status.

Species Description

The snail kite is a medium-sized raptor, with a total body length for adult birds of 14 to 15.5 in and a wingspan of 43 to 46 in (Sykes et al. 1995). In both sexes, the tail is square-tipped with a distinctive white base that appears as a white patch on the rump when in flight. The wings are broad, long, and paddle-shaped and are held bowed downward or cupped when in flight (Sykes et al. 1995). Adults of both sexes have red eyes and juveniles have brown eyes (Brown and Amadon 1976; Clark and Wheeler 1987). The plumage is markedly different among adult male, adult female, and juvenile birds. Adult males have a uniformly slate gray plumage, and adult female plumage is brown dorsally and pale white to cream ventrally, with dark streaking on the breast and belly (Sykes et al. 1995). Immature kites are similar in appearance to adult females but are more cinnamon-colored, with tawny or buff-colored streaking rather than brown streaking. Females are slightly larger than males. The slender, decurved bill is an adaptation for extracting the kite's primary prey, the apple snail; the bill is a distinguishing character for field identification in both adults and juveniles.

Critical Habitat

Critical habitat for the Everglade snail kite was designated in 1977 (Service 1977b). The designation identified nine units of critical habitat (Table 3) that included two small reservoirs, the littoral zone of Lake Okeechobee, and areas of Everglades' marshes within the WCAs and ENP. In total, about 841,635 acres were included in the designation. Because this designation was one of the earliest under the Act, primary constituent elements were not defined. Since designation of critical habitat in 1977, the Service has consulted on the loss of 18.66 acres of critical habitat in a construction project. Construction of C&SF infrastructure resulted in impacts to less than 20 acres of critical habitat. A Service biological opinion addressed the effects of construction of the Miccosukee Tribe's Government Complex Center on critical habitat, which resulted in loss of 16.88 acres of critical habitat. In addition, the Service has consulted on impacts to 88,000 acres of critical habitat resulting from prolonged flooding and temporary degradation of critical habitat because of prescribed fire. In addition to these projects, degradation of snail kite critical habitat has occurred because of the effects of long-term hydrologic management and eutrophication. While it is not possible to accurately estimate the changes that have occurred within each unit, about 40 percent of the original designation is estimated to be in a degraded condition for snail kite nesting and foraging relative to when it was designated in 1977. For further discussion on effects to critical habitat, see the Environmental Baseline Section, Factors affecting species environment with the action area.

Table 3. Everglade snail kite critical habitat units and acreage.

Critical Habitat Unit Description	**Acres**
St. John's Reservoir, Indian River County	2,075
Cloud Lake and Strazzula Reservoirs, St. Lucie County	816
Western Lake Okeechobee, Glades and Hendry Counties	85,829
Loxahatchee National Wildlife Refuge, Palm Beach County	140,108
WCA-2A, Palm Beach and Broward Counties	106,253
WCA-2B, Broward County	28,573
WCA-3A, Broward and Miami-Dade Counties	319,078
ENP, Miami-Dade County	158,903
TOTAL	**841,635**

Life History

Everglade snail kites are dietary specialists, a relatively rare foraging strategy among raptors. The Florida apple snail (*Pomacea paludosa*) is the kite's principal prey in Florida, and makes up the great majority of the kites' diet (Sykes 1987a; Kitchens et al. 2002). Throughout the range of all subspecies of snail kites, *Pomacea* snails consistently compose the primary prey of snail kites (Sykes 1987a; Beissinger 1990) and kites possess several unique adaptations that allow them to efficiently capture, extract, and consume *Pomacea* snails (*e.g.*, the slender, deeply hooked sharp-tipped bill that allows kites to efficiently extract snails from their shells, long slender toes that allow kites to grasp large snails) (Sykes et al. 1995; Beissinger 1990). Under normal conditions, Everglade snail kites are nearly completely dependent on apple snails as prey. However, other prey items have been documented. Beissinger (1990) reported that kites captured and consumed small turtles such as the musk turtle (*Sternotherus odoratus*) and mud turtles (*Kinosternon* spp), and they captured and consumed another type of small freshwater snail (*Viviparus georgianus*). Other prey that have been occasionally documented include crayfish (*Procambarus* spp.), speckled perch (*Pomoxis nigromaculatus*), and small snakes (Sykes et al. 1995).

Several species of non-native apple snails have become established recently within limited areas of Florida and have been used to varying degrees by snail kites. Takekawa and Beissinger (1983) reported kite use of the non-native *Pomacea bridgesii*, and snail kites now regularly forage on a relatively newly-arrived non-native apple snail species that currently occurs at high densities within Lake Tohopekaliga, Osceola County, Florida (Kitchens, personal communication 2006). This snail species was initially suspected to be *Pomacea canaliculata*, but recent research suggests that it is suspected to be *Pomacea haustrom* (Collins and Rawlings 2006). Despite the use of these other species for foraging, all available evidence suggests that snail kites are still primarily dependent on Florida apple snails. Beissinger (1990) reported that use of turtles and other snail species occurred primarily during periods of limited prey availability such as drought conditions or cold spells. The specializations that allow the snail kite to so efficiently capture and extract apple snails make it difficult for them to capture and eat other alternative prey items (Beissinger 1990). The snail kite may be relatively well-adapted to capture and consume non-native *Pomacea* species, but preliminary information suggests that snail kites may only be able to successfully extract the flesh from a small portion of the presumed *P. haustrom* due to their large size. Juvenile kites that are reliant on these non-native snails may not be able to sustain themselves, despite the fact that snails are abundant (Kitchens, personal communication 2006). The close tie between the Everglade snail kite and the Florida apple snail require consideration of both species when developing management strategies and addressing potential impacts.

Everglade snail kites and their primary prey are both wetland-dependent species and rely on wetland habitats for all aspects of their life history. The primary wetland habitat types upon which kites rely consist of freshwater marshes and the shallow vegetated littoral zones along the edges of lakes (natural and man-made) where apple snails occur in relatively high abundance and can be found and captured by kites.

Snail kites use two visual foraging methods: course-hunting, while flying 5 to 33 ft above the water surface or still-hunting from a perch (Sykes 1987a; Sykes et al. 1995). While course-hunting, the flight is characterized by slow wing beats, alternating with gliding; the flight path is usually into the wind, with the head oriented downward to search for prey. Snails are captured with the feet at or below the surface, to a maximum reach of about 6 inches below the surface. Snail kites do not plunge into the water to capture snails and never use the bill to capture prey. Individuals may concentrate hunting in a particular foraging site, returning to the same area as long as foraging conditions are favorable (Cary 1985). Capture rates are higher in summer than in winter (Cary 1985), with no captures observed at a temperature less than 10°C (50°F). Snail kites frequently transfer snails from the feet to the bill while in flight to a perch. Feeding perches include living and dead woody-stemmed plants, blades of sawgrass and cattails, and fence posts.

While kites are capable of foraging successfully under a variety of habitat conditions, the preferred foraging habitat is typically a combination of relatively short-stature, sparse graminoid marsh vegetation less than 6.5 ft (2 meters) in height. The apple snail requires emergent aquatic plants to provide substrate that allows them to reach the water surface to breathe. However, for kites to feed, the emergents must be sparse enough that they are capable of locating and capturing snails (Kitchens et al. 2002). Marshes and lake littoral zones composed of interdigitated areas of open water 0.6 to 4.3 ft deep which is relatively clear and calm and patches of herbaceous emergent wetland plants or sparse continuous growth of herbaceous wetland plants generally provide the appropriate balance of emergent vegetation and open water (Sykes et al. 1995; Kitchens et al. 2002). Marsh species that commonly occur within favorable kite foraging habitat include spike rush (*Eleocharis cellulosa*), maidencane (*Panicum hemitomon*), sawgrass (*Cladium jamaicense*), bulrush (*Scirpus* spp.), and/or cattails (*Typha* spp.). Shallow open-water areas may also contain sparse cover of species such as white water lily (*Nymphaea odorata*), arrowhead (*Sagittaria lancifolia*), pickerel weed (*Pontederia lanceolata*), and floating heart (*Nymphoides aquatica*). Periphyton growth on the submerged substrate provides food source for apple snails, and submergent aquatic plants such as bladderworts (*Utricularia* spp.) and eelgrass (*Vallisneria* spp) may contribute to favorable conditions for apple snails while not preventing kites from detecting snails (Sykes et al. 1995).

Foraging habitat conditions that differ substantially from those described above will result in either reduced apple snail density or reduced ability of snail kites to locate and capture snails. Vegetation cover that is either too dense or too sparse can result in reduction in the quality of the area as foraging habitat.

The Everglade snail kite breeding season in Florida varies from year to year and is probably affected by rainfall and water levels (Sykes et al. 1995). Ninety-eight percent of the nesting attempts are initiated from December through July, while 89 percent are initiated from January through June (Sykes 1987c; Beissinger 1988; Snyder et al. 1989), with the peak in nest initiation occurring from February to April (Sykes 1987c). Snail kites often renest following failed attempts early in the season, as well as after successful attempts (Beissinger 1986; Snyder et al. 1989), but the actual number of clutches per breeding season is not well documented (Sykes et al. 1995).

Pair bonds are established prior to egg-laying and are relatively short, typically lasting from nest initiation through most of the nestling stage (Beissinger 1986, Sykes et al. 1995). Male kites select nest sites and conduct most nest-building, which is probably part of courtship (Sykes 1987c; Sykes et al. 1995). Unlike most raptors, snail kites do not defend large territories and frequently nest in loose colonies or in association with wading bird nesting colonies (Sykes 1987b; Sykes et al. 1995). Kites actively defend small territories extending about 4 miles around the nest (Sykes 1987b). Copulation can occur from early stages of nest construction, through egg-laying, and during early incubation if the clutch is not complete. Egg-laying begins soon after completion of the nest, but may be delayed a week or more (Sykes 1987c). An average 2-day interval between laying each egg results in the laying of a three egg clutch in about 6 days (Sykes et al. 1995). The clutch size ranges from 1 to 5 eggs, with a mode of three (Sykes 1987c; Beissinger 1988; Snyder et al. 1989). Incubation may begin after the first egg is laid, but generally after the second egg (Sykes 1987c). In Florida, the incubation period lasts 24 to 30 days (Sykes 1987c). Incubation is shared by both sexes, but the contribution of incubation time between the male and female is variable (Beissinger 1987). Hatching success is variable from year to year and between areas. In nests where at least one egg hatched, hatching success averaged 2.3 chicks per nest (Sykes 1987c).

After hatching, both parents initially participate in feeding young, but there is variability in the contribution of each member of the pair (Beissinger 1987). The nestling period lasts about 23 to 34 days and fledging dates may vary by 5 days among chicks (Sykes et al. 1995). Following fledging, young are fed by one or both adults until they are 9 to 11 weeks old (Beissinger 1987). In total, snail kites have a nesting cycle that lasts about 4 months from initiation of nest-building through independence of young (Beissinger 1986; Sykes et al. 1995).

Snail kites also have a relatively unique mating system in Florida that is described as ambisexual mate desertion, in which either the male or female may abandon nests part way through the nestling stage (Beissinger 1986, 1987). This behavior appears to occur primarily under conditions when prey is abundant, and it may be an adaptation to maximize productivity during favorable conditions. Following abandonment, the remaining parent continues to feed and attend chicks through independence (Beissinger 1986). Abandoning parents presumably form new pair bonds and initiate a new nesting attempt. Snail kites mature early compared to many other raptors and can breed successfully the first spring after they hatch, when they are about 8 to 10 months old. However, not all kites breed at this age. Bennetts et al. (1998) reported that only three out of nine first-year snail kites attempted to breed, while all of 23 adults that were tracked attempted to breed. Of the 23 adult kites, 15 attempted to breed once, 7 attempted to breed twice, and one individual attempted to breed three times. Only one adult kite successfully fledged two clutches (Bennett et al. 1998). Adult kites generally attempt to breed every year with the exception of drought years when some kites may not attempt to nest (Sykes et al. 1995).

Nesting almost always occurs over water, which deters predation (Sykes 1987b). An important feature for snail kite nesting habitat is the proximity of suitable nesting sites to favorable foraging areas. Thus, extensive stands of contiguous woody vegetation are generally unsuitable for nesting and suitable nest sites consist of single trees or shrubs or small clumps of trees and shrubs within or adjacent to an extensive area of suitable foraging habitat. Trees usually less than 32 ft tall are used for nesting include willow (*Salix* spp.), bald cypress (*Taxodium distichum*), pond cypress (*Taxodium ascendens*), *Melaleuca quinquenervia*, sweetbay (*Magnolia virginiana*), swamp bay (*Persea borbonia*), pond apple (*Annona glabra*), and dahoon holly (*Ilex cassine*). Shrubs used for nesting include wax myrtle (*Myrica cerifera*), cocoplum (*Chrysobalanus icaco*), buttonbush (*Cephalanthus occidentalis*), *Sesbania* sp, elderberry (*Sambucus simpsonii*), and Brazilian pepper (*Schinus terebinthifolius*). Nesting also can occur in herbaceous vegetation, such as sawgrass (*Cladium jamaicense*), cattail (*Typha* sp.), bulrush (*Scirpus* sp.), and reed (*Phragmites australis*) (Sykes et al. 1995). Nests are more often observed in herbaceous vegetation around Lake Kissimmee and Lake Okeechobee during periods of low water when dry conditions beneath the willow stands (which tend to grow to the landward side of the cattails, bulrushes, and reeds) prevent snail kites from nesting in woody vegetation. Nests constructed in herbaceous vegetation on the waterward side of the lakes' littoral zone are more vulnerable to collapse due to the weight of the nests, wind, waves, and boat wakes and are more exposed to disturbance by humans (Chandler and Anderson 1974; Sykes and Chandler 1974; Sykes 1987b; Beissinger 1986, 1988; Snyder et al. 1989).

Adult snail kites have relatively high annual survival rates, with estimated average rates ranging from 85 to 98 percent (Nichols et al. 1980, Bennetts et al. 1999, Martin et al. 2006). Adult survival is probably reduced in drought years (Takekawa and Beissinger 1989, Martin et al. 2006). Adult longevity records in the wild are more than 15 years, and kites may frequently live longer than 13 years in the wild (Sykes et al. 1995).

Everglade snail kites may roost communally outside of breeding season, and occasionally roost in groups of up to 400 or more individuals (Bennetts et al. 1994). Roosting sites are also usually located over water. On average, in Florida, 91.6 percent are located in willows, 5.6 percent in *Melaleuca*, and 2.8 percent in pond cypress. Roost sites are in taller vegetation among low-profile marshes. Snail kites tend to roost around small openings in willow stands at a height of 5.9 to 20.0 ft, in stand sizes of 0.05 to 12.35 acres. Roosting also has been observed in *Melaleuca* or pond cypress stands with tree heights of 13 to 40 ft (Sykes 1985).

Snail kites are considered nomadic, and this behavior pattern is probably a response to changing hydrologic conditions (Sykes 1979). During breeding season, kites remain close to their nest sites until they fledge young or fail. Following fledging, adults may remain around the nest for several weeks, but once young are fully independent adults may depart the area. Outside of breeding season, snail kites regularly travel long distances within and among wetland systems in southern Florida (Bennetts and Kitchens 1997). While most movements may be in response to droughts or other unfavorable conditions, kites may also move away from wetlands when conditions appear favorable. Movements within large wetlands and movements among adjacent wetland units occurred frequently, while movements among spatially isolated wetlands occurred less frequently (Martin et al. 2006). Fledgling kites also move frequently, but are more likely to move to immediately adjacent wetland units than adults, and this may indicate a degree of familiarity with the availability of wetlands across the landscape that adult kites acquire through experience.

Snail kites are highly gregarious. In addition to nesting in loose colonies and roosting communally in large numbers, kites may also forage in common areas in proximity to other foraging kites.

Population Dynamics

From a demographic perspective, Everglade snail kites appear to exhibit high levels of variability in some demographic parameters, while others remain relatively constant. For example, distribution of nesting appears to fluctuate dramatically among years. Similarly, productivity appears to be highly variable and heavily influenced by environmental conditions (Sykes 1979; Beissinger 1989, 1995; Sykes et al. 1995). Duration of breeding season and amount of double- or triple-brooding are also variable (Beissinger 1986). Juvenile survival also appears to be highly variable among years (Beissinger 1995; Bennetts and Kitchens 1999; Martin et al. 2006). In contrast, adult survival appears to be relatively constant over time at a relatively high level (Bennetts et al. 1999; Martin et al. 2006), though drought years may result in reduced adult survival (Beissinger 1995; Martin et al. 2006). The combination of these demographic characteristics may allow kites to survive unfavorable conditions, by either moving to other areas or simply waiting out the unfavorable conditions. Under favorable environmental conditions, kites have the ability to achieve high reproductive rates (Beissinger 1986), and similarly, juvenile survival rates appear to be higher under more favorable conditions.

Relatively large fluctuations in the Everglade snail kite population size have been widely reported and generally attributed to environmental conditions (Beissinger 1986; Beissinger 1995). However, some of these reported fluctuations and the magnitude of reported declines in particular, may be influenced by the population survey methods (see below) and the fact that kites tend to depart traditional areas when those areas experience unfavorable conditions (Bennetts et al. 1999).

Historic records of snail kite nesting include areas as far north as Crescent Lake and Lake Panasoffke in north-central Florida and as far west as the Wakulla River (Howell 1932; Sykes 1984). Several authors (Nicholson 1926; Howell 1932; Bent 1937) indicated that the snail kite was numerous in central and southern Florida marshes during the early 1900s, with groups of up to 100 birds. Reports of snail kite population declines in the 1940s and 1950s suggested that as few as 6 to 100 individuals remained (Sykes 1979). Reports of declines resulted from disappearance of kites from areas where they had previously occurred in large numbers, including Lake Okeechobee and the headwaters of the St. John's marsh (Sykes 1979). Limited resources were available at that time for researchers to reach potential snail kite habitats, the resulting low level of survey effort may have biased these low snail kite population estimates, and absence of kites from particular areas may have resulted from the kite's nomadic behavior and responses to unfavorable hydrologic conditions (Sykes 1979). However, there is little doubt that the snail kite was endangered at that time and that its range had been dramatically reduced.

When the snail kite was listed as endangered in 1967 (Service 1967), the species was considered to be at an extremely low population level. In 1965, only 10 birds were found, 8 in WCA-2A and 2 at Lake Okeechobee. A survey in 1967 found 21 birds in WCA-2A (Stieglitz and Thompson 1967).

Prior to 1969, the snail kite population was monitored only through sporadic and inconsistent surveys (Sykes 1979, 1984). From 1969 to 1994, an annual quasi-systematic mid-winter snail kite count was conducted by a succession of principal investigators. Counts since 1969 have ranged from 65 in 1972 to 996 in 1994. Bennetts et al. (1993, 1994) cautioned that the 1993 and 1994 counts were performed with the advantage of having numerous birds radio-tagged. This influenced the total count, because radio-tagged birds could be easily located and often led researchers to roosts that had not been previously surveyed. Bennetts and Kitchens (1997) identified issues with the count surveys and recommended that they should not be the basis of population estimates or used to infer demographic parameters such as survival or recruitment. Bennetts et al. (1999) analyzed these counts and the sources of variation in these counts and determined that count totals were influenced by observer differences, differences in hydrologic conditions and effort, and site effects. While significant sources of error were identified, these data could provide a crude indication of trends, if all influences of detection rates had been adequately taken into account. The sources of variation in the counts should be recognized prior to using these data in subsequent interpretations, especially in attempting to determine population viability and the risk of extinction.

Although sharp declines have occurred in the counts since 1969 (for example, 1981, 1985, 1987), it is unknown to what extent this reflects actual changes in population. Rodgers et al. (1988) have stated that it is unknown whether decreases in snail kite numbers in the annual count are due to mortality, dispersal (into areas not counted), decreased productivity, or a combination of these factors. Despite these problems in interpreting the annual counts, the data since 1969 have indicated a generally increasing trend (Sykes 1979; Rodgers et al. 1988; Bennetts et al. 1994). While acknowledging the problems associated with making year-to-year comparisons in the count data, some general conclusions are apparent. Changes in occurrence and occupancy of individual wetland units are variable among years and the degree of variability among wetlands is also variable. For example, Lake Okeechobee apparently retains some suitable snail kite habitat throughout both wet and dry years and remained relatively continuously occupied from 1969 through the mid-1980s. In contrast, snail kite use of WCAs fluctuates greatly, with low use during drought years, such as 1991, and high use in wet years, such as 1994.

Refined population estimates were generated for the Everglade snail kite using a mark-recapture method beginning in 1997 (Dreitz et al. 2002). These new population estimates which explicitly address detection probability and incorporate corrections to exclude the effects of variable detection probability that affected previous population estimates are higher than those resulting from the previous counts. The population size estimate generated from mark-recapture estimates for 1997-2000 was about 2 to 3 times higher than count-based estimates (estimates of about 800 to 1,000 individuals in 1993 and 1995 based on count-based surveys compared to about 2,700 to 3,500 estimated from mark-recapture analyses from 1997 to 2000) (Bennetts and Kitchens 1997; Dreitz et al. 2002). Confidence intervals can also be generated for population estimates generated using the new method, which increases the validity of comparing population estimates among years.

Since 1997, population estimates and estimates of demographic parameters have been generated exclusively employing mark-recapture methods that incorporate detection probabilities. From 1997 through 1999, the snail kite population was estimated to be about 3,000 birds (Dreitz et al. 2002). From 1999 through 2002, the population estimates declined each year until they reached a low level of about 1,400 birds in 2002 and 2003, then increased slightly to about 1,700 birds in 2004 and 2005 (Martin et al. 2006). A preliminary estimate of the 2006 snail kite population size is about 1,600 birds.

The observed declines in the kite population from 1999 to 2002 (Figure 3) coincided with a regional drought that affected southern Florida during 2000 to 2001. During this period, nest success was generally low (Martin et al. 2006), and demographic parameters estimated from mark-recapture methods also indicated that juvenile survival rates were low, and even adult survival declined during 2001 (Figure 4) (Martin et al. 2006). 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. 2006).

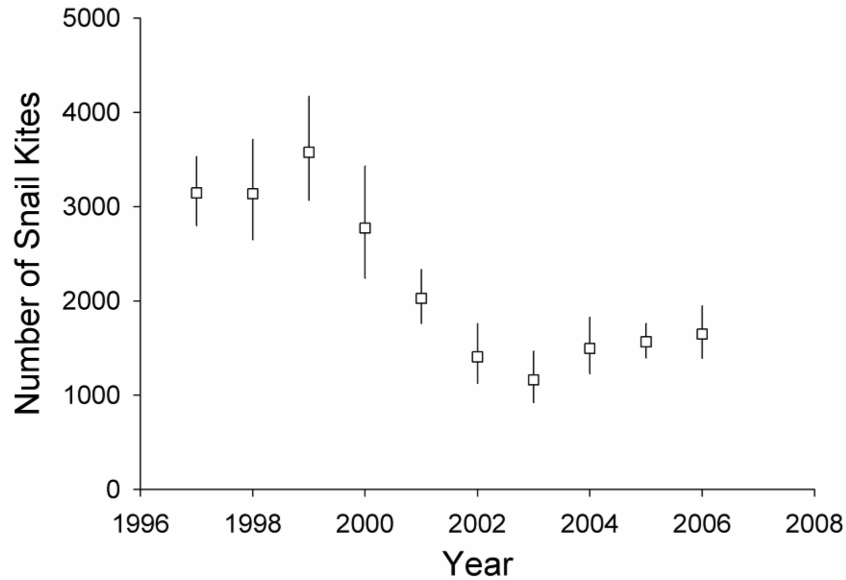

Figure 3. Everglade snail kite population size estimates, 1996 to present.

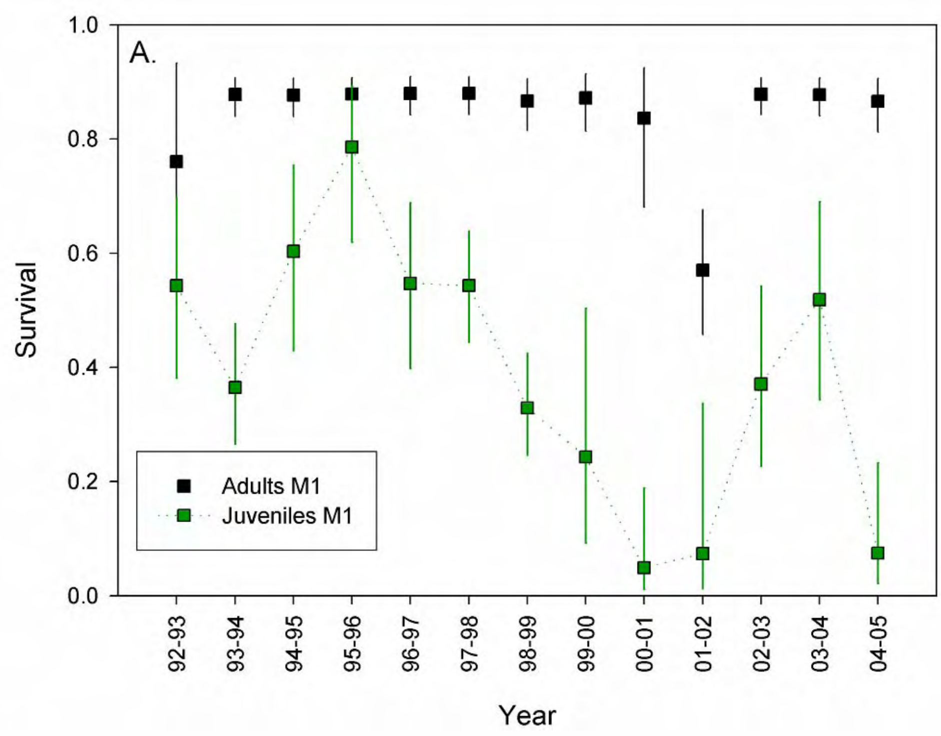

Figure 4. Everglade snail kite survival estimates, 1992 through 2005.

Status and Distribution

The subspecies *R. s. plumbeus* occurs in Florida, Cuba (including Isla de la Juventud) and northwestern Honduras. There is no evidence of movement of birds between Cuba and Florida, but this possibility has not been ruled out (Sykes 1979; Beissinger et al. 1983). In Florida, the historic range of the snail kite was larger than at present.

The current distribution of the snail kite in Florida is limited to central and southern portions of the State. Six large freshwater systems are located within the current range of the snail kite: 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). Habitats that support snail kites in the Upper St. Johns drainage include the East Orlando Wilderness Park, the Blue Cypress Water Management Area, the St. Johns Reservoir, and the Cloud Lake, Strazzulla, and Indrio impoundments with most current nesting occurring within the Blue Cypress Water Management Area (Martin et al. 2006). In the Kissimmee Chain of Lakes, snail kites may occur within most of the lakes and adjacent wetlands, with the majority of kite nesting occurring within Lake Kissimmee, Lake Tohopekaliga, and East Lake Tohopekaliga. Lake Okeechobee and surrounding wetlands represent significant snail kite nesting and foraging habitats that have consistently supported kites. Most of the recent nesting in Lake Okeechobee has occurred within the expansive marsh in the southwestern portion of the lake and the area southwest of the inflow of the Kissimmee River (Martin et al. 2006). In the Loxahatchee Slough region of Palm Beach County, snail kites may occur throughout the remaining marshes in the vicinity and most frequently nest within Grassy Waters, which is also known as the West Palm Beach Water Catchment Area. Kites may occur within nearly all remaining wetlands of the Everglades region, with recent nesting occurring within WCA-2B, WCA-3A, WCA-3B, and ENP (Martin et al. 2006). Within the Big Cypress basin, snail kites may occur within most of the non-forested and sparsely forested wetlands. Nesting has not been regularly documented in this area in recent years, though some nesting likely occurs.

In addition to the primary wetlands where most kite nesting has been documented recently, there are numerous records of kite occurrence and/or nesting within isolated wetlands throughout the region. The Savannas State Preserve, in St. Lucie County, the Hancock impoundment in Hendry County, and Lehigh Acres in Lee County are among the smaller more isolated wetlands used by snail kites (Sykes et al. 1995). 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. Although the above list generally describes the current range of the species, 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 the Upper St. John’s marshes.

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. Martin et al. (2006) reported that the population has declined by about 50 percent and their estimates result from consistent methods. In addition, the distribution of nesting activity in recent years has suggested that several of the traditional nesting areas were in unfavorable conditions for nesting. Low productivity, both in terms of low rates of nest initiation and low success rates resulting from those initiated nests suggest that conditions were poor for kite nesting in those years. Relatively low juvenile survival rates in recent years also support the conclusion that conditions for kites have been relatively unfavorable due to a variety of factors. There has, however, been the expected annual variation in juvenile survival estimates, with 2002-2004 showing comparatively high rates since 2000.

Studies of apple snail abundance and occurrence within traditional snail kite nesting areas also support conclusions that foraging conditions may be poor. Darby et al. (2005) reported that apple snail abundance has recently declined substantially within WCA-3A. Darby (2005a, 2005b) reported that apple snail abundance remains relatively low in areas of traditional snail kite use within Lakes Kissimmee, Tohopekaliga, and Okeechobee in recent years.

As previously noted, however, adult survival has been relatively constant over time at a relatively high level (Bennetts et al. 1999; Martin et al. 2006), except in 2001 and 2002. This factor helps kites survive unfavorable conditions, and the adults can either move to other areas with favorable conditions or simply 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 appear to be higher under more favorable conditions. We expect the following 4 years to include the variation in juvenile survival rates that characterizes the species, with some relatively low years and some relatively high years. On balance, we do not expect a significant change in the health of the population during this time.

Threats to the Species

There are a variety of threats that have been identified which affect kite nesting, kite foraging, and survival. These threats include loss of wetland habitats, degradation of wetland habitat, changes in hydrologic conditions, and impacts to prey base.

Collapse of nests constructed in herbaceous vegetation is cited as a cause of increased nest failure during low-water years. This is because the water table is usually below the ground surface at willow heads and other stands of woody vegetation during drought, causing snail kites to nest in herbaceous vegetation, where the nests are more vulnerable to collapse. This effect is more prevalent in lake environments than in the Everglades. Weather also can result in the variability of nesting success. Wind storms can cause toppling of nests, particularly on Lake Okeechobee and Lake Kissimmee due to the long wind fetch across these large lakes. Cold weather can also produce nest failure, either through decreased availability of apple snails or mortality of young due to exposure. Abandonment of nests before egg-laying is common, particularly during drought or following passage of a cold front.

The snail kite has apparently experienced population fluctuations associated with hydrologic influences, both man-induced and natural (Sykes 1983a; Beissinger and Takekawa 1983; Beissinger 1986), but the amount of fluctuation is debated. However, the abundance of its prey, apple snails, has been definitively linked to water regime (Kushlan 1975; Sykes 1979, 1983a). Drainage of Florida's interior wetlands has reduced the extent and quality of habitat for both the snail and the kite (Sykes 1983b). The snail kite nests over water and nests become accessible to predators in the event of unseasonable drying (Beissinger 1986; Sykes 1987b). In dry years, snail kites depend on water bodies that normally are suboptimal for feeding, such as canals, impoundments, or small marsh areas, remote from regularly used sites (Beissinger and Takekawa 1983; Bennetts et al. 1988; Takekawa and Beissinger 1989). These secondary or refuge habitats could play an important role in the future.

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 Everglades Agricultural Area alone eliminated 3,100 square-miles of the original Everglades and the urban areas in Miami-Dade, Broward, and Palm Beach Counties have contributed to the reduction of habitat. North of ENP, which has preserved only about one-fifth of the original extent of the Everglades, the remaining marsh has been fragmented into shallow impoundments. The Corps' 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.

Degradation of water quality, particularly runoff of phosphorus from agricultural and urban sources, is another concern for the snail kite. The Everglades was historically an oligotrophic system, but major portions have become eutrophic, primarily due to anthropogenic sources of phosphorus and nitrogen (cultural eutrophication). Most of this increase has been attributed to non-point source runoff from agricultural lands north of the lake, in the Kissimmee River, Taylor Slough, and Nubbin Slough drainages (Federico et al. 1981). Cultural eutrophication also is a concern in the Kissimmee chain of lakes. Nutrient enrichment leads to growth of dense stands of herbaceous emergent vegetation, floating vegetation (primarily water hyacinth [*Eichhornia crassipes*] and water lettuce [*Pistia Stratiotes*]) and woody vegetation, which inhibits the ability of snail kites to forage along the shorelines of lake areas. Regulation of water stages in lakes and the WCAs is particularly important to maintain the balance of vegetative communities required to sustain snail kites.

Species/Critical Habitat Description

Wood Stork

The United States breeding population of the wood stork was federally listed under the Act as endangered on February 28, 1984, (Service 1984). No critical habitat has been designated for the wood stork; therefore, none will be affected.

Species Description

The wood stork is a large, long-legged wading bird, with a head to tail length of 33 to 45 inches and a wingspan of 59 to 65 inches (Coulter et al. 1999). The plumage is white, except for iridescent black primary and secondary wing feathers and a short black tail. Wood storks fly with their neck and legs extended. On adults, the rough scaly skin of the head and neck is un-feathered and blackish in color, the legs are dark, and the feet are dull pink. The bill color is also blackish. During courtship and the early nesting season, adults may develop buff or pinkish coloration on the wing linings, fluffy, plume-like undertail coverts, and their toes are bright pink. Immature wood storks, up to the age of about 3 years, have yellowish or straw-colored bills and varying amounts of dusky feathering on the head and neck (Coulter et al. 1999).

Life History

Wood stork nesting habitat consists of mangroves as low as 3 ft, cypress as tall as 100 ft , and various other live or dead shrubs or trees located in standing water (swamps) or on islands surrounded by relatively broad expanses of open water (Palmer 1962; Rodgers et al. 1987; Ogden 1991; Coulter et al. 1999). Wood storks nest colonially, often in conjunction with other wading bird species, and generally occupy the large-diameter trees at a colony site (Rodgers et al. 1996). The same colony site will be used for many years as long as the colony is undisturbed and sufficient feeding habitat remains in surrounding wetlands. However, not all storks nesting in a colony will return to the same site in subsequent years (Kushlan and Frohring 1986). Natural wetland nesting sites may be abandoned if surface water is removed from beneath the trees during the nesting season (Rodgers et al. 1996). In response to this type of changes to nest site hydrology, wood storks may abandon that site and establish a breeding colony in managed or impounded wetlands (Ogden 1991). Wood storks that abandon a colony early in the nesting season due to unsuitable hydrological conditions may re-nest in other nearby areas (Borkhataria et al. 2004; Crozier and Cook 2004). Between breeding seasons or while foraging wood storks may roost in trees over dry ground, on levees, or large patches of open ground. Wood storks may also roost within wetlands while foraging far from nest sites and outside of the breeding season (Gawlik 2002).

While the majority of stork nesting occurs within traditional stork rookeries, a handful of new stork nesting colonies are discovered each year (Meyer and Frederick 2004; Service unpublished data 2006). These new colony locations may represent temporary shifts of historic colonies due to changes in local conditions, or they may represent formation of new colonies in areas where conditions have improved.

Wood storks forage in a wide variety of wetland types, where prey are available and the water is shallow and open enough to hunt successfully (Ogden et al. 1978; Browder 1984; Coulter 1987). Calm water, about 2 to 16 inches deep and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993). Typical foraging sites include freshwater marshes, ponds, hardwood and cypress swamps, narrow tidal creeks or shallow tidal pools, and artificial wetlands such as stock ponds, shallow, seasonally flooded roadside or agricultural ditches, and managed impoundments (Coulter et al. 1999; Coulter and Bryan 1993).

Several factors affect the suitability of potential foraging habitat for wood storks. Suitable foraging habitats must provide both a sufficient density and biomass of forage fish and other prey, and have vegetation characteristics that allow storks to locate and capture prey. During nesting, these areas must also be near the colony for efficient delivery of prey to nestlings. Hydrologic and environmental characteristics have strong affects on fish density, and these factors may be some of the most significant in determining foraging habitat suitability, particularly in southern Florida.

Within the wetland systems of southern Florida, the annual hydrologic pattern is very consistent, with water levels rising over 3 ft during the wet season (June to November), and then receding gradually during the dry season (December to May). Storks nest during the dry season, and rely on the drying wetlands to concentrate prey items in the ever-narrowing wetlands (Kahl 1964). Because of the continual change in water levels during the stork nesting period, any one site may only be suitable for stork foraging for a narrow window of time when wetlands have sufficiently dried to begin concentrating prey and making water depths suitable for storks to access the wetlands. Once the wetland has dried to where water levels are near the ground surface, the area is no longer suitable for stork foraging, and will not be suitable until water levels rise and the area is again repopulated with fish. Consequently, there is a general progression in the suitability of wetlands for foraging based on their hydroperiods, with the short hydroperiod wetlands being used early in the season, the mid-range hydroperiod sites being used during the middle of the nesting season, and the longest hydroperiod areas being used later in the season (Kahl 1964; Gawlik 2002).

In addition to the concentration of fish due to normal drying, several other factors affect fish abundance in potential foraging habitats. Longer hydroperiod areas generally support more and larger fish (Trexler et al. 2002; Loftus and Ecklund 1994; Turner et al. 1999). In addition, nutrient enrichment (primarily phosphorus) within the oligotrophic Everglades wetlands generally results in increased density and biomass of fish in potential stork foraging sites (Rehage and Trexler In Press), and distances from dry-season refugia, such as canals, alligator holes, and similar long hydroperiod sites also affect fish density and biomass. Within the highly modified environments of southern Florida, fish availability varies with respect to hydrologic gradients, nutrient availability gradients, and it becomes very difficult to predict fish density. The foraging habitat for most wood stork colonies within southern Florida includes a variety of hydroperiod classes, nutrient conditions, and spatial variability.

Dense submergent and emergent vegetation may reduce foraging suitability by preventing storks from moving through the habitat and interfering with prey detection (Coulter and Bryan 1993). Some submergent and emergent vegetation does not detrimentally affect stork foraging, and may be important to maintaining fish populations. Average submergent and emergent vegetation cover at foraging sites was 26 and 29 percent, respectively, at foraging sites at a Georgia colony, and ranged from 0 to 100 percent (Coulter and Bryan 1993). These cover values did not differ significantly from random wetland sites. Similarly, densely forested wetlands may preclude storks from accessing prey within the areas (Coulter and Bryan 1993). Storks tend to select foraging areas that have an open canopy, but occasionally use sites with 50 to 100 percent canopy closure (Coulter and Bryan 1993; O'Hare and Dalrymple 1997; Coulter et al. 1999).

Wood storks feed almost entirely on fish from 1 to 10 inches long (Kahl 1964; Ogden et al. 1976; Coulter 1987) but may occasionally consume crustaceans, amphibians, reptiles, mammals, birds, and arthropods. Wood storks generally use a specialized feeding behavior called tactilocation, or grope feeding, but also forage visually under some conditions (Kushlan 1979). Storks typically wade through the water with the beak immersed and open about 2.5 to 3.5 in. When the wood stork encounters prey within its bill, the mandibles snap shut, the head is raised, and the food swallowed (Kahl 1964). Occasionally, wood storks stir the water with their feet in an attempt to startle hiding prey (Rand 1956; Kahl 1964; Kushlan 1979). This foraging method allows them to forage effectively in turbid waters, at night, and under other conditions when other wading birds that employ visual foraging may not be able to forage successfully.

Wood storks generally forage in wetlands within 31 miles of the colony site (Bryan and Coulter 1987), but forage most frequently within 12.5 miles of the colony (Coulter and Bryan 1993). Maintaining this wide range of feeding site options ensures sufficient wetlands of all sizes and varying hydroperiods are available, during shifts in seasonal and annual rainfall and surface water patterns, to support wood storks. Adults feed furthest from the nesting site prior to laying eggs, forage in wetlands closer to the colony site during incubation and early stages of raising the young, and then further away again, when the young are able to fly. Wood storks generally use wet prairie ponds early in the dry season then shift to slough ponds later in the dry season thus following water levels as they recede into the ground (Browder 1984).

Gawlik (2002) characterized wood storks as "searchers" that employ a foraging strategy of seeking out areas of high density prey and optimal (shallow) water depths, and abandoning foraging sites when prey density begins to decrease below a particular efficiency threshold, but while prey was still sufficiently available that other wading bird species were still foraging in large numbers (Gawlik 2002). Wood stork choice of foraging sites was significantly related to both prey density and water depth (Gawlik 2002). Because of this strategy, wood stork foraging opportunities are more constrained than many of the other wading bird species (Gawlik 2002).

Breeding wood storks are believed to form new pair bonds every season. First age of breeding has been documented in 3 to 4 year-old birds but the average first age of breeding is unknown. Wood storks begin laying eggs in early October in south Florida and into late June in north Florida (Rodgers 1990; Service unpublished data 2006). A single clutch of two to five (average three) eggs is laid per breeding season but a second clutch may be laid if a nest failure occurs early in the breeding season (Coulter et al. 1999). There is variation among years in the clutch sizes, and clutch size does not appear to be related to longitude, nest data, nesting density, or nesting numbers, and may be related to habitat conditions at the time of laying. Egg laying is staggered and incubation, which lasts about 30 days, begins after the first egg is laid. Therefore, the eggs hatch at different times and the nestlings vary in size (Coulter et al. 1999). The younger birds are first to die during times of scarce food.

The young fledge in about 8 weeks but will stay at the nest for 3 to 4 more weeks to be fed. Adults feed the young by regurgitating whole fish into the bottom of the nest about three to 10 times per day. Feedings are more frequent when the birds are young (Coulter et al. 1999). Feedings are less frequent when wood storks must fly great distances to locate food (Bryan et al. 1995). The total nesting period, from courtship and nest-building through independence of young, lasts about 100 to 120 days (Coulter et al. 1999). Within a colony, nest initiation may be asynchronous, and consequently, a colony may contain active breeding wood storks for a period significantly longer than the 120 days required for a pair to raise young to independence. Adults and independent young may continue to forage around the colony site for a relatively short period following the completion of breeding.

Wood storks produce an average of 1.29 fledglings per nest and 0.42 fledgling per egg, which is a probability of survivorship from egg laying to fledgling of 42 percent (Rodgers and Schwikert 1997) (Table 4). The probability of survivorship from egg laying to day 14 is 80 percent, to day 28 (hatching) 70 percent, to day 42 (nestling 2 weeks of age) 62 percent, to day 56 (nestling 4 weeks of age) 56 percent, to day 70 (nestling 6 weeks) 50 percent and to day 84 (fledgling) 42 percent. The greatest losses occur from egg laying to hatching with a 30 percent loss of the nest productivity. From hatching to nestlings of 2 weeks of age, nest productivity loss is an additional 8 percent. Corresponding losses for the remainder of the nesting cycles are on the average of a 6 percent per 2 weeks increase in age of the nestling (Rodgers and Schwikert 1997).

Table 4. Wood stork survival.

Age	**Percent Survival**
Egg laying to Fledging	42
Egg Laying to Day 14	80
Egg Laying to Day 28 (hatching)	70
Egg Laying to Day 42	62
Egg Laying to Day 56	56
Egg Laying to Day 79	50

During the period when a nesting colony is active, storks are dependent on consistent foraging opportunities in wetlands within about 18.6 miles for the nest site, with the greatest energy demands occurring during the middle of the nestling period, when nestlings are 23 to 45 days old (Kahl 1964). Based on Kahl's (1964) estimate that 443 pounds (about 70 ounces per day) are needed for the success of a nest, and that 50 percent of the foraging base is needed in the middle third of the nesting cycle when chicks are about 23 to 45 days old (Kahl 1962). It is estimated that about 110 pounds are needed to meet the foraging needs of the adults and nestling in the first third of the nesting cycle. Receding water levels are necessary in south Florida to concentrate suitable densities of forage fish (Kahl 1964; Kushlan et al. 1975).

Many researchers (Flemming et al. 1994; Ceilley and Bortone 2000) believe that the short hydroperiod wetlands provide a more important pre-nesting foraging food source and a greater effect on early nestling survival for wood storks than the foraging base (ounces of fish per square-ft) that is suggested in short hydroperiod wetlands. For instance, Loftus and Eklund (1994) provide an estimate of 5 fish per square ft for long hydroperiod wetlands and

0.5 fish per square-ft for short hydroperiod wetlands. Because of the consistent pattern of drying that normally occurs during the stork nesting season, the short hydroperiod wetlands would also be the ones used for foraging early in the season when long hydroperiod wetlands remain too deep for storks to forage effectively, or sufficient prey concentration has not yet occurred because of drying.

Although the short hydroperiod wetlands support fewer fish and lower fish biomass per unit area than long hydroperiod wetlands, these short hydroperiod wetlands were historically more extensive and provided foraging areas for storks during colony establishment, courtship and nest-building, egg-laying, incubation, and the early stages of nestling provisioning. This period corresponds to the greatest periods of nest failure (*i.e.*, 30 percent and 8 percent, respectively from egg laying to hatching and from hatching to nestling survival to two weeks) (Rodgers and Schwikert 1997).

Considering the relatively low foraging values these short hydroperiod wetlands provide in relationship to corresponding long hydroperiod wetlands, a much larger acreages of these wetlands are needed to ensure survival and to sustain development of nestlings. The disproportionate reduction (85 percent) of this specific habitat loss known to have occurred from development and overdrainage has been proposed as a major cause of late colony formation and survivorship reduction in early nestling survival rates (Fleming et al. 1994).

Storks that are not breeding do not require the same degree of fish concentration that is required to sustain successful nesting. Kahl (1964) estimated the food requirements for an individual free-flying stork to be about 18 ounces per day. Storks that are not nesting are able to find sufficient prey to sustain themselves in many wetlands that would not be suitable to sustain adults and chicks during nesting.

Following the completion of the nesting season, both adult and fledgling wood storks generally begin to disperse away form the nesting colony. Fledglings have relatively high mortality rates within the first 6 months following fledging, most likely of their lack of experience, including the selection of poor foraging locations (Hylton et al. 2006). Post-fledging survival also appears to be variable among years, probably reflecting the environmental variability that affects storks and their ability to forage (Hylton et al. 2006).

In southern Florida, both adult and juvenile storks consistently disperse northward following fledging in what has been described as a mass exodus (Kahl 1964). Storks in central Florida also appear to move northward following the completion of breeding, but generally do not move as far (Coulter et al. 1999). Many of the juvenile storks from southern Florida move beyond Florida into Georgia, Alabama, Mississippi, and South Carolina (Coulter et al. 1999; Borkhataria et al. 2004; Borkhataria et al. 2006). Some flocks of juvenile storks have also been reported to move well beyond the breeding range of storks in the months following fledging (Kahl 1964). This post-breeding northward movement appears consistent across years.

Both adult and juvenile storks return southward in the late fall and early winter months. In a study employing satellite telemetry, Borkhataria et al. (2006) reported that nearly all storks that had been tagged in the southeastern United States moved into Florida near the beginning of the dry season, including all subadult storks that fledged from Florida and Georgia colonies. Adult storks that breed in Georgia remained in Florida until March, and then moved back to northern breeding colonies (Borkhataria et al. 2006). Overall, about 75 percent of all locations of radio-tagged wood storks occurred within Florida (Borkhataria et al. 2006). Preliminary analyses of the range-wide occurrence of wood storks in December, recorded during the annual Christmas bird surveys, suggest that the majority of the southeastern United States wood stork population occurs in central and southern Florida. Relative abundance of storks in this region was 10 to 100 times higher than in northern Florida and Georgia (Service unpublished data 2006). Because of these general population-level movement patterns, during the earlier period of the stork breeding season in southern Florida the wetlands upon which nesting storks depend are also being heavily used by a large portion of the southeastern United States wood stork population, including storks that breed in Georgia and the Carolinas, and subadult storks from throughout the stork's range. In addition, these same wetlands support a variety of other wading bird species (Gawlik 2002).

Population Dynamics

The United States breeding population of wood storks declined from an estimated 20,000 pairs in the 1930s to about 10,000 pairs by 1960 (Service 1984). Since the 1960s, the wood stork population has declined in southern Florida and increased in northern Florida, Georgia, and South Carolina (Ogden et al. 1987). The number of nesting pairs in the Everglades and Big Cypress ecosystems (southern Florida) declined from 8,500 pairs in 1961 to 969 pairs in 1995. During the same period, nesting pairs in Georgia increased from 4 to 1,501 and nesting pairs in South Carolina increased from 11 to 829 (Service 1997).

Between 1958 and 1985, the wood stork breeding population center shifted north from Lake Okeechobee to Polk County, a distance of about 82 miles. The 1976 breeding season was the last year when more pairs nested in south Florida than in central-north Florida. Productivity is generally higher in central-north Florida than south Florida. Whereas the number of colonies in south Florida has remained relatively stable, the number of colonies in central-north Florida region continues to increase (Ogden et al. 1987). The increase in central-north Florida is associated with an increase in colony numbers and not colony size; colonies in the north are smaller than colonies in the south. Historically colonies in the south were associated with extensive wetland systems and predictable patterns of prey availability. Ogden et al. (1987) suggested the population shift is the result of deteriorating feeding conditions in south Florida and better nesting success rates in central-north Florida that compound population growth in that area. Further evidence of a general northern breeding range expansion occurred in 2005 when storks were first documented nesting successfully in North Carolina, and storks are again nesting at that site in 2006 (Service unpublished data 2006).

The wood stork life history strategy has been characterized as a "bet-hedging" strategy (Hylton et al. 2006) in which high adult survival rates and the capability of relatively high reproductive output under favorable conditions allow the species to persist during poor conditions and capitalize on favorable environmental conditions. This life-history strategy may be adapted to variable environments (Hylton et al. 2006) such as the wetland systems of southern Florida.

Nest initiation date, colony size, nest abandonment, and fledging success of a wood stork colony varies from year to year based on availability of suitable wetland foraging areas, which can be affected by local rainfall patterns, regional weather patterns, and anthropogenic hydrologic management (Service 1997). A colony site may be vacant in years of drought or unfavorable conditions due to inadequate foraging conditions in the surrounding area (Kahl 1964). Storks may abandon traditional colony nesting sites completely when hydrological changes occur such as removing surface water from beneath the colony trees (Service 1997; Coulter et al. 1999). Nesting failures and colony abandonment may also occur if unseasonable rainfall causes water levels to rise when they are normally receding, thus dispersing rather than concentrating forage fish (Kahl 1964; Service 1997; Coulter et al. 1999).

The annual climatological pattern that appeared to stimulate the heaviest nesting efforts by storks was a combination of the average or above-average rainfall during the summer rainy season prior to colony formation and an absence of unusually rainy or cold weather during the following winter-spring nesting season (Kahl 1964). This pattern produced widespread and prolonged flooding of summer marshes that maximized production of freshwater fishes, followed by steady drying that concentrated fish during the dry season when storks nest (Kahl 1964).

Status and Distribution

The wood stork occurs from northern Argentina, eastern Peru and western Ecuador, north to Central America, Mexico, Cuba, Hispaniola, and the southeastern United States (American Ornithologists Union 1983). Only the population segment that breeds in the southeastern United States. is listed as endangered. In the United States, wood storks were historically known to nest in all coastal states from Texas to South Carolina (Wayne 1910; Bent 1926; Howell 1932; Oberholser 1938; Dusi and Dusi 1968; Cone and Hall 1970; Oberholser and Kincaid 1974). Dahl (1990) estimates these states lost about 38 million acres, or 45.6 percent, of their historic wetlands between the 1780s and the 1980s. However, it is important to note wetlands and wetland losses are not evenly distributed in the landscape. Hefner et al. (1994) estimated 55 percent of the 2.3 million acres of the wetlands lost in the southeastern United States between the mid-1970s and mid-1980s were located in the Gulf-Atlantic Coastal Flats. These wetlands were strongly preferred by wood storks as nesting habitat. Currently, wood stork nesting occurs in Florida, Georgia, South Carolina, and North Carolina. Breeding colonies of wood storks exist in all southern Florida counties except for Okeechobee County. Additional expansion of the breeding range of wood storks in the southeastern United States may continue in coming years, both to the north and possibly to the west along the Gulf Coast (Brooks, personal communication 2006).

The decline in the United States population of the wood stork is thought to be related to one or more of the following factors: (1) reduction in the number of available nesting sites, (2) lack of protection at nesting sites, and/or (3) loss of an adequate food base during the nesting season (Ogden and Nesbitt 1979). Ogden and Nesbitt (1979) indicate a reduction in nesting sites is not the cause in the population decline, because the number of nesting sites used from year to year is relatively stable. They suggest loss of an adequate food base is a cause of wood stork declines. Changes in remaining wetland systems in Florida, including drainage and impoundment, may be a larger problem for wood storks than loss of foraging habitat (Ogden and Nesbitt 1979).

The primary cause of the wood stork population decline in the United States is loss of wetland habitats or loss of wetland function resulting in reduced prey availability. Almost any shallow wetland depression where fish become concentrated, through either local reproduction or receding water levels, may be used as feeding habitat by the wood stork during some portion of the year, but only a small portion of the available wetlands support foraging conditions (high prey density and favorable vegetation structure) that storks need to maintain growing nestlings. Browder et al. (1976; Browder 1978) documented the distribution and the total acreage of wetland types occurring south of Lake Okeechobee, Florida, for the period 1900 through 1973. We combined their data for habitat types known to be important foraging habitat for wood storks (cypress domes and strands, wet prairies, scrub cypress, freshwater marshes and sloughs, and saw grass marshes) and found these habitat types have been reduced by 35 percent since 1900.

The alteration of wetlands and the manipulation of wetland hydroperiods to suit human needs have also reduced the amount of foraging habitat available to wood storks. The decrease in wood storks nesting on Cape Sable was related to the construction of the drainage canals during the 1920s (Kushlan and Frohring 1986). Water level manipulation can aid raccoon predation of wood stork nests when water is kept too low (alligators deter raccoon predation when water levels are high). Artificially high water levels may retard nest tree regeneration since many wetland tree species require periodic droughts to establish seedlings. Water level manipulation may decrease food productivity if the water levels and length of inundation do not match the breeding requirements of forage fish. Dry-downs of wetlands may selectively reduce the abundance of the larger forage fish species that wood storks tend to use, while still supporting smaller prey fish.

Since the 1970s, wood storks have also been observed to shift their nest sites to artificial impoundments or islands created by dredging activities (Ogden 1991). The percentage of nests in artificial habitats in central and north Florida has increased from about 10 percent of all nesting pairs in 1959 to 1960 to 60 to 82 percent between 1976 and 1986 (Ogden 1991). Nest trees in these artificially impounded sites often include exotic species such as Brazilian pepper or Australian pine (*Casuarina* spp.). Ogden (1996) has suggested the use of these artificial wetlands indicates wood storks are not finding suitable conditions within natural nesting habitat or they are finding better conditions at the artificial wetlands. The long-term effect of these nesting areas on wood stork populations is unclear.

Human disturbance is a factor known to have a detrimental affect on wood stork nesting (Service 1997). Wood storks have been known to desert nests when disturbed by humans, thus exposing eggs and young birds to the elements and to predation by gulls and fish crows. The role of chemical contamination in the decline of the wood stork is unclear. Pesticide levels high enough to cause eggshell thinning have been reported in wood storks but decreased productivity has not yet been linked to chemical contamination (Ohlendorf et al. 1978; Fleming et al. 1984).

Burger et al. (1993) studied heavy metal and selenium levels in wood storks from Florida and Costa Rica. Adult birds generally exhibited higher levels of contaminants than young birds. The authors attribute this to bioaccumulation in the adults who may be picking up contaminants at the colony nesting site and while foraging at other locations during the non-breeding season. There were higher levels of mercury in young birds from Florida than young birds or adults from Costa Rica. Young birds from Florida also exhibited higher levels of cadmium and lead than young birds from Costa Rica. The authors recommended the lead levels in Florida be monitored. Burger et al. (1993) drew no conclusions about the potential health effects to wood storks.

The wood stork population in the southeastern United States appears to be increasing. Preliminary population totals indicate that the stork population has reached its highest level since it was listed as endangered in 1984. In all, about 11,200 wood stork pairs nested within their breeding range in the southeastern United States. Wood stork nesting was again recorded in North Carolina in 2006 after it was first documented there in 2005. This suggests that the northward expansion of wood stork nesting may be continuing. Several new colonies were located in 2006, including several in Florida. Of the preliminary 11,232 nesting pairs, 7,261 occurred within Florida. There were 1,919 nests recorded in Georgia, 1,963 in South Carolina, and 125 in North Carolina. Total nest numbers have also been over 9,000 in 2002 and 2003 (Service 2004). The number of colonies also continues to rise, and over 80 nesting colonies were reported in 2006 throughout the southeastern United States (Service unpublished data 2006), which is the highest to date in any one year.

The 2006 stork nesting season also appears to be very productive for storks throughout their range. While final productivity estimates are still not available, preliminary estimates are over 2.5 chicks per nest (Borkhataria et al. 2006b). The apparent success this year is welcome news in light of the nearly complete failure of stork nesting in 2005 in southern Florida, and relatively poor nest success rates in this region since 2002.

Wood Stork Nesting in the Southeastern United States

The 2006 estimate of total wood stork nesting pairs is the highest recorded since the stork was listed, and since the early 1960s (Table 5). The trend in the total nesting numbers shows a steady increasing trend, with some degree of variation around the trend that occurs because of environmental conditions, etc. The number of known stork colonies has also shown a steady increase over time, so the increase in nesting effort is primarily occurring because of nesting in more places, and not because of growth in known colonies.

Table 5. Wood stork nesting date in the southeastern United States.

YEAR	TOTAL		FLORIDA		GEORGIA		SOUTH CAROLINA		NORTH CAROLINA	
	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies
1981	4,442	22	2,365	19	275	2	11	1		
1982	3,575	22	778	19	135	2	20	1		
1983	5,983	25	2,350	22	363	2	20	1		
1984	6,245	29	1,550	25	576	3	22	1		
1985	5,193	23	1,455	17	557	5	74	1		
1986					648	4	120	3		
1987					506	5	194	3		
1988					311	4	179	3		
1989					543	6	376	3		
1990					709	10	536	6		
1991	4,073	37	2,293	23	969	9	664	3		
1992					1,091	9	475	3		
1993	6,729	43	4,262	28	1,661	11	806	3		
1994	5,768	47	3,589	26	1,468	14	712	7		
1995	7,853	54	5,617	33	1,501	17	829	6		
1996					1,480	18	953	7		
1997					1,379	15	917	8		
1998					1,665	15	1,093	10		
1999					1,139	13	520	8		
2000					566	7	1,236	11		
2001	4,998	44	2,662	22	1,162	12	1,174	9		
2002	7,855	70	5,463	48	1,256	14	1,136	10		
2003	9,551	78	6,449	49	1,653	18	1,356	11		
2004	8,857	93	5,227	63	1,596	17	2,034	13		
2005	5,560	74	2,336	41	1,817	19	1,407	14	32	1
2006	11,232	81	7,216	49	1,928	21	1,963	12	125	1

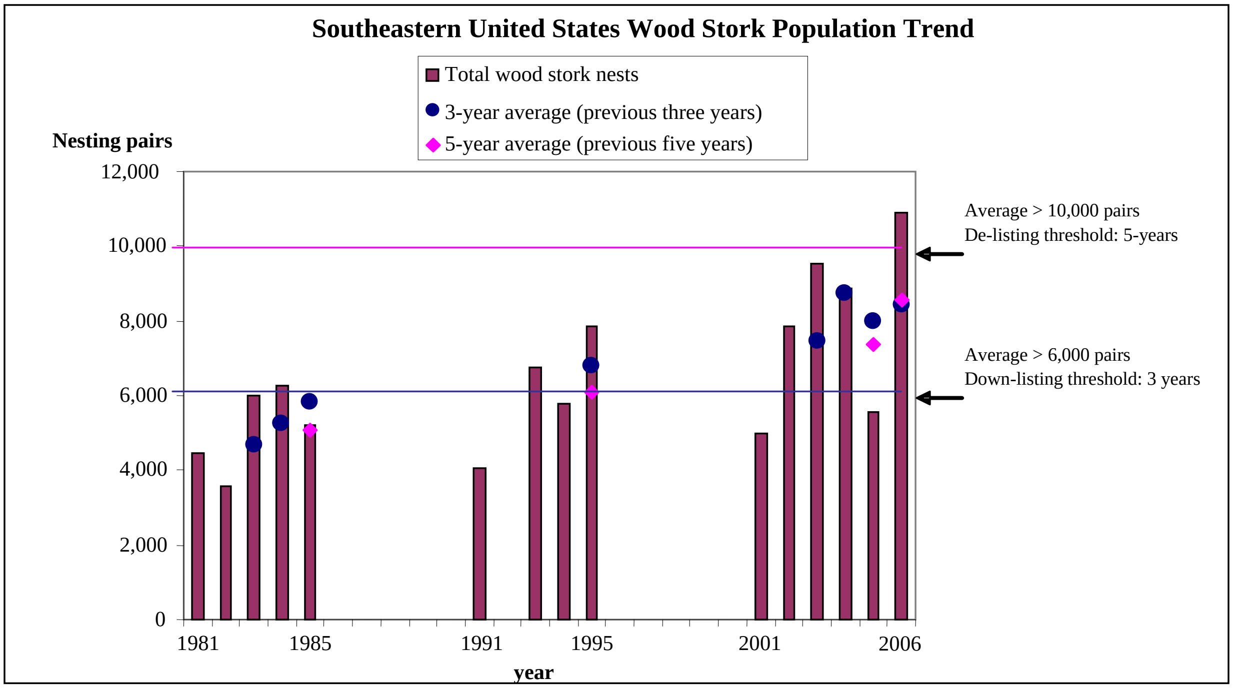

Figure 5. The total wood stork nesting in the southeastern United States in relation to recovery criteria.

Wood Stork Nesting in the Everglades and Big Cypress Systems

The Multi Species Recovery Plan defines the Everglades and Big Cypress systems as those colonies south of Lake Okeechobee from Lee County on the west coast to Palm Beach County on the East Coast. Nesting pairs for colonies in this region totaled have been variable, but have shown a general pattern of decline within the past 4 to 5 years (Crozier and Gawlik 2003; Service 2003; Crozier and Cook 2004; Cook and Call 2005). However, in a review of nesting data (Table 6), wood stork nesting success have shown a significant increase from 1996 from an average of 400 to 500 pairs to a high of 4,549 pairs in 1999, with a 3-year running average over the 10-year period ranging from 507 to 3,742 pairs with considerable variability over the 10-year period. These observed fluctuations in the nesting between years and nesting sites has been attributed primarily to variable hydrologic conditions during the nesting season (Crozier and Gawlik 2003; Crozier and Cook 2004). Frequent heavy rains during nesting can cause water levels to increase rapidly. The abrupt increases in water levels during nesting, termed reversals (Crozier and Gawlik 2003), may cause nest abandonment, re-nesting, late nest initiation, and poor fledging success. Abandonment and poor fledging success was reported to have affected most wading bird colonies in southern Florida during 2004 and 2005 (Crozier and Cook 2004; Cook and Call 2005).

Table 6. Total number of wood stork nesting pairs within the Everglades and Big Cypress Basins, 1996 to present.

Year	Nesting Pairs	3-Year Running Average
1996	600	-
1997	445	-
1998	475	507
1999	4,549	1,823
2000	3,996	3,007
2001	2,681	3,742
2002	2,880	3,186
2003	2,386	2,649
2004	1,015	2,094
2005	634	1,345
2006	2,710	1,453

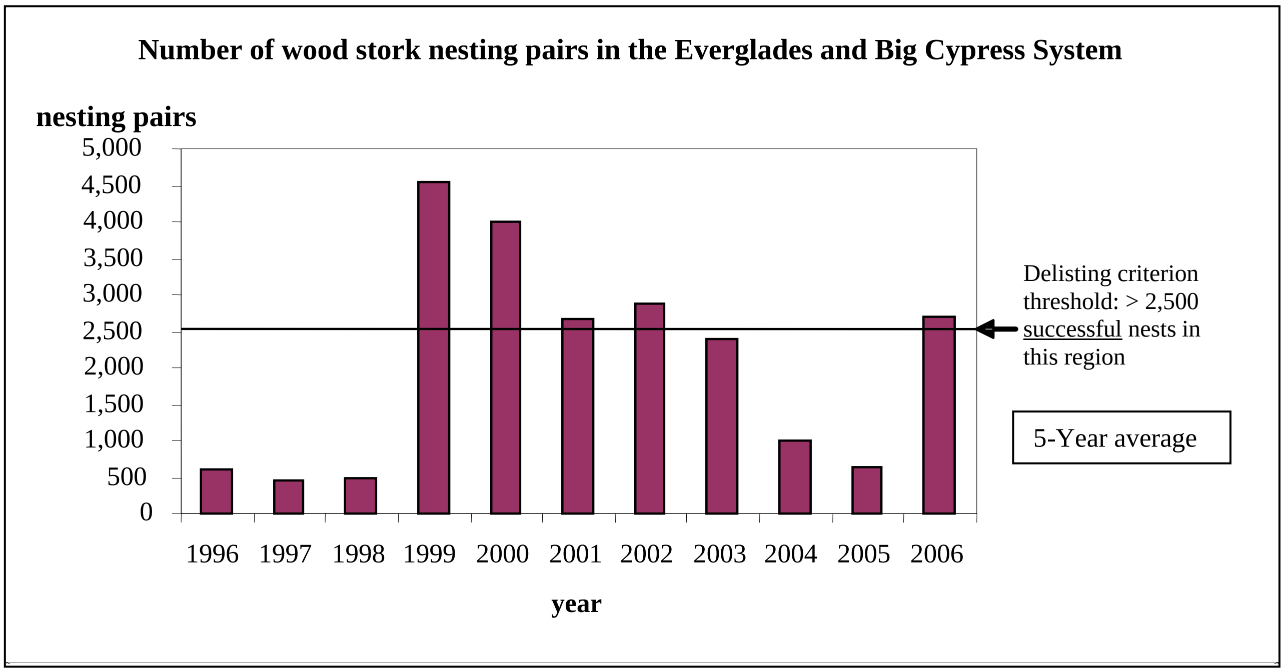

Figure 6. Graph of wood stork nesting in Everglades and Big Cypress System.

ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation and the impact of State or private actions, which occur simultaneously with the consultation in progress.

The project area is composed of a series of hydrologically interconnected wetland units that include some of the largest remaining expanses of remaining Everglades marshes, natural lakes, and many manmade features, including canals, levees, and artificial impoundments. Flow among these wetland units is controlled through a network of canals, and is regulated through a variety of water control structures and pumps. While large volumes of water are stored, controlled, and discharged the hydrologic patterns within all wetlands in southern Florida are still influenced by rainfall.

While hydrologic management does not overwhelm the natural hydrologic pattern, it does have the capacity to significantly alter the duration of flooding, the extreme water levels (both high and low), and the timing of high and low water. Most water management features in southern Florida are operated by schedules, constraints, or other operational rules that have been developed singly or in regional groups. The Service has conducted numerous consultations on these past and present operational rules. These operational rules now drive the hydropatterns and vegetation succession patterns within the Everglades wetlands, and interact with other environmental drivers, such as fire, to produce conditions that would not have occurred within the system naturally. While many factors affect the specific habitat conditions in any one point, hydrology may have the strongest influence on local conditions.

Status of the Species Within the Action Area

Cape Sable Seaside Sparrow and Critical Habitat

The action area encompasses the entire range of the Cape Sable seaside sparrow. Therefore, the information in the Status of the Species section addresses the status of the species and critical habitat within the action area, and is incorporated here by reference.

Everglade Snail Kite and Critical Habitat

The action area encompasses the current range of the Everglade snail kite. Therefore, the information in the Status of the Species section addresses the status of the species and critical habitat within the action area, and is incorporated here by reference.

Wood Stork

The action area encompasses a subset of the range of the wood stork within the southeastern United States. The storks that nest within the action area are not a distinct segment of the southeastern United States stork population, and regularly interact with the rest of the wood stork population.

Historic and Current Patterns of Wood Stork Nesting

Historically, the action area contained some of the larger wood stork colonies within the southeastern United States in the southern Everglades. Prior to the1970s, the majority of stork nesting within the southeastern United States occurred south of Lake Okeechobee (Ogden 1996), including the action area. Since that time, there has been a gradual reduction in nesting within that region, while more nesting has been documented farther north within the stork's range. Since the 1970s, there have been few occurrences of large nesting colonies within southern Florida.

From the 1970s through the 1990s, a continued pattern of relatively low nesting effort within the Everglades has continued. More stork nesting colonies have been located in the region, but they tend to support relatively small numbers of stork nests (< 100 nesting pairs), and they tend to be less consistently active. However, the action area includes several Everglades colonies that have been among the most consistent over the past decade and earlier in terms of nesting effort and location, including the Tamiami West, Paurotis Pond, Cuthbert, and Rodgers River colonies.

Recent Wood Stork Surveys

From 2001 through 2006, there have been annual statewide aerial surveys of known wood stork nesting colonies in Florida, including all of the action area. ENP personnel have also monitored colonies within the ENP boundary. These surveys have provided information on the occupancy of colony sites by storks and on the number of nesting wood storks within each colony. Because the surveys are conducted at a single point during the nesting season, the results do not necessarily represent all storks nesting activity that occurred in a year; colonies that initiated effort but abandoned prior to surveys would not be recorded, and similarly, colonies that formed or grew in numbers following survey flights would not be recorded accurately.

Since 1996, there have been 13 stork nesting colonies within the action area (Table 7). In each year, the number of colonies that are active varies, ranging from 1 to 7 colonies, and the estimated total number of nesting storks within the region has varied from 25 to 2,535. Comprehensive surveys of the entire action area have not been conducted in each year, and the stork numbers represented are the minimum numbers reported in only those colonies that were monitored.

Table 7. Number of wood stork colonies and nesting pairs within the action area from 1997 to 2006.

Year	Number of Colonies	Number of Nesting Pairs
2006	6	1,032
2005	6	302
2004	6	670
2003	6	1,100
2002	6	1,600
2001	7	2,585
2000	6	2,103
1999	7	590
1998	1	25
1997	3	225

There has not been a clear consistent trend in stork nesting numbers within the action area. Stork numbers and the number of active colonies appeared to increase in the late 1990s, reaching a peak in 2000 and 2001. Since that time, the number of active colonies has remained constant, but the number of nesting pairs has declined. As in other geographic areas, the number of nesting pairs is variable among years, and is probably heavily influenced by local hydrological conditions, but possibly also regional hydrologic conditions.

Factors Affecting Species Environment Within the Action Area

Cape Sable Seaside Sparrow

The C&SF Project is a system-wide network of canals and water-control structures located in south Florida, and includes portions of several counties as well as portions of ENP, BCNP, and adjacent areas. The Corps and District manage operations of the C&SF Project to achieve a variety of local and regional objectives including flood protection, water supply, and environmental benefits. Operations of the C&SF Project affect the hydrologic conditions within nearly all wetland systems within southern Florida, including the habitat supporting the Cape Sable seaside sparrow. The Service's 1999 Biological Opinion on Test 7 of the Experimental Program, the C-111 Project, and the MWD Project concluded that the Experimental Program jeopardized the sparrow. It prescribed an RPA that included a hydrologic management regime that would protect sparrow breeding by reducing water deliveries in western marl prairies and increasing water deliveries to eastern marl prairies that had been historically overdrained.

The Corps implemented ISOP operations that achieved some of the benefits specified in the RPA, but also met their requirement for maintaining flood protection. In 2002, the Service issued an amendment to the 1999 Biological Opinion that adopted IOP as an RPA. Under IOP, hydrologic management provided reduced hydroperiods and reduced flows during the breeding season to sparrow habitat in the western marl prairies. Construction and operation of several detention areas adjacent to sparrow habitat in the eastern subpopulations increased hydroperiods in some overdrained habitats. Many other hydrologic operations throughout the C&SF system that routinely occur have resulted in minor changes to hydrologic conditions in and adjacent to sparrow habitat. Pre-storm and post-storm operations, testing of hydrologic management operations, and other similar activities conducted by the Corps and District have also affected hydrologic conditions within sparrow habitat.

Fire is a natural factor that affects marl prairies occupied by the sparrow and most sparrow habitats have burned at some point during the past 30 to 40 years. ENP, BCNP, and the Florida Fish and Wildlife Conservation Commission (FWC) have conducted prescribed burns within sparrow habitat. The Service has consulted with ENP on several prescribed fire plans. In addition, these agencies and the Florida Division of Forestry conduct wildfire suppression and management within sparrow habitat. In the short term, fires render sparrow habitat unsuitable for occupancy by sparrows because they remove the vegetation that sparrows rely upon for cover and for a substrate during periods when habitat is flooded. Following fire, vegetation normally begins to regrow rapidly, and reaches pre-burn density and species composition about two years later. Sparrows do not regularly occupy burned areas for 2 to 3 years after fire. ENP has conducted a prescribed fire in former sparrow habitat within the western marl prairies to facilitate habitat restoration. Within sparrow subpopulations, ENP has conducted wildfire suppression that was intended specifically to reduce potential impacts to sparrows and sparrow habitat within Subpopulation B. Prescribed burns have also been conducted along the eastern ENP boundary to reduce the likelihood of human-ignited fires spreading into sparrow habitat near Subpopulations C, E, and F. Because fires reduce habitat suitability, both prescribed fires and wildfire management can have a significant affect on sparrow populations.

Changes in vegetation composition can result from changes in hydrologic conditions, changes in fire frequency, and management history of a site. Many areas of sparrow habitat have experienced vegetation change since monitoring was initiated. Overdrying that results from maintaining artificially low water levels within areas of sparrow habitat, such as those that occur along on the eastern boundary of ENP, are subject to woody vegetation encroachment, which reduces the suitability for sparrow occupancy. Extended hydroperiods and deep inundation that result from managed water releases in combination with wet-season rainfall have resulted in changes in vegetation from marl prairie to marsh species, resulting in reduced habitat suitability. Extended hydroperiods have resulted in vegetation changes in portions of the western marl prairies in sparrow Subpopulation A, and in the lower C-111 basin near Subpopulation D.

Invasive and exotic species may also affect sparrows. Invasive plant species such as *Melaleuca*, Australian pine, Brazilian pepper, and other woody species can become established in sparrow habitat and reduce habitat suitability. While limited information is available on the effects of invasive exotic animals on sparrows, species like the Burmese python (*Python molurus bivittatus*), which has become established near sparrow habitat, may depredate sparrows. Additional information is needed to evaluate the magnitude of potential threat from invasive animal species.

Management of invasive woody plants has been conducted by ENP, FWC, and District in and adjacent to sparrow habitat to reduce impacts of these species on sparrow habitat suitability. Herbicide treatment of large stands of exotic trees has reduced the spread of these species and has improved sparrow habitat in some areas. These species regrow rapidly, and continued maintenance control has been initiated. Efforts to remove invasive exotic animals like the Burmese python have also been conducted.

While direct physical disturbance to sparrow habitat and disturbance resulting from construction activities is limited because nearly all sparrow habitat occurs within ENP and other conservation lands, some construction activities have affected sparrows and sparrow habitat. From 2002 to present, construction of the S-332B, C, and D Pump Stations and associated detention areas in and adjacent to sparrow habitat has resulted in impacts to sparrow habitat and possibly indirect impacts to sparrows. Similarly, construction activities associated with the replacement of the Taylor Slough Bridge in ENP may have had indirect effects on sparrows. Construction and maintenance of roads, canals, and levees near sparrow habitat may result in direct and indirect impacts to sparrows.

Critical Habitat

Construction of the S-332B North and West Detention Areas and the associated pumps occurred within designated sparrow critical habitat. In total, the construction of these features resulted in impacts to about 471.5 acres of critical habitat. These features were built within abandoned agricultural fields that were overgrown with shrubs and weedy vegetation. Construction consisted of scraping the soil to create levees around the detention areas and construction of elevated pads for pumps and associated infrastructure.

Everglade Snail Kite

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, District, and St. John's River Water Management District manage water levels in snail kite habitat in accord with many different local and regional water management plans and schedules. The Service has conducted formal consultation on the MWD Program, the IOP, Lake Kissimmee and Lake Tohopekaliga drawdowns, and several other projects that have affected snail kites and their habitat. Water management plans affect water levels in marshes and lakes upon which snail kites rely, the rates of water level recessions in lakes and marshes, and the timing of high and low water events. These factors affect snail kite habitat suitability directly. The compartmentalization of Everglades' wetlands under the 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.

Changes in kite foraging habitat that have resulted from hydrologic management have occurred within southern WCA-3A. In these areas, prolonged deep water has caused changes in vegetation that affect kites' ability to forage. They have also affected growth and survival of woody plants that kites use as perches. From about 1993 to present, which coincides with Test 7 of the Experimental Program and subsequent ISOP and IOP operations, WCA-3A stages have shown relatively little annual variation in stages compared to the previous decades, with an annual average stage of about 9.5 ft. In addition, stages in WCA-3A have exceeded 10.5 ft in 10 of the past 13 years, while there were only about four occurrences of stages exceeding 10.5 ft during the 40-year period from 1953 to 1993. Stages in 1994, 1995, and 1999 also exceeded 11.5 ft, and are the three highest stages within the period of record. Preliminary 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. 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 hydroperiods and deep water impact woody vegetation and prevent regrowth of woody vegetation that kites use for nesting and perch-hunting. These changes, however, are not expected to have long term and significant impacts on snail kites and the habitat changes are reversible by favorable hydrological conditions.

Drydowns result from hydrologic management, including both intentional drawdowns to aid in habitat restoration such as those that occurred on Lake Kissimmee and Lake Tohopekaliga, and drydowns that result from a combination of water management activities and unexpected environmental conditions, like those that have affected Lake Okeechobee. These reduce the suitability of habitat for snail kites by reducing kites' ability to locate apple snails, and by reducing the apple snail populations. Hydrologic management also has resulted in impacts to kite nesting habitat. Prolonged deep water within marsh habitats occupied by kites, such as those that have occurred within WCA-3A and within Lake Okeechobee in the last 20 to 30 years may kill and limit regrowth of woody vegetation that kites use as nesting substrate particularly in the near term. Drawdowns within lake systems may also reduce suitability of nesting substrates.

Degradation of water quality, particularly runoff of phosphorus from agricultural and urban sources, is another factor affecting snail kite habitats. The Everglades, including the areas that currently support kites, was historically an oligotrophic system, but major portions have become eutrophic. Nutrient enrichment has led to the growth of dense stands of cattails and other herbaceous emergent vegetation, which inhibits the ability of snail kites to find food.

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. Construction of docks and maintenance of waterways that service residential developments has altered kite foraging habitat and allowed boat access to areas that are frequented by kites, leading to increased disturbance. Within the Everglades marshes, residential construction has resulted in some loss of snail kite habitat in the past. Since 1996, few residential developments have resulted in loss of marsh habitat. Construction and maintenance of canals, levees, and water control structures can also affect snail kite habitat.

Exotic and invasive aquatic plants have had an impact on snail kite habitat within the lake systems and other areas. Species such as water hyacinth and water lettuce can grow rapidly within lake littoral zones, completely obscuring areas where kites forage, and can even affect littoral zone vegetation composition and cover by shading other species and competing for space. Dense mats of these species make an area unsuitable for kite foraging. Hydrilla (*Hydrilla verticillata*) is a submerged aquatic invasive that has become the dominant submerged species in some lakes. In some cases, hydrilla has resulted in reduced apple snail densities. However, apple snails sometimes occur within hydrilla in high densities. 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. Application of herbicides to control aquatic invasive species is a routine maintenance activity conducted by the Corps, District, FWC, and other local government agencies. 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.

Fire management within the marshes and some of the lakes affects snail kite habitat. Prescribed burning conducted by FWC, District, ENP, and other agencies can cause changes in snail kite nesting and foraging habitat. While most areas of snail kite foraging habitat are not likely to burn due to low density of vegetation, these areas may burn during drought conditions and dense patches of vegetation within foraging habitat may burn under normal conditions. Vegetation generally regrows rapidly following fires in marsh communities. Because kites rely on visual detection of prey, reduction in vegetation density may improve kites' ability to forage successfully. However, fires may damage or kill woody plant species that provide nesting substrate.

Recreational activities directly 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. In addition, these activities result in disturbance to kites.

Critical Habitat

The factors affecting designated snail kite critical habitat are generally the same as those described above. Construction of C&SF infrastructure resulted in impacts to less than 20 acres of critical habitat. A Service biological opinion addressed the effects of construction of the Miccosukee Tribe's Government Complex Center on snail kite critical habitat, which resulted in loss of 16.88 acres of critical habitat.

Wood Stork

Operation of the C&SF Project and other hydrologic management has a strong effect on hydrologic conditions within most of the areas occupied by wood storks. The Corps and District manage water levels in accord with many different local and regional water management plans and schedules. The Service has conducted formal consultation on the MWD Program, the IOP, and several other smaller projects that have affected wood storks and their habitat. Water management plans affect water levels in marshes upon which storks rely, the rates of water level recessions, and the timing of high and low water events. These factors affect the suitability of habitat for wood stork foraging. Water regulation schedules have resulted in changes in the timing of peak water levels and recessions within the southern Everglades. Because of compartmentalization and flood control measures, peak water levels occur later than they would naturally occur, and recessions begin later. Stork nesting is closely tied to the recession, and because of altered timing of hydrologic peaks and recession, storks have nested later than they had historically. This results in increased vulnerability to reduced prey availability that occurs at the onset of early wet season rains.

Alteration of wetland hydroperiod and depth because of management actions cause changes in foraging suitability for storks. Reduced depth and hydroperiod generally result in reduced densities of wood stork prey, but may increase the availability of prey to storks. Increased hydroperiod and increased water depth may result in increased productivity and abundance of prey, but reduced availability of prey to storks because of water depths that preclude effective stork foraging. Alteration of hydrologic conditions across the landscape results in complex changes in wood stork habitat suitability.

Development projects have resulted in the loss of stork foraging wetlands and changes in the availability of wetlands with particular characteristics. Construction and development projects mitigate for losses of wetlands on-site, but mitigation wetlands do not necessarily share the same hydroperiod characteristics and vegetation characteristics that were present in those wetlands that were impacted. As a result, development projects have resulted in a different set of hydrologic conditions. Some changes may have resulted in improvements to stork foraging, while others may have reduced stork foraging.

The Service completed formal consultation on the issuance of Lakebelt Rock mining permits that is expected to result in loss of 4,521 acres of melaleuca-infested wetlands east of WCA 3B. Of this total, 1,281 acres were considered suitable for wood stork foraging. A total of 6,985 acres of wetland preservation and enhancement within the Pennsuco wetlands will mitigate for project impacts, and will replace wetlands lost with wetlands of similar hydroperiod characteristics. In addition, installation of littoral shelves in conjunction with deep-water rock mine pits may provide additional high-quality stork foraging habitat.

Invasive and exotic plants have reduced the suitability of large areas of former stork foraging habitat. Dense stands of *Melaleuca* have become established within large areas of private and public lands. These stands may become dense enough to preclude storks from accessing the area. Exotic plant control programs have significantly reduced the density of exotic plants in many of these areas, but there remain large areas of potential stork foraging habitat that are not suitable due to extensive exotic plant infestation.

Construction and maintenance of canals, levees, and roads may result in temporary or permanent impacts to stork foraging habitat. These activities may affect vegetation in wetlands adjacent to these features.

EFFECTS OF THE ACTION

Cape Sable Seaside Sparrow

This assessment of the effects of IOP on the Cape Sable seaside sparrow is based on the Service's 1999 Biological Opinion on the MWD, the Experimental Program,, and the C-111 Project, modeling provided in the SEIS the and observed data that have been recorded during the operation of ISOP, ISOP 2001, and IOP. The SEIS modeling was conducted to evaluate the effects of IOP Alternative 7R based on the South Florida Water Management Model version 4.4 with a model period of record of 1965 to 1995. The effects of a continuation of IOP on sparrows are almost completely hydrologic because most of the construction of IOP structural features has been completed. However, hydrologic impacts to sparrow nesting, sparrow habitat suitability, and sparrow critical habitat will occur.

Managed water releases through the S-12 structures and the S-343 A and B structures affect the hydrologic condition within sparrow Subpopulation A, which is located immediately downstream from these structures. The structures are presumed to have differential impacts on the hydrology in sparrow habitat that are reflected in hydrologic modeling. However, the individual effects of each structure on hydrologic conditions in the area have not been corroborated through field measurements. The S-12A structure probably has the greatest direct influence on hydrologic conditions within sparrow Subpopulation A due to its location close to and immediately upstream from Subpopulation A.

The RPA in the Service's 1999 Biological Opinion prescribed operations of these structures to provide for a minimum of 60 consecutive days with water levels below 6.0 ft NGVD measured at gauging station NP-205 during the period from March 1 to July 15 (137 days). When water levels reach the 6.0 ft criterion at NP-205, about 40 percent of potential sparrow habitat within Subpopulation A has water levels below ground surface (Nott et al. 1998), which are conditions favorable for nesting. Due to the topographic variation in the area, portions of the area at elevations higher than the 6.0 ft criterion may experience dry conditions for periods of 80 days or more, which should be sufficient to allow birds in those areas to successfully nest twice. Operation of structures to achieve these conditions within sparrow Subpopulation A has been conducted since 2000 (ISOP).

During the 7-year period from 2000 to present, the target of 60 continuous days with water levels below ground was met in four of the years, and was not met in three of the years. Naturally occurring rainfall events caused the failures to meet the targets in all three years. In two of the years when the target was not met, failure resulted from mid-season rainfall events that caused water levels to temporarily exceed 6.0 ft by less than 0.20 ft, and water levels subsequently receded to less than 6.0 ft after several days. Under these conditions, about 30 percent of potential habitat would have remained dry. While these types of rainfall events can cause increased predation risk to nests and increase the risk of flooding (Lockwood et al. 1997; Pimm et al. 2002), they would not be expected to result in widespread nest failure. In the third year when targets were not met (2003), two late-dry-season rainfall events raised water levels above 6 ft, and then continued rain prior to July 15 prevented stages from dropping below 6 ft. Some portion of the habitat remained dry during these conditions.

Modeling of IOP operations indicates that they are generally consistent with the RPA. Based on the results for indicator Region 201, which is commonly used as the representation of hydrologic conditions within sparrow Subpopulation A, water levels remain below ground for > 60 days at a frequency of about 8 out of 10 years. Similarly, cell-by-cell evaluation of South Florida Water Management Model output on the duration of water levels below ground during the nesting window shows that there are large areas, including those both within and outside of indicator region 201, where water levels will remain below ground in at least 8 out of 10 years.

The focus of IOP has been on maintaining favorable conditions for sparrow nesting within Subpopulation A, and IOP measures were not intended to result in significant improvements in habitat. However, managing water releases to maintain water levels below ground during the sparrow nesting season has resulted in shorter hydroperiods in some areas under IOP. Within all of the South Florida Water Management Model cells that encompass sparrow Subpopulation A, the average annual hydroperiod is about 225 days. While this hydroperiod is longer than what is considered optimal for sparrows, it does support some sparrow habitat. In addition, because this is an average value calculated across a large area, many portions of the habitat will have hydroperiods shorter than 225 days that will be likely to support vegetation species that more closely represent optimal sparrow habitat.

The availability of suitable habitat for sparrows does not appear to be limiting within the area of Subpopulation A. While some large areas of former habitat remain in a degraded condition, there are about 44 square-miles of potential habitat that support wet prairie type vegetation which sparrows commonly occupy (Ross et al. 2006). This amount of potential habitat is probably not all in optimal condition for sparrows, but based on recent population estimates, there is sufficient available habitat for more sparrows in the area than currently occur there. The Service estimates there is enough habitat in Subpopulation A to support roughly 1,000 sparrows. IOP is not expected to result in a reduction of habitat over the next 4 years because we do not expect further hydrologic changes compared to IOP operations to date.

The fluctuation in the size of sparrow Subpopulation A under ISOP and IOP at least partially reflected the variability in environmental conditions that occurred. Rainfall during the breeding season may continue to impact sparrows, but the operation of IOP does not appear to exacerbate these impacts. The fact that the sparrow population has been capable of increasing following low counts suggests that this subpopulation remains resilient.

Since the Service's 1999 Biological Opinion, new information about sparrow movements among subpopulations has emerged, and several dispersal events among subpopulations have been documented, including the movement of two sparrows into Subpopulation A in 2003. The frequency of movements still appears to be low and movements among subpopulations do not appear to be frequent enough to result in population increases.

Consistent with past evaluations, maintaining and restoring sparrow Subpopulation A is essential to maintaining the overall sparrow population. Because it is most distantly separated form other sparrow subpopulations, thereby providing the greatest protection from the risk associated with local catastrophic events, and because it has the potential to support large numbers of sparrows, it can contribute to improved population resiliency more than any other subpopulation. The extirpation of Subpopulation A would represent a significant reduction in the distribution of the sparrow, and would be the most challenging area in which to restore a self-sustaining subpopulation (Walters et al. 2000). IOP appears to be sufficient to maintain this subpopulation for 4 years, but is not expected to improve the status of this subpopulation.

Previous ISOP and IOP operations have resulted in improved hydrologic conditions within eastern sparrow Subpopulations C and F because of the S-332 Detention Areas (ENP 2005). These detention areas have reduced the overdrying of potential sparrow habitat in these areas by reducing seepage out of ENP. This has likely reduced the risk of damaging wildfires, though the degree of risk reduction cannot be quantified. The operation of these features has also resulted in more natural responses to rainfall events. There is some small degree of associated risk to sparrow nesting resulting from increased effect of rainfall on surface water levels within marl prairies, but we believe this risk is insignificant and discountable. The operation of the S-332 Detention Areas has also had indirect effects on sparrow habitat. Based on the results of IOP to date, improved hydroperiods over the next 4 years are expected to continue to support self-sustaining marl prairie vegetation in conditions favorable for sparrows, and increased hydroperiods are expected to reduce the spread of encroaching woody vegetation within areas that were previously overdrained. However, overflows from the detention areas, though infrequent, are expected to contribute to unfavorable vegetation in local areas that result from increased nutrient levels in water that overflows the weirs. We do not expect these effects to be significant.

The Corps' SEIS indicated that Subpopulation E had benefited from increased hydroperiods that occurred because of the removal of the L-67 Extension. While there may have been some benefit, effects of IOP on Subpopulation E have been relatively small, and are expected to continue to be minor for the next 4 years. IOP has similarly had few effects on hydrologic conditions within sparrow Subpopulations B and D, and no effects are expected to occur in these areas over the next 4 years.

Critical Habitat

The completion of the S-332 pumps and reservoirs that are reflected in the fully built IOP will directly affect Cape Sable seaside sparrow designated critical habitat. Construction of the remaining features will result in loss of 171.5 acres of designated critical habitat near sparrow Subpopulation F. The majority of the habitat near the area that will be impacted is currently unsuitable for sparrows, and consists of a mixture of fallow agricultural fields and abandoned groves. However, the majority of the 171.5 acres that will be impacted is composed of native marl prairie vegetation with scattered small tree islands that may be able to support sparrows under some conditions. The proximity of this area to adjacent agricultural areas makes it unlikely that sparrows will use it.

Once constructed, water levels within the detention areas will be deeper than that which normally supports sparrow habitat, and consequently, the construction will preclude sparrow habitat. The construction of the S-332 Detention Areas is also expected to result in improved hydroperiods within the adjacent marshes and remaining designated critical habitat. The impacts to critical habitat resulting from IOP construction will affect less than one percent of the total area designated as critical habitat. The impacts are consequently not expected to result in destruction or adverse modification of critical habitat.

The operations of IOP have improved the hydrologic and habitat conditions within designated critical habitat near sparrow's Subpopulations C and F. We expect that favorable hydrological conditions will continue to occur within critical habitat in these areas. No other changes in the condition of critical habitat are expected to occur because of hydrologic changes under the continuation of IOP.

Everglade Snail Kite

The assessment of the effects of IOP on the Everglade snail kite is based on the Service's 2002 Biological Opinion for IOP, modeling provided in the Corps' SEIS conducted to evaluate the effects of IOP Alternative 7R, and observed data that have been recorded during the operation of ISOP, ISOP 2001, and IOP. The effects of continuation of IOP on kites are completely hydrologic because the construction of IOP structural features near kites has been completed.

In the 2002 Amended Biological Opinion issued on IOP, the Service concluded that IOP would not relieve high water levels that have caused declines in the condition of nesting and foraging habitat in WCA-3A, one part of the snail kite's range. It does not appear that IOP has resulted in significant reductions in hydroperiods to date, and we believe that IOP may result in habitat degradation resulting from high water levels over the next 4 years. From about 1993 to present, which coincides with Test 7 of the Experimental Program and subsequent ISOP and IOP operations, WCA-3A stages have shown relatively little annual variation in stages compared to the previous decades, with an annual average stage of about 9.5 ft. In addition, stages in WCA-3A have exceeded 10.5 ft in 10 of the past 13 years, while there were only about 4 occurrences of stages exceeding 10.5 ft during the 40-year period from 1953 to 1993. Stages in 1994, 1995, and 1999 also exceeded 11.5 ft, and are the three highest stages within the period of record. Preliminary 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. We believe this trend is likely to continue during the next 4 years to some degree, which could affect foraging habitat, apple snail abundance, and the woody vegetation that kites use for nesting and perch-hunting. However, we do not expect these changes over the next 4 years to have significant long term impacts to the health of snail kites. We expect to see a variation in juvenile survival, with some relatively low years and some relatively high years as we have seen in years past. Furthermore, we expect adult survival rates to remain fairly high. In addition, habitat changes that have occurred are reversible through favorable hydrological conditions.

The 0.5-ft reduction in the bottom zone (Zone E) of the WCA-3A regulation schedule, termed Zone E1, was first incorporated into the WCA-3A deviation schedule under ISOP and subsequently included in IOP. This change resulted in greater reduction in WCA-3A stages prior to the wet season, and was intended to help offset the effects of reduced outflows through the S-12 structures that resulted from closures in the dry season and early wet season. While this new zone may have helped to achieve the desired result of reducing high water impacts that could result from S-12 closures during the early wet season, it likely resulted in detrimental impacts to snail kite nesting and foraging within WCA-3A. During the years of IOP and ISOP operations, the low stages (as indicated by gauge 3A-28) that have occurred have reached about 8.4 ft, with the exception of 2003, when the low reached 8.9 ft. In the 6 years prior to IOP, the low stages at gauge 3A-28 had been above about 8.9 ft at their lowest point. A difference of 0.5 ft is not large. However, depending on where kites choose to nest, this difference could have a notable impact on how hydrologic conditions change near kite nests during the spring recession. Kites' reliance on the area immediately around the nest for foraging and capturing sufficient prey to feed nestlings during the 2 months of the nestling period make them vulnerable to rapidly changing hydrologic conditions.

Kites generally select nest sites that are over water, but not deep water, and they rely on the water around the nest to deter predators from approaching the nest and to support abundant apple snails. If water levels around nests drop to below about 6 inches, nests are depredated at a higher rate. In addition, when water levels drop below about 3.9 inches in the marshes around the nest, apple snails cease moving and aestivate, making them completely unavailable for kites. Either of these events will result in elevated rates of nest failure.

During wet years or in periods of elevated water levels, kites appear to select nest sites at higher elevations than during dry years, where water depths are similar to those that occur at lower elevations under drier conditions. Habitat at these higher elevations may dry more rapidly and become completely dry more frequently than habitats at lower elevations. For this reason, high nesting effort and low nest success often result when high water levels occur early in the kite nesting season and decline rapidly during the nesting season. These conditions appeared to occur during 2004 through 2006 within WCA-3A under IOP operations. Therefore, continued operation of IOP could result in poor nest success within WCA-3A during years when water levels, dictated largely by natural hydrological conditions, start high and drop by greater than 1-ft from February 1 through May 1, as measured at gauge 3A-28.

During years of poor nest success from rapidly dropping water levels, post-fledging survival of young will probably be reduced for those nests that successfully fledge young. After leaving the nest, fledglings are not immediately capable of moving large distances in search of favorable foraging areas, and remain closely tied to the area around the nest site for several more weeks. Therefore, we expect the juvenile survival rate to be relatively low in some years and relatively high in some years.

High stages in WCA-3A will indirectly affect kites by reducing the abundance, growth, and reproduction of apple snails. High water levels result in reduced position and reduced growth rates of young snails, and fewer adult-size snails are available for snail kites. Apple snail densities dropped by 82 percent from 2003 to 2004 within southern WCA-3A, presumably because of high water levels (Darby et al. 2005). If the apple snail population becomes depressed, it may require several years of favorable environmental conditions to recover. Rapid recessions can also be detrimental to snail reproduction when an area dries shortly after snails lay eggs. Newly hatched young snails are not able to survive long periods with water levels below ground. Rapid recession in spring months may result in reduced snail recruitment, and consequently reduced snail kite foraging suitability.

IOP operations have had relatively little effect on hydrologic conditions within WCA-3B and NE Shark Slough within ENP due to constraints on stages. These areas may continue to support low levels of snail kite nesting effort in some years, and IOP operations are not expected to have either beneficial or detrimental effects on snail kites and kite nesting in these areas, nor in the other parts of the snail kite's range.

While kite nesting remains widespread throughout many of southern Florida's marshes and lakes, WCA-3A has traditionally supported a large percentage of the total. When conditions within WCA-3A are favorable, total kite productivity in that area can be more than 300 fledglings, and these times can be very important to maintaining the kite population and compensating for poor reproduction years, that have historically resulted from large-scale droughts.

During the period that ISOP and IOP were in operation, the snail kite population statewide declined by about 50 percent. The majority of this decline occurred from 1999 through 2002, which was mostly prior to initiation of IOP also coincided with difficult drought conditions at the end of this period. However, during this period, ISOP operations were in place, and their effects on hydrologic conditions within areas occupied by snail kites were similar to those that were finalized under IOP. The decline in the kite population since 1999 combined with reduction in habitat conditions within one of the largest centers of kite breeding activity result in increased risk to the kite population. However, because kites regularly and successfully breed in other parts of their range and because they are long-lived and have high adult survival rates are high under normal (non-drought) conditions, localized detrimental conditions, even when they occur when kite population sizes are at a reduced level, do not pose a significant risk to the persistence of the species over the next 4 years. Risk to the population in WCA-3A will need to be re-evaluated following the reinitiation provisions herein.

Critical Habitat

The construction of IOP features is nearly complete, and all remaining construction will occur outside of Everglade snail kite designated critical habitat. However, the hydrologic conditions that are expected to occur under the continuation of IOP are expected to result in degradation of critical habitat within areas that have experienced persistent high water levels in recent years. Within southern WCA-3A, impacts to woody vegetation that may provide nesting substrate for snail kites are expected to continue to increase. Vegetation community changes from *Eleocharis* wet prairie to slough communities are also expected to increase resulting in reduced suitability for kite foraging.

Despite these changes, the area of designated critical habitat within southern WCA-3A continues to support large numbers of snail kites and snail kite nesting, and we expect this area to continue to provide habitat for kites. We expect that the impacts of the IOP on the vegetation within critical habitat are temporary, and under an appropriate hydrologic regime, more favorable habitat conditions can be restored. Because the continuation of IOP is for 4 years, no permanent loss of critical habitat is expected because of unfavorable conditions.

Wood Stork

The redistribution of water that results from IOP will have a variety of effects throughout the area. The effects on wood storks are based on hydrologic modeling provided in the SEIS on IOP Alternative 7R, and observed data from the past years of IOP operations. The expected effects of IOP on wood storks include changes in hydrologic conditions that affect risk of stork nest depredation and abandonment resulting from overdrying around a colony site, and changes in foraging habitat conditions that affect the ability of storks to forage and provision their nestlings. The IOP operations are expected to result in different hydrologic effects in different parts of the action area.

Within WCA-3A, IOP operations are expected to result in continued high water levels during the wet season and early dry season, followed by a rapid spring recession and rapidly increasing stages in the early wet season. These effects result in relatively high abundance of wood stork prey because of high stages and long hydroperiods, and these prey would become available to storks at a rapid rate in the late dry season. Because the WCA-3A deviation schedule results in an increased rate of recession beginning on February 1, availability of prey to storks early in their nesting season prior to February 1 may be limited in WCA-3A. The expected effect of this condition would be later initiation of nesting or reduced rates of nest initiation in those colonies closely associated with WCA-3A (L-28 Crossover, Jetport, and others).

Within the vicinity of western ENP and lower Shark River Slough, IOP operations will result in early recession rates within the short-hydroperiod marshes south of Tamiami Trail that result from the closures of the S-12 and S-343 structures. This would tend to result in early initiation of nesting within these areas, but the limited water deliveries into Shark River Slough in the dry season may result in reduced amounts of potential foraging habitat for colonies closely associated with this region (Paurotis Pond) especially during dry years.

Near NE Shark Slough, IOP operations in most years will result in reduced stages during the dry season because of constraints on inflows. This may cause increased recession rates in the vicinity resulting in a reduction of habitat available near the end of stork nesting in the late dry season when stages in that area reach their lowest levels. In addition, reduced flows may result in the risk of drying below the Tamiami West stork colony that would cause increased nest depredation rates and risk of nest abandonment, particularly in drier-than-average years. The proximity of the colony to the L-29 Canal helps to reduce the risk of drying below the colony because canal stages are maintained at a relatively stable level throughout the dry season.

Modeling indicates that IOP operations occasionally result in increased water levels in NE Shark Slough during the spring dry season. These conditions presumably occur when stages are sufficiently low that the G-3273 constraint does not restrict inflows, and water from WCA-3A is diverted into NE Shark Slough through the S-333 structure. In these cases, water levels within NE Shark Slough, in the immediate vicinity of the Tamiami West stork colony, rise by up to one foot during the period when storks are nesting and when water levels are generally receding throughout the system. This results in an artificial reversal and would cause a reduction in stork foraging conditions in areas near the colony, and may be significant enough to cause colony abandonment. Modeling indicates that these conditions may occur at a frequency of about one out of every 4 years. Because the foraging radius of the Tamiami West colony includes parts of WCA-3A and WCA-3B, ENP, the Pennsuco Wetlands, and urban areas, sufficient foraging opportunities may remain in other areas to offset the poor foraging conditions that result from IOP in NE Shark Slough, but some reduction in foraging opportunities is expected.

The S-356 pump operations are expected to directly affect hydrologic conditions at the Tamiami West colony and in the area immediately around the colony, although the precise impacts are not clear and will vary based on conditions at the time. The on/off pump operation criteria may result in a locally flashy hydropattern in the area of the colony, which may affect local foraging opportunities. In addition, if operated at the 500 cfs maximum pump capacity, the operations may cause water levels to rise in NE Shark Slough. Modeling suggests that the pump does not have large effects on hydropatterns in NE Shark Slough. The Corps will coordinate closely with the Service to assess conditions prior to future tests, develop the test protocol, and establish parameters to ensure no adverse affects.

IOP operations have little effect on the hydrologic conditions within WCA-3B, and consequently, no effects on stork foraging are expected in this region.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they will require a separate consultation pursuant to section 7 of the Act.

Most of the lands in the action area for the Cape Sable seaside sparrows are publicly owned and managed. Therefore, the majority of impacts to Cape Sable seaside sparrows and their habitat, including designated critical habitat, are anticipated to be related to future Federal actions that will require a separate consultation.

Most of the wetlands within the action area for the Everglade snail kite and wood stork are subject to Corps' jurisdiction and permitting under section 404 of the Clean Water Act. In some instances, wetlands may be determined to be outside the Corps' jurisdiction. For an unknown percentage of these Federal exemptions, it is expected that the State, or county if delegated wetland permitting by the State, will claim jurisdiction and require the process of minimization of, and compensation for, wetland impacts, which should assist in minimizing impacts to the wood stork.

Lands surrounding or adjacent to wetlands used by the snail kite and wood stork that do not require Federal involvement may be developed resulting in disturbance, habitat degradation, reduction in prey availability, isolated hydrologic changes, and/or permanent habitat loss. Land management activities conducted by State agencies may also have detrimental impacts to these species.

Some wetlands and the areas adjacent to those and other wetlands may be adversely affected by actions without Federal involvement, resulting in a decrease in habitat quality and quantity, prey availability, and productivity for wood storks and snail kites. However, based on the status of the species discussed previously and the status of the species in the action area, we believe that this loss and reduction is not expected to affect the recovery or survival of the wood stork or snail kite.

CONCLUSION

Cape Sable Seaside Sparrow

The continued operation of IOP for 4 years is expected to remain consistent with the RPA in the Service's 1999 Biological Opinion. Accordingly, we anticipate reduced water levels during sparrow nesting season to a level that will allow adult sparrow pairs to complete one or two successful clutches in most years. This level of nesting is sufficient to maintain Subpopulation A for the remainder of IOP. Rainfall events are expected to continue to affect the hydrologic conditions within subpopulation A during the nesting season, but IOP protections are sufficient to minimize the detrimental effects of these rainfall events on sparrow reproduction over the period. IOP operations are also expected to maintain hydrologic conditions to support suitable sparrow habitat within portions of Subpopulation A that are sufficient to maintain the subpopulation. Large increases in the number of sparrows within Subpopulation A or large improvements in the condition of habitat in the area are not expected to occur under IOP. However, the continued operation of IOP, designed to avoid jeopardizing the Cape Sable seaside sparrow, is anticipated to sustain Subpopulation A, which is necessary for overall population health. Some improvements to hydrologic conditions within sparrow subpopulations C and F are expected to result in improved habitat conditions and possibly larger numbers of sparrows. There are few effects of IOP to other sparrow subpopulations. In total, the impacts from IOP over the next 4 years are not anticipated to appreciable reduce the likelihood of survival and recovery of the sparrow.

Construction of IOP features will result in impacts to 171.5 acres of sparrow designated critical habitat, but this is not expected to result in destruction or adverse modification. Improvements in habitat conditions within limited areas of critical habitat within sparrow Subpopulations C and F are likely. No other effects to critical habitat are expected.

Everglade Snail Kite

Continued IOP operations are expected to result in continued habitat degradation within WCA-3A, which has been one of the most significant areas of kite habitat within the past 30 years. In addition, IOP operations are expected to result in reduced nest success of kites within WCA-3A, reduced foraging habitat suitability, and reduced abundance of the kite's primary prey. These impacts are expected to limit population growth in WCA-3A and possibly cause further reductions in the overall kite population. However, because snail kites are long-lived, have high rates of adult survival, and continue to successfully nest in other portions of their range in southern Florida, these impacts are not anticipated to appreciably reduce the likelihood of survival and recovery of the species in the wild.

Degradation of designated critical habitat within WCA-3A is expected to continue under IOP, but this is reversible with improved hydrologic conditions. No permanent loss of critical habitat is expected.

Wood Stork

Impacts to wood stork foraging and nesting are likely to occur under IOP resulting from reductions in foraging habitat suitability and potential increased risk of depredation within some stork colonies. These effects are not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild.

After reviewing the status of the Cape Sable seaside sparrow, Everglade snail kite, and wood stork; the environmental baseline for the action area; the effects of the proposed action; and the cumulative effects, it is the Service's biological opinion that IOP, as proposed, is not likely to jeopardize the continued existence of the Cape Sable seaside sparrow, Everglade snail kite, or wood stork and is not likely to destroy or adversely modify designated critical habitat for the Cape Sable seaside sparrow or Everglade snail kite.

INCIDENTAL TAKE STATEMENT

Sections 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in action 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.

AMOUNT OR EXTENT OF TAKE

Cape Sable Seaside Sparrow

The Service anticipates incidental take of Cape Sable seaside sparrows will be difficult to detect for the following reasons: the sparrow is very secretive in behavior and cryptic in coloring and it is unlikely that injury or mortality of individual sparrows or losses of sparrow nests will be documented. However, some level of take of this species, in the form of harassment resulting from construction activities associated with the S-332 detention features, harm resulting from habitat changes, and injury or death of adult and young sparrows, including nestlings is anticipated.

<u>Eastern Marl Prairies</u>

Harassment of sparrows because of disturbance from construction equipment and human activity may occur within 0.3 mile of construction activities associated with the S-332 Detention Area features 0.6 mile of the construction sites. The precise impact of this activity is difficult to measure, although the Service roughly anticipates based on observational data that when construction is occurring, up to two pairs of sparrows per year for the next 4 years may be harassed. This level of take will be exceeded if the footprint of the construction area increases. The Corps Construction Monitoring Plan should avoid all additional impacts to sparrows and nests near construction.

Operation of the S-332 structures may result in flooding of sparrow nests that occur within 0.6 mile of the S-332 Detention Areas, either because of increased water levels resulting from seepage or from overflow from the detention areas directly into sparrow habitat within ENP. This will result in loss of the contents of all nests within 0.6 mile of S-332, estimated to be to eight eggs/nestlings per year based on observational data. Operation of the detention areas that result in transition from groundwater conditions to surface water conditions beyond 0.6 mile from the detention areas prior to June 1 will result in incidental take not exempted in this opinion. In addition, operations that increase surface water levels by greater than 3.9 inches beyond 0.6 mile from the detention areas will exceed incidental take.

<u>Western Marl Prairie</u>

Information from various sources identifies different amounts of potential and available habitat, in the western marl prairies. To date, there is still limited detailed information about the condition and susceptibility to flooding within all portions of this area. Consequently, we used figures for habitat available that were presented in the Service's 1999 Biological Opinion.

The Service anticipates that a maximum of 66 square-miles of potential and historic sparrow habitat may be subject to flooding during the nesting season near Subpopulation A due to water releases. This area corresponds to 60 percent of potential sparrow habitat within the area of Subpopulation A. Any adult birds that have territories within the 66 square-miles would be impacted by water levels too high to allow breeding or by lower fecundity associated with nest abandonment. Likewise, injury or death to juvenile sparrows or eggs could result from pump discharges that raise the water level above existing nests.

Currently an estimated 110 square-miles (70,400 acres) of potential sparrow habitat is available in the western marl prairies. Although not all 110 square-miles (70,400 acres) may actually be suitable for nesting, the habitat that is suitable for the sparrow is contained within this acreage. The highest recorded population estimate occurred in 1981 when an estimated 2,688 sparrows occupied Subpopulation A. In 1992, this estimate was 2,608 and the estimate has varied between 16 and 432 birds since that time. Werner (1975, 1976) recognized density variability between one pair per 5 acres to one pair per 50 acres. IOP would result in a minimum of 44 square-miles (28,160 acres, or 40 percent of the total) of potential nesting habitat that is not flooded and available for sparrow nesting for at least 60 continuous days from March 1 through July 15 in 8 out of every 10 years.

There is enough sparrow habitat within the 40 percent of potential habitat that will be available for the next 4 years to support over 500 pairs, or a population of 1,000 birds at a density of about one pair per 0.08 square-mile (50 acres). However, because we cannot predict which portion of the available suitable habitat (the 60 percent verses the 40 percent) an individual bird will nest in, we anticipate that incidental take will occur each time the 66 square-miles (42,240 acres) are flooded over the next 4 years. More specifically, if more than 66 square-miles (42,240 acres) of habitat are unavailable for nesting sufficient to maintain the subpopulation (fewer than 60 consecutive days with water levels below ground surface at NP-205) due to water releases in any one year, then incidental take will be exceeded.

IOP operations allow water releases into Subpopulation A beginning on July 15 of each year. Because sparrows may nest through August, release of water through the S-12 structures is expected to increase the rate of nest failure for any nests that are active on July 15. In most years, water levels are already high within Subpopulation A by July 15, nesting activity is likely reduced, and nest success rates during this period will be low due to increased depredation rates. However, we expect that water releases will cause increases in water depths that may result in injury to or death of sparrow eggs or nestlings that are active on July 15, although this will be difficult to measure and not significant.

The Service’s 1999 Biological Opinion did not include any incidental take after calendar year 1999 because a sufficient amount of breeding habitat was available to allow sparrows to nest successfully. The incidental take for sparrows that is provided in this biological opinion does not represent an assessment of increased impacts to the sparrows that results from IOP, and only reflects a reassessment of the amount of take that is likely to occur under IOP based on new information about sparrow ecology and improved sparrow monitoring that has occurred since 1999. We think that this level of incidental take is consistent with the protections provided in the RPA of the Service’s 1999 Biological Opinion and continues to allow for a self-sustaining sparrow subpopulation in this area.

Everglade Snail Kite

The Service anticipates incidental take of Everglade snail kites will be difficult to detect for the following reasons: the snail kite is relatively secretive and occupies expansive areas of marshes where it is unlikely that injury or mortality of individuals will be detected and where it is unlikely that all snail kites will be detected by monitoring crews. However, take of this species, in the form injury or death of kites, including eggs and nestlings is anticipated.

High water levels in WCA-3A are expected to continue during the next 4 years resulting in a reduction in the quality of foraging habitat for snail kites and a reduction in the suitability of habitat to support abundant apple snails. As a result, the Service anticipates that incidental take of snail kites in the form of harm resulting from reduced ability to forage successfully because of habitat changes will occur whenever water levels rise above 10.5 ft NGVD as measured at gauge 3A-28. We expect that these stages will result in degradation of 184,320 acres of snail kite habitat within WCA-3A in each of the next 4 years when stages exceed 10.5 ft.

The Service also anticipates that injury or death of snail kite nestlings and eggs will result from rapid dry-season recession rates that occur under current the WCA-3A regulation schedule and IOP, which increases the risk of nest loss through overdrying in areas where kites initiate nesting under high water levels. It is difficult to estimate the number of eggs and nestlings that will be impacted because the number of nests is variable among years and because many nests remain undetected by monitoring crews. We expect that incidental take will occur when water levels within southern WCA-3A (as measured at gauge 3A-28) recede by more than 1 ft during the period from February 1 to May 1 in each of the next 4 years. The amount of incidental take in the form of injury or death of snail kite nestlings and eggs will increase as the amount of recession from February 1 to May 1 increases. The level of incidental take will be exceeded if stages in WCA-3A recede by more than 1.7 ft from February 1 through May 1 of any year. Instead of using the 5-year rolling average of water levels at two indicator regions to determine incidental take as in the Service's 2002 Biological Opinion, we will allow for real time monitoring versus assessing incidental take over a longer period.

While it will not be possible to accurately account for a number or proportion of kite nests affected, the Service roughly estimates this level of incidental take may result in a net increase in failure of up to 40 percent of nests within southern WCA-3A in any one year above typical range-wide levels during favorable conditions (roughly 40 percent).

We do not expect this level of impact each year that IOP operations are in place, and in most years, the nest failure rate within WCA-3A is expected to be less. The overall rates of failure in each year will be affected by hydrologic conditions prior to the kite breeding season, rainfall patterns during the breeding season, and water regulation. Under some hydrologic conditions, kite nest success may be favorable under IOP operations.

Wood Stork

The Service anticipates incidental take of wood storks will be difficult to detect for the following reasons: wood storks are highly mobile and may occupy any of a number of breeding colonies. Because they occupy remote areas, it is unlikely that injury or mortality of individual storks will be detected. However, the following level of take of this species, in the form of harm resulting from reduced ability to forage successfully because of habitat changes, and injury or death of adult and young storks, including nestlings is anticipated.

Because the IOP will result in a variety of hydrologic changes across the landscape that will be difficult to distinguish from environmental factors, it is difficult to estimate incidental take. The Service anticipates that take in the form of harm, resulting from reductions in foraging habitat suitability will result in injury or death of up to six wood stork eggs or nestlings during each of the next 4 years.

This level of incidental take will be exceeded if IOP results in an increase in water depth of more than 8 inches across an area of greater than 16 square-miles from December 15 through May 1 within the core foraging area of any active wood stork colony.

The Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 7 03-712), or the Bald Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species, or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Cape Sable seaside sparrows, Everglade snail kites, and wood storks.

1. Minimize the impacts of construction-related activities. Determine the presence/absence and location of these species, plan construction to avoid periods when species are more susceptible to disturbance, and adopt measures to reduce disturbance during construction.

2. Conduct testing under controlled conditions to determine the effects of operations that have not been refined. Operations of the S-356 and the S-332 structures have the potential to affect these species and their habitats. Determining the effects of specific operations on habitats and the species will allow the Corps to minimize impacts of operations.

3. Use operational flexibility within the IOP to minimize impacts related to hydrology. During periods when water regulations are not restricted by constraints, the Corps will work with the Service and other partners to identify operations that minimize detrimental impacts or reduce the future risk of detrimental impacts to the species and their habitat.

4. Obtain further information about the effects of IOP and develop appropriate measures to further minimize impacts. This includes obtaining information on: (a) the status and distribution of species in areas affected by IOP; (b) impacts of hydrology on the species; and (c) the effects of operational changes at specific structures on hydrology in the habitats occupied by the species.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. The Corps must conduct pre-construction surveys for Cape Sable seaside sparrows in areas where construction of the additional S-332 Detention Areas is proposed. If construction will be conducted during sparrow breeding season (February 15 through August 31), surveys must also be conducted sufficient to determine if Cape Sable seaside sparrows are present or absent. The survey protocol is to include an interagency committee composed of experts from the Service, the Corps, ENP, and the FWC, similar to the method that was employed during construction of the Taylor Slough Bridge. If Cape Sable seaside sparrows are found to be present, then the Corps will coordinate with the Service and other experts to develop criteria, as necessary, to avoid and minimize impacts to Cape Sable seaside sparrows.

2. The Corps will continue to test and refine marsh criteria in partnership with the Service and other agencies, in anticipation of full implementation of marsh criteria when CSOP is fully implemented.

3. If fire occurs within Cape Sable seaside sparrow Subpopulation A habitat, the Corps will coordinate with the Service and seek a deviation from the WCA-3A regulation schedule to ameliorate impacts to Cape Sable seaside sparrow habitat, as necessary.

4. The Corps will continue to conduct interagency operational conference calls to coordinate and discuss operations that will minimize impacts to listed species and other species of concern. As part of the established interagency coordinated process, the Corps will investigate and discuss when appropriate whether current constraints can be adjusted, such as the G-3273 constraint, to allow further minimization of impacts to sparrows, snail kites, and storks and their habitats.

5. The Corps must ensure that the on-going monitoring and research programs sufficient to track the nature, amount, and extent of any take for listed species resulting from implementation of IOP are continued for the life of the IOP. This includes, at a minimum: (a) tracking the yearly

status of Everglade snail kite and wood stork populations and any vegetative shifts that may occur within their habitats; and (b) determining the number of wood storks initiating nesting in the action area and the success rate of those nesting efforts each year.

Upon locating a dead, injured, or sick specimen of any threatened or endangered species, initial notification must be made to the nearest Service Law Enforcement Office (Fish and Wildlife Service; 9549 Koger Boulevard, Suite 111; St. Petersburg, Florida 33702; 727-570-5398). Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission; South Region, 3900 Drane Field Road, Lakeland, Florida, 33811-1299; 1-800-282-8002. Care should be taken in handling sick or injured specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured specimens or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Continue to monitor the series of existing hydrological gauges and coordinate on the possible addition of gauges, if necessary, to measure hydrologic impacts within the IOP project area.

2. In cooperation with the Service and other parties, continue to explore ways to increase outflow capacity of the S-333, S-12C, and S-12D and other projects to benefit listed species.

3. Seek authority to explore ways to backfill the remaining portions of the L-31W Canal not backfilled under CSOP, specifically south of State Road 9336 to its terminus, and to backfill the borrow ditch to the west of the main north to south Aerojet Road.

4. In cooperation with the Service and collaborating researchers, provide technical assistance when available to develop methods to restore marl prairie vegetation that has been impacted by high water levels.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the reinitiation request. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) new information reveals effects of the Corps' action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the Corps' action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your cooperation and effort in protecting fish and wildlife resources. If you have any questions regarding this project, please contact me at 722-562-3909.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Planning Division, Jacksonville, Florida (Stuart Appelbaum)
District, West Palm Beach, Florida (Carol Wehle)
FWC, Tallahassee, Florida (Mary Ann Poole)
FWC, Vero Beach, Florida (Timothy Towles)
NPS/ENP, Homestead, Florida (Dan Kimbell)
Service, Atlanta, Georgia (Noreen Walsh) electronic copy only
SOL/DOI, Atlanta, Georgia (Michael Stevens)

LITERATURE CITED

American Ornithologists Union. 1983. Checklist of North American birds. Sixth Edition. American Ornithologists Union, Baltimore, Maryland.

Anderson, W. 1942. Rediscovery of the Cape Sable seaside sparrow in Collier County. Florida Naturalist 16:12.

Beissinger, S.R. 1986. Demography, environmental uncertainty, and the evolution of mate desertion in the snail kite. Ecology 67:1445-1459.

Beissinger, S.R. 1987. Mate desertion and reproductive effort in the snail kite. Animal Behavior 35:1504-1519.

Beissinger, S.R. 1988. Snail kite. Pages 148-165 *in* R.S. Palmer, eds. Handbook of North American birds, Volume 4. Yale University Press; New Haven, Connecticut.

Beissinger, S.R. 1990. Alternative foods of a diet specialist, the snail kite. Auk 107:327-333.

Beissinger, S.R. 1995. Modeling extinction in periodic environments: Everglades water levels and snail kite population viability. Ecological Applications 5(3):618-631.

Beissinger, S.R. and J. E. Takekawa. 1983. Habitat use and dispersal by snail kites in Florida during drought conditions. Florida Field Naturalist 11:89-106.

Beissinger, S.R., A. Sprunt, IV, and R. Chandler. 1983. Notes on the snail (Everglade) Kite in Cuba. American Birds 37:262-265.

Bennetts, R.E., M.W. Collopy, and S.R. Beissinger. 1988. Nesting ecology of snail kite in WCA-3A. Florida Cooperative Fisheries and Wildlife Research Unit Technical report number 31. University of Florida; Gainesville, Florida.

Bennetts, R.E. and W.M. Kitchens. 1997. The demography and movements of snail kites in Florida. Final report. Florida Cooperative Fish and Wildlife Research Unit, National Biological Service, Department of the Interior, Gainesville, Florida.

Bennetts, R.E. and W.M. Kitchens. 1999. Within-year survival patterns of snail kites in Florida. Journal of Field Ornithology 70(2):268-275.

Bennetts, R.E., P. Darby, and P. Darby. 1993. 1993 annual snail kite survey. Florida Cooperative Fisheries and Wildlife Research Unit, University of Florida; Gainesville, Florida.

Bennetts, R.E., M.W. Collopy, and J.A. Rodgers, Jr. 1994. The snail kite in the Florida Everglades: a food specialist in a changing environment. Pages 507-532 *in* S. Davis and J. Ogden, eds. Everglades: the ecosystem and its restoration. St. Lucie Press, Delray Beach, Florida.

Bennetts, R.E., K. Golden, V.J. Dreitz, and W.M. Kitchens. 1998. The Proportion of snail kites attempting to breed and the number of breeding attempts per year in Florida. Florida Field Naturalist 26(3):77-108.

Bennetts, R.E., V.J. Dreitz, W.M. Kitchens, J.E. Hines, and J.D. Nichols. 1999. Annual survival of snail kites in Florida: radio telemetry versus capture-resighting data. Auk 116(2): 435-447.

Bennetts, R.E, W.A. Link, J.R. Sauer, and P.W. Sykes, Jr. 1999. Factors influencing counts in an annual survey of snail kites in Florida. Auk 116: 312-323.

Bent, A.C. 1926. Life histories of North American marsh birds. U.S. National Museum Bulletin 135.

Bent, A.C. 1937. Life histories of North American birds of prey. U.S. National Museum Bulletin 167.

Borkhataria, R., P. Frederick, and B. Hylton. 2004. Nesting success and productivity of south Florida wood storks in 2004. Unpublished report to the Fish and Wildlife Service; Jacksonville, Florida.

Borkhataria, R. and P. Frederick. 2005. Demography and movements of wood storks in the southeastern United States. Quarterly report, July 2005. Unpublished report to the Fish and Wildlife Service; Vero Beach, Florida.

Borkhataria, R.B., P.C. Frederick, and A.L. Bryan. 2006. Analysis of wood stork (*Mycteria americana*) locations in Florida and throughout the southeast from satellite transmitters and band returns. Unpublished report to the Fish and Wildlife Service; Vero Beach, Florida.

Brooks, B. 2006. Personal Communication. Biologist. U.S. Fish and Wildlife Service; Jacksonville, Florida.

Browder, J.A. 1978. A modeling study of water, wetlands, and wood storks. *In* A. Sprunt, IV, J.C. Ogden, and S. Winckler eds. Wading Birds. National Audubon Society. Research Report Number 7: 325-346.

Browder, J.A. 1984. Wood stork feeding areas in southwest Florida. Florida Field Naturalist 12:81-96.

Browder, J.S., C. Littlejohn, and D. Young. 1976. The Florida Study. Center for Wetlands, University of Florida; Gainesville, Florida, and Bureau of Comprehensive Planning, Florida Department of Administration; Tallahassee, Florida.

Brown, L.H. and D. Amadon. 1976. Eagles, hawks, and falcons of the world. McGraw-Hill Book Company; New York.

Bryan, A.L., Jr. and M.C. Coulter. 1987. Foraging characteristics of wood storks in East-Central Georgia, U.S.A. Colonial Waterbirds 10(2):157-161.

Bryan, A.L., Jr., M.C. Coulter, and C.J. Pennycuick. 1995. Foraging strategies and energetic costs of foraging flights by breeding wood storks. Condor 97(1):133-140.

Burger, J., J.A. Rodgers, Jr., and M. Gochfeld. 1993. Heavy metal and selenium levels in endangered woods storks *Mycteria americana* from nesting colonies in Florida and Costa Rica. Archives Environmental Contaminant Toxicology. 24:417-420.

Cary, D.M. 1985. Climatological and environmental factors effecting the foraging behavior and ecology of Everglade kites. Masters thesis, University of Miami; Coral Gables, Florida.

Ceilley, D.W. and S.A. Bortone. 2002. A survey of freshwater fishes in the hydric flatwoods of flint pen strand, Lee County, Florida. Proceedings of the 27th Annual Conference on Ecosystems Restoration and Creation, 70-91. Hillsborough Community College; Hillsborough County, Florida.

Chandler, R. and J.M. Anderson. 1974. Notes on Everglade kite reproduction. American Birds 28:856-858.

Clark, W.S. and B.K. Wheeler. 1987. A field guide to hawks of North America. Houghton Mifflin Company; Boston, Massachusetts.

Collins, T. and T. Rawlings. Progress Report, June 22, 2006: Population structure of the native apple snail, *Pomacea paludosa*, a key indicator species in Florida’s aquatic ecosystems: Historical structure and anthropogenic effects. Unpublished report to the Fish and Wildlife Service; Vero Beach, Florida.

Cone, W.C. and J.V. Hall. 1970. Wood ibis found nesting in Okefenokee Refuge. Oriole 35:14.

Cook, M.I. and E.M. Call. 2005. South Florida wading bird report, Volume 10. Unpublished report, South Florida Water Management District. September 2005.

Coulter, M.C. 1987. Foraging and breeding ecology of wood storks in east-central Georgia. Pages 21-27 *in* R.R. Odom, K.A. Riddleberger, and J.C. Ozier, eds. Proceedings of the third southeastern nongame and endangered wildlife symposium. Georgia Department of Natural Resources, Atlanta, Georgia.

Coulter, M.C. and A.L. Bryan, Jr. 1993. Foraging ecology of wood storks (*Mycteria americana*) in east-central Georgia: Characteristics of foraging sites. Colonial Waterbirds 16:59-70.

Coulter, M.C., J.A. Rodgers, J.C. Ogden, and F.C. Depkin. 1999. Wood stork (*Mycteria americana*). *In* A. Poole and F. Gill eds. The Birds of north America, No. 409. The Birds of North America, Incorporated; Philadelphia, Pennsylvania.

Crozier, G.E. and D.E. Gawlik. 2003. South Florida wading bird report, Volume 9. Unpublished report, South Florida Water Management District. November 2003.

Crozier, G.E. and M.I. Cook. 2004. South Florida wading bird report, Volume 10. Unpublished report, South Florida Water Management District. November 2004.

Dahl, T.E. 1990. Wetlands losses in the United States 1780s to 1980s. U.S. Department of the Interior, Fish and Wildlife Service; Washington, D.C.

Darby, P. 2005a. Apple snail abundance in snail kite foraging sites on Lake Okeechobee in 2005. Unpublished report to the Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Darby, P. 2005b. Apple snail habitat relationships on central Florida lakes. Unpublished report to the Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Darby, P.C., L.B. Karunaratne, and R.E. Bennetts. 2005. The influence of hydrology and associated habitat structure on spatial and temporal patterns of apple snail abundance and recruitment. Unpublished report to the U.S. Geological Survey; Gainesville, Florida.

Davis, S. and Ogden, J. 1994. Introduction. Pages 3-8 *in* S. Davis and J. Ogden, eds. Everglades: the ecosystem and its restoration. St. Lucie Press; Delray Beach, Florida.

Davis, S.M., E.E. Gaiser, W.F. Loftus, and A.E. Huffman. 2005. Southern marl prairies conceptual ecological model. Wetlands 25(4):821-831.

Dean, T.F. and J.L. Morrison. 2001. Non-breeding season ecology of the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). Final Report. Unpublished report to the Fish and Wildlife Service; Vero Beach, Florida.

Dreitz, V.J., J.D. Nichols, J.E. Hines, R.E. Bennetts, W.M. Kitchens, and D.E. DeAngelis. 2002. The use of resighting data to estimate the rate of population growth of the snail kite in Florida. Journal of Applied statistics 29(4):609-623.

Dusi, J.L. and R.T. Dusi. 1968. Evidence for the breeding of the wood stork in Alabama. Alabama Birds 16:14-16.

Everglades National Park. 2004. Cape Sable seaside sparrow numbers slightly increase in 2004 count. Press Release, July 15, 2004. Everglades National Park; Homestead, Florida.

Everglades National Park. 2005. An assessment of the Interim Operational Plan. Unpublished report to Congress. May, 2005. South Florida Natural Resources Center, Everglades National Park; Homestead, Florida.

Federico, A.C., K.G. Dickson, C.R. Kratzer, and F.E. Davis. 1981. Lake Okeechobee water quality studies and eutrophication assessment. Technical publication 81-2, South Florida Water Management District; West Palm Beach, Florida.

Fleming, W.J., J.A. Rodgers, Jr., and C.J. Stafford. 1984. Contaminants in wood stork eggs and their effects on reproduction, Florida, 1982. Colonial Waterbirds 7:88-93.

Gawlik, D.E. 2002. The effects of prey availability on the numerical response of wading birds. Ecological Monographs 72(3):329-346.

Hefner, J.M., B.O. Wilen, T.E. Dahl, and W.E. Frayer. 1994. Southeast wetlands; status and trends, mid-1970s to mid-1980s. U.S. Department of the Interior, Fish and Wildlife Service; Atlanta, Georgia.

Howell, A.H. 1919. Description of a new seaside sparrow from Florida. Auk 37:86-87.

Howell, A.H. 1932. Florida bird life. Coward-McCann; New York, New York.

Hylton, R.A., P.C. Frederick, T.E. De La Fuente, and M.G. Spalding. 2006. Effects of nestling health on post fledging survival of wood storks. Condor 108:97-106.

Johnson, R.A., J.I. Wagner, D.J. Grigsby, and V.A. Stern. 1988. Hydrologic effects of the 1984 through 1986 L-31 canal drawdown on the northern Taylor Slough Basin of Everglades National Park. South Florida Research Center Report-88/01.

Kahl, M.P., Jr. 1964. Food ecology of the wood stork (*Mycteria americana*) in Florida. Ecological Monographs 34:97-117.

Kitchens, W.M., R.E. Bennetts, and D.L. DeAngelis. 2002. Linkages between the snail kite population and wetland dynamics in a highly fragmented south Florida hydroscape. Pages 183-201 *in* J.W Porter and K.G. Porter, eds. The Everglades, Florida Bay, and Coral Reefs of the Florida Keys: An Ecosystem Sourcebook. CRC Press; Boca Raton, Florida.

Kitchens, W.M. 2006. Personal Communication. Primary Investigator. Florida Cooperative Fish and Wildlife Research Unit.

Kushlan, J.A. 1975. Population changes of the apple snail, *Pomacea paludosa*, in the southern Everglades. Nautilus 89:21-23.

Kushlan, J.A. 1979. Prey choice by tactile foraging wading birds. Proceedings of the Colonial Waterbird Group 3:133-142.

Kushlan, K.A. and O.L. Bass, Jr. 1983. Habitat use and the distribution of the Cape Sable seaside sparrow. Pages 139-146 *in* T.L. Quay, J.B. Funderburg, Jr., D.S. Lee, F. Potter, and C.S. Robbins, eds. The seaside sparrow, its biology and management. Occasional Paper of the North Carolina Biological Survey; Raleigh, North Carolina.

Kushlan, J.A. and P.C. Frohring. 1986. The history of the southern Florida wood stork population. Wilson Bulletin 98(3):368-386.

Kushlan, J.A., J.C. Ogden, and A.L. Higer. 1975. Relation of water level and fish availability to wood stork reproduction in the southern Everglades, Florida. U.S. Geological Survey open file report 75-434. U.S. Government Printing Office; Washington, D.C.

Lockwood, J.L., K.H. Fenn, J.L. Curnutt, D. Rosenthal, K.L. Balent, and A.L. Mayer. 1997. Life history of the endangered Cape Sable seaside sparrow. Wilson Bulletin 109(4):720-731.

Lockwood, J.L., K.H. Fenn, J.M. Caudill, D. Okines, O.L. Bass, Jr., J.R. Duncan, and S.L. Pimm. 2001. The implications of Cape Sable seaside sparrow demography for Everglades restoration. Animal Conservation 4:275-281.

Lockwood, J.L., M.S. Ross, and J.P. Sah. 2003. Smoke on the water: the interplay of fire and water flow on Everglades restoration. Frontiers in Ecology 1(9):462-468.

Lockwood, J.L., D.A. LaPuma, and M.J. Davis. 2005. The response of the Cape Sable seaside sparrow to fire. 2005 Annual Report. Unpublished Report to the Critical Ecosystem Studies initiative, Everglades National Park; Homestead, Florida.

Lockwood, J.L., D.A. LaPuma, B. Baiser, M. Boulton, and M.J. Davis. 2006. Detailed study of Cape Sable seaside sparrow nest success and causes of nest failure. 2006 annual report. Unpublished report to the Fish and Wildlife Service; Vero Beach, Florida.

Loftus, W.F. and A.M. Ecklund. 1994. Long-term dynamics of an Everglades small-fish assemblage. *In* S. Davis and J. Ogden, eds. Everglades: The ecosystem and its restoration. St. Lucie Press; Delray Beach, Florida.

Main, M.B. and M.J. Barry. 2002. Influence of fire on flowering of wet prairie grasses in south Florida, USA. Wetlands 22(2):430-434.

Martin, J., W. Kitchens, C. Cattau, A. Bowling, M. Conners, D. Huser, and E. Powers. 2006. Snail kite demography annual report 2005. Unpublished report to the Fish and Wildlife Service; Vero Beach, Florida.

Meyer, K.D. and P.C. Frederick. 2004. Survey of Florida's wood stork (*Mycteria americana*) nesting colonies, 2004. Unpublished report to the Fish and Wildlife Service; Jacksonville, Florida.

Nicholson, D.J. 1926. Nesting habitats of the Everglade kite in Florida. Auk 43:62-67.

Nicholson, D.J. 1928. Nesting habits of seaside sparrows in Florida. Wilson Bulletin 40:234-237.

Nichols, J.D., G.L. Hensler, and P.W. Sykes, Jr. 1980. Demography of the Everglade snail kite: implications for population management. Ecological modeling 9:215-232.

Nott, M.P., O.L. Bass, Jr., D.M. Fleming, S.E. Killeffer, N. Fraley, L. Manne, J.L. Curnutt, T.M. Brooks, R. Powell, and S.L. Pimm. 1998. Water levels, rapid vegetational changes, and the endangered Cape Sable seaside sparrow. Animal Conservation 1:23-32.

Oberholser, H.C. 1938. The bird life of Louisiana. Louisiana Department of Conservation, Bulletin 28.

Oberholser, H.C. and E.B. Kincaid, Jr. 1974. The bird life of Texas. University of Texas Press; Austin, Texas.

Ogden, J.C. 1972. Florida region. American Birds 26:852.

Ogden, J.C. 1991. Nesting by wood storks in natural, altered, and artificial wetlands in central and northern Florida. Colonial Waterbirds 14:39-45.

Ogden, J.C. 1996. Wood Stork. *In* J.A. Rodgers, H. Kale II, and H.T. Smith, eds. Rare and endangered biota of Florida. University Press of Florida; Gainesville, Florida.

Ogden, J.C. and S.A. Nesbitt. 1979. Recent wood stork population trends in the United States. Wilson Bulletin 91(4):512-523.

Ogden, J.C., J.A. Kushlan, and J.T. Tilmant. 1976. Prey selectivity by the wood stork. Condor 78(3):324-330.

Ogden, J.C., J.A. Kushlan, and J.T. Tilmant. 1978. The food habits and nesting success of wood storks in Everglades National Park in 1974. U.S. Department of the Interior, National Park Service, Natural Resources Report No. 16.

Ogden, J.C., D.A. McCrimmon, Jr., G.T. Bancroft, and B.W. Patty. 1987. Breeding populations of the wood stork in the southeastern United States. Condor 89:752 - 759.

O'Hare, N.K. and G.H. Dalrymple. 1997. Wildlife in southern Everglades invaded by Melaleuca (*Melaleuca quinquenervia*). Bulletin of the Florida Museum of Natural History 41:1-68.

Ohlendorf, H.M., E.E. Klass, and T.E. Kaiser. 1978. Environmental pollutants and eggshell thinning in the black-crowned night heron. *In* A. Sprunt, IV, J.C. Ogden, and S. Winckler, eds. Wading Birds. National Audubon Society. Research Report Number 7:63-82.

Palmer, R.S. 1962. Handbook of North American birds, Volume 1, Loons through Flamingos. Yale University Press, New Haven, Connecticut.

Pimm, S.L. and O.L. Bass, Jr. 2002. Range-wide risks to large populations: the Cape Sable seaside sparrow as a case history. Pages 406-424 *in* S.R. Beissinger and D.L. McCullough, eds. Population viability analysis. The University of Chicago Press; Chicago, Illinois.

Pimm, S.L., J.L. Lockwood, C.N. Jenkins, J.L. Curnutt, M.P. Nott, R.D. Powell, and O.L. Bass, Jr. 2002. Sparrow in the grass: a report on the first 10 years of research on the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). Unpublished report to Everglades National Park; Homestead, Florida.

Post, W. and J.S. Greenlaw. 1994. Seaside sparrow (*Ammodramus maritimus*). *In* A. Poole and F. Gill, eds. The birds of North America, No. 127. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.

Rand, A.L. 1956. Foot-stirring as a feeding habit of wood ibis and other birds. American Midland Naturalist 55:96-100.

Rehage, J.S. and J.C. Trexler. In Press (2006). Assessing the net effect of anthropogenic disturbance on aquatic communities in wetlands: Community structure relative to distance from canals. Hydrobiologia

Rodgers, J.A., Jr. 1990. Breeding chronology and clutch information for the wood stork from museum collections. Journal of Field Ornithology 61(1):47-53.

Rodgers, J.A., Jr., A.S. Wenner, and S.T. Schwikert. 1987. Population dynamics of wood storks in north and central Florida. Colonial Waterbirds 10:151-156.

Rodgers, J.A., Jr., S.T. Schwikert, and A.S. Wenner. 1988. Status of the snail kite in Florida: 1981-1985. American Birds 42:30-35.

Rodgers, J.A., Jr., S.T. Schwikert, and A. Shapiro-Wenner. 1996. Nesting habitat of wood storks in north and central Florida, USA. Colonial Waterbirds 19(1):1-21.

Ross, M.S., J.P. Sah, P.L. Ruiz, D.T. Jones, H. Cooley, R. Travieso, J.R. Snyder, and D. Hagyari. 2006. Effect of hydrologic restoration on habitat of the Cape Sable seaside sparrow – Annual report of 2004-2005. Unpublished report, Southeast Environmental Research Center, Florida International University; Miami, Florida.

Ross, M.S. 2006. Personal Communication. Primary Investigator. Southeast Environmental Research Center, Florida International University; Miami, Florida.

Rumbold, D.G. and M.B. Mihalik. 1994. Snail kite use of a drought-related habitat and communal roost in West Palm Beach, Florida: 1987-1991. Florida Field Naturalist 22:29-38.

Snyder, J.R. 2003. Clipping as a substitute for fire to study seasonal fire effects on muhly grass (*Muhlenbergia capillaris* var. *filipes*). Pages 203-204 *in* U.S. Geological Survey Greater Everglades Science Program: 2002 Biennial Report. U.S. Geological Survey Open File Report 03-54. Tallahassee, Florida.

Snyder, N.F.R., S.R. Beissinger, and R. Chandler. 1989. Reproduction and demography of the Florida Everglade (snail) kite. Condor 91:300-316.

Snyder, J.R., and C. Schaeffer. 2004. Response of muhly grass to different seasons of prescribed fire in southern Florida. Poster presentation, First National Conference on Ecosystem Restoration. December 6-10, 2004. Orlando, Florida.

Sprunt, A., Jr. 1954. Cape Sable seaside sparrow: *Ammospiza mirabilis* (Howell). Pages 479-481 *in* Florida Bird Life. Coward-McCann, Inforporated, New York, and the National Audubon Society.

Steward, K.K. and W.H. Ornes. 1975. The autecology of sawgrass in the Florida Everglades. Ecology 56:162-171.

Stimson, L.A. 1956. The Cape Sable seaside sparrow; its former and present distribution. Auk 73:489-502.

Stimson, LA. 1968. *Ammospiza mirabilis* (Howell) Cape Sable sparrow. Pages 859-868 *in* O.L. Austin, Jr., ed. Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and allies. Smithsonian Institution Press; Washington, D.C.

Stieglitz, W.O. and R.L. Thompson. 1967. Status and life history of the Everglade kite in the United States. Bureau of Sport Fisheries and Wildlife, Scientific report Wildlife, Number 109.

Sykes, P.W., Jr. 1979. Status of the Everglade kite in Florida 1968-1978. Wilson Bulletin 91:495-511.

Sykes, P.W., Jr. 1983a. Recent population trends of the Everglade snail kite in Florida and its relationship to water levels. Journal of Field Ornithology 54:237-246.

Sykes, P.W., Jr. 1983b. Snail kite use of the freshwater marshes of south Florida. Florida Field Naturalist 11:73-88.

Sykes, P.W., Jr. 1984. The range of the snail kite and its history in Florida. Bulletin, Florida State Museum, Biological Sciences 29:211-264.

Sykes, P.W., Jr. 1985. Evening roosts of the snail kite in Florida. Wilson Bulletin 97:57-70.

Sykes, P.W., Jr. 1987a. The feeding habits of the snail kite in Florida, USA. Colonial Waterbirds 10(1):84-92.

Sykes, P.W., Jr. 1987b. Snail kite nesting ecology in Florida. Florida Field Naturalist 15:57-84.

Sykes, P.W., Jr. 1987c. Some aspects of the breeding biology of the snail kite in Florida. Journal Field Ornithology 58:171-189.

Sykes, P.W., Jr. and R. Chandler. 1974. Use of artificial nest structures by Everglade kites. Wilson Bulletin 86:282-284.

Sykes, P.W., Jr., J.A. Rodgers, Jr., and R.E. Bennetts. 1995. Snail kite (*Rostrhamus sociabilis*) *in* A. Poole and F. Gill, eds. The birds of North America, Number 171, The Academy of Natural Sciences, Philadelphia, and the American Ornithologists Union; Washington, D.C.

Takekawa, J.E. and S.R. Beissinger. 1983. First evidence of snail kite feeding on the introduced snail, *Pomacea bridgesi*, in Florida. Florida Field Naturalist 11:107-108.

Takekawa, J.E. and S.R. Beissinger. 1989. Cyclic drought, dispersal, and the conservation of the snail kite in Florida: lessons in critical habitat. Conservation Biology 3:302-311.

Taylor, D.L. 1983. Fire management and the Cape Sable seaside sparrow. Pages 147-152 *in* T.L. Quay, J.B. Funderburg, Jr., D.S. Lee, F. Potter, and C.S. Robbins, eds. The seaside sparrow, its biology and management. Occasional Paper of the North Carolina Biological Survey; Raleigh, North Carolina.

Trexler, J.C., W.F. Loftus, F. Jordan, J.H. Chick, K.L. Kandl, T.C. McElroy, and O.L. Bass. 2002. Ecological scale and its implications for freshwater fishes in the Florida Everglades. Pages 153-182 *in* J.W. Porter and K.G. Porter, eds. The Everglades, Florida Bay, and Coral Reefs of the Florida Keys: An ecosystem sourcebook. CRC Press, Boca Raton, Florida.

Turner, A.W., J.C. Trexler, C.F. Jordan, S.J. Slack, P. Geddes, J.H. Chick, and W.F. Loftus. 1999. Targeting ecosystem features for conservation: standing crops in the Everglades. Conservation Biology 13(4):898-911.

U.S. Fish and Wildlife Service. 1967. Native Fish and Wildlife, Endangered Species. Federal Register 32:4001

U.S. Fish and Wildlife Service. 1977a. Final Correction and Augmentation of Critical Habitat Reorganization. Federal Register 42:47840-47845

U.S. Fish and Wildlife Service. 1977b. Endangered and threatened Wildlife and Plants; Determination of Critical Habitat for Six Endangered Species Including Palila, Renumbering of Critical Habitat Listings. Federal Register 42:40685-40690

U.S. Fish and Wildlife Service. 1984. Endangered and Threatened Wildlife and Plants; U.S. Breeding Population of the Wood Stork Determined to be Endangered. Federal Register 49:7332-7335.

U.S. Fish and Wildlife Service. 1997. Revised recovery plan for the U.S. breeding population of the wood stork. U.S. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service. 1999. Final biological opinion on the experimental program, the program of modified water deliveries to Everglades National Park, and the C-111 Project. U.S. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Fish and Wildlife Service. 2003. Wood Stork Report. Volume 2, Number 1, March 2003. U.S. Fish and Wildlife Service; Jacksonville, Florida.

U.S. Fish and Wildlife Service. 2004. Wood stork report. Volume 3, Number 1, April 2004. U.S. Fish and Wildlife Service, Jacksonville, Florida.

Van Lent, T. and R. Johnson. 1993. Towards the restoration of Taylor Slough. Unpublished report to South Florida Natural Resources Center, Everglades National Park; Homestead, Florida.

Walters, J.R., S.R. Beissinger, J.W. Fitzpatrick, R. Greenberg, J.D. Nichols, H.R. Pulliam, and D.W. Winkler. 2000. The American Ornithologists Union Conservation Committee review of the biology, status, and management of Cape Sable seaside sparrows: Final report. Auk 117(4):1093-1115.

Wayne, A.T. 1910. Birds of South Carolina. Contributions to the Charleston Museum No.1.

Werner, H.W. 1975. The biology of the Cape Sable seaside sparrow. Unpublished report to the Fish and Wildlife Service, Frank M. Chapman Memorial Fund, The International Council for Bird Preservation, and the U.S. National Park Service, Everglades National Park; Homestead, Florida.

Werner, H.W. and G.E. Woolfenden. 1983. The Cape Sable seaside sparrow: its habitat, habits, and history. Pages 55-75 *in* T.L. Quay, J.B. Funderburg, Jr., D.S. Lee, F. Potter, and C.S. Robbins, eds. The seaside sparrow, its biology and management. Occasional Paper of the North Carolina Biological Survey, Raleigh, North Carolina.

Woolfenden, G.E. 1956. Comparative breeding behavior of *Ammospiza caudacuta* and *A. maritima*. University of Kansas Publication of the Museum of Natural History 10:45-75.

APPENDIX A

Modified Water Deliveries to Everglades National Park and C-111 Projects Map