United States Department of the Interior

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

May 15, 2012

Memorandum

To: Janet Mizzi, Chief of Endangered Species, Southeast Regional Office

From: Craig Aubrey for Larry Williams, Field Supervisor, South Florida Ecological Services Office

Subject: Biological Opinion addressing effects of issuing a recovery permit (TE 65550A) to Dr. Dale Gawlik for research on the wood stork

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion based on the proposed issuance of a section 10(a)(1)(A) recovery permit to conduct research on the endangered wood stork (*Mycteria americana*) within Everglades National Park (ENP) and Water Conservation Area 3A (WCA3), Miami-Dade County, Florida, 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.*).

This Biological Opinion is based on published literature, research reports, the permit application and subsequent correspondence, telephone conversations, field investigations, and other sources of information. A complete administrative record of this consultation is on file at the South Florida Ecological Services Office (SFESO) in Vero Beach, Florida.

Consultation History

On February 9, 2012, the SFESO received a request from the Service's Southeast Regional Office (RO) for formal consultation on the proposed recovery permit mentioned above.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Pursuant to section 10(a)(1)(A) of the Act, the Service proposes to issue a recovery permit to the Applicant for take of wood storks while conducting research within ENP and WCA3. Botson and Gawlik (2010) documented above normal densities of nesting wading birds within south Florida during 2009. For some species, such as white ibis (*Eudocimus albus*), this increased nesting correlated with greater crayfish abundance. However, there was no increase in fish biomass to account for an increase in wood stork nesting that year. Therefore, these events suggest that wood storks may be able to shift their diets dramatically from year-to-year in response to changing prey communities and perhaps hydrologic patterns. The most recent dietary study conducted on wood storks in ENP was in 1976 (Ogden et al. 1976). The proposed studies are designed to determine the type and size of prey species fed on by wood storks, as well as temporal trends in prey taken during the breeding season.

During wood stork nesting season (March to May) researchers (n = 2) will visit colonies on Paurotis Pond and Tamiami West, within ENP, and Hidden Colony within WCA3. Colonies will be visited once or twice per week and reached either by foot or boat. All work within the colonies will occur in the morning hours in order to reduce heat stress to birds. Before entering a colony researchers will use binoculars to observe and locate active nests and to choose an appropriate entry point to minimize disturbance on nesting birds. Once in a colony, work locations will be moved frequently within the sampling area so that no one nest is disturbed for more than 30 minutes. Researchers will exit the colony at a different location than originally entered in order to prevent flushing nests more than once. No colonies will be visited during inclement weather.

Within the colonies, wood stork boluses (indigestible gut contents) will be collected. Nestling wading birds often regurgitate in the presence of researchers making bolus contents readily available. In the event a targeted wood stork nestling does not voluntarily regurgitate, the researchers will gently massage the bird's trachea to encourage regurgitation. Researchers will be prepared to spray water on nestling's leg to keep them cool on warmer days. Once a nestling regurgitates, a dead bait fish will be left in the nest to compensate for loss of bolus contents. While in the field, bolus content samples will be stored in Ziplock bags, individually labeled and placed in an ice cooler. In the laboratory, bolus contents will be rinsed and preserved in 70 percent alcohol solution. Each bolus prey item will be weighted and identified.

Boluses will be collected from 30 wood stork nestlings per week (no more than 360 samples over the entire nesting season). Based on nestling availability, some nestlings may be sampled more than once. In order to make a stronger link between wood stork diet and hydrology, these studies may continue for up to 4 years.

The action area is defined as all areas within ENP and WCA3 to be affected directly or indirectly by the Federal action. The Service has determined the action area for this project is Miami-Dade County, Florida.

STATUS OF THE SPECIES/CRITICAL HABITAT

The following discussion is summarized from the South Florida Multi-Species Recovery Plan (MSRP) (Service 1999) the 5-year status review (Service 2006), as well as from recent research publications and monitoring reports.

Species/critical habitat description

The wood stork was listed under the Act as endangered on February 28, 1984 (49 FR 7332). No critical habitat is designated for the wood stork; therefore, none will be affected. The wood stork is a large, long-legged wading bird, with a head to tail length of 85 to 115 cm (33 to 45 inches [in]) and a wingspan of 150 to 165 cm (59 to 65 in) (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 unfeathered 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 have pale salmon coloring under the wings, fluffy undertail coverts that are longer than the tail, 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 1 m (3 ft), cypress as tall as 30.5 m (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 change 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 on 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 rookeries, a handful of new stork nesting colonies are discovered each year and each year a number of colonies also become inactive depending on local environmental conditions and sometimes remain inactive (Meyer and Frederick 2004). 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 to storks 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 in (5 to 40 cm) in depth, 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 and Bryan 1993, Coulter et al. 1999).

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 sufficiently close to the colony to allow storks to efficiently deliver prey to nestlings. Hydrologic and environmental characteristics have strong effects 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 feet during the wet season (June-November), and then receding gradually during the dry season (December-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 fish and larger fish (Loftus and Ecklund 1994, Jordan et al. 1998, Turner et al. 1999, Trexler et al. 2002). 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 2006). Distances from dry-season refugia, such as canals, alligator holes, and similar long hydroperiod sites, also affect fish density and biomass in southern Florida.

Across the highly modified landscape of southern Florida, fish availability varies with respect to hydrologic gradients and 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 wide variety of hydroperiod classes, nutrient conditions, and spatial variability. Dense submerged 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 submerged 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 but ranged from 0 to100 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).

Carlson and Duever (1979) also noted in their study that long distance movement of fish into deeper habitats is not a regular occurrence in the Big Cypress watershed communities. They also noted in their study the preponderance of obstacles and plant debris all contribute to hindering mobility and limiting movement across the site. In addition, in Chapman and Warburton's (2006) studies on *Gambusia*, they noted movement between drying pools was limited. Carlson and Duever (1979) concluded in their study that "density and biomass of both wet and dry season

fish populations are dependant primarily on the production of the particular site and not of adjacent habitats from which fish may have migrated."
Wood storks feed almost entirely on fish between 1 and 10 in length (Kahl 1964, Ogden et al. 1976, Coulter 1987), but may consume crustaceans, amphibians, reptiles, mammals, birds, and arthropods. Lauritsen (Corkscrew Swamp Sanctuary, personal communication, 2007; 2009) observed wood stork foraging on crayfish. Studies by Depklin et al. (1992) of wood stork foraging at colonies in east-central Georgia also noted the presence of crayfish in the diets of wood storks. In their analysis, crayfish represented 1 percent of the biomass and 1.9 percent of the prey items. Fish represented 92 percent of all individual prey items and 93 percent of the biomass. A similar study conducted by Bryan and Gariboldi (1997) also noted the presence of crayfish in wood stork diets and noted a similar frequency of occurrence. In the foraging studies conducted by Ogden et al. (1976), Coulter et al. (1999), Carlson and Duever (1979), Turner et al. (1999) and Trexler et al. (2002), little information is provided on consumption of invertebrates. Ogden et al. (1976) summarized information from Kahl's publications (1962, 1964) on stomach contents of wood storks sampled in south Florida and southwest Florida and noted that all individuals examined contained only fish. Ogden et al.'s (1976) study also noted the prey consumed were fish, although the average density of prawns was 2.5 times the density of the most abundant fish.

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 7 to 8 cm (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 is 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.

In Georgia, wood storks generally forage in wetlands within 50 km (31 miles) of the colony site (Bryan and Coulter 1987), but forage most frequently within 20 km (12 miles) of the colony (Coulter and Bryan 1993). Herring (2007) noted similar foraging patterns for wood storks in south Florida with most frequent foraging within 10.29 km (6.4 miles). 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. Storks forage the greatest distances from the colony at the beginning of the nesting season, before eggs are laid, and near the end of the season when the young are large. They feed nearest the colony during incubation (Browder 1984, Mitchell 1999). In south Florida wood storks generally use wet prairie ponds early in the dry season, and then shift to slough ponds later in the dry season, thus, following water levels as it recedes into the ground (Browder 1984).

Gawlik (2002) characterized wood storks foraging in the Everglades 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, although prey was still sufficiently available that other wading bird species were still foraging in large numbers. Wood stork choice of foraging sites in the Everglades 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. Eggs are laid as early as October in south Florida and as late as June in north Florida (Rodgers 1990). 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 3 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 are forced to 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 stork colonies experience considerable variation in production among colonies and years in response to local habitat conditions and food availability (Holt 1929, Kahl 1964, Ogden et al. 1978, Clark 1978, Hopkins and Humphries 1983, Rodgers and Schwikert 1997). Recent studies (Rodgers et al. 2008, Bryan and Robinett 2008, Winn et al. 2008, Murphy and Coker 2008) documented production rates to be similar to rates published between the 1970s and 1990s. Rodgers et al. (2008) reported a combined production rate for 21 north and central Florida colonies from 2003 to 2005 of 1.19 ± 0.09 fledglings per nest attempt (n=4,855 nests). Bryan and Robinette (2008) reported rates of 2.3 and 1.6 fledged young per nesting attempt for South Carolina and Georgia in 2004 and 2005. Murphy and Coker (2008) report since listing, South Carolina colonies averaged 2.08 young per successful nest with a range of 1.72 to 2.73. The Palm Beach County Solid Waste Authority colony (M. Morrison, PBC, personal communication 2008) was documented with 0.86 fledglings per nesting attempt (2003 to 2008) with annual rates ranging from 0.25 to 1.49.

Rodgers and Schwikert (1997) reported on the breeding chronology of 21 north and central Florida wood stork colonies for the years 1981 to 1985. They found wood storks produced an average of 1.29 fledglings per nest and 0.42 fledglings per egg, which is a probability of survivorship from egg laying to fledgling of 42 percent (Rodgers and Schwikert 1997). The probability of survivorship from egg laying until day 14 is 80 percent, to day 28 (hatching) is 70 percent, to day 42 (nestling 2 weeks of age) is 62 percent, to day 56 (nestling 4 weeks of age) is 56 percent, to day 70 (nestling 6 weeks) is 50 percent, and until day 84 (fledgling) is 42 percent.

The greatest losses occur from egg laying to hatching with a 30 percent loss of the nest production. From hatching to nestlings of 2 weeks of age, nest production loss is an additional 8 percent. Corresponding losses for the remainder of the nesting cycles are on the average of a 6 percent loss per 2 week increase in age of the nestling (Rodgers and Schwikert 1997).

During the period when a nesting colony is active, storks are dependent on consistent foraging opportunities in wetlands within about 20 to 30 km of the nest site (Kahl 1964 and Coulter and Bryan 1993) with the greatest energy demands occurring during the middle of the nestling period, when nestlings are 23 to 45 days old (Kahl 1964). The average wood stork family requires 201 kg (443 pounds) of fish during the breeding season, with 50 percent of the nestling stork's food requirement occurring during the middle third of the nestling period (Kahl 1964). Receding water levels are necessary in south Florida to concentrate suitable densities of forage fish (Kahl 1964, Kushlan et al. 1975).

Fleming et al. (1994) as well as Ceilley and Bortone (2000) believe the short hydroperiod wetlands in south Florida provide a more important pre-nesting foraging food source and a greater effect on early nestling survival for wood storks than the foraging base (grams of fish per square meter) that is suggested in short hydroperiod wetlands. For instance, for foraging sites in the Everglades, Loftus and Eklund (1994) provided an estimate of 50 fish per square meter for long hydroperiod wetlands and 10 fish per square meter 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 as a result 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 in 2 weeks) (Rodgers and Schwikert 1997).

Based on Kahl's (1964) estimate that 201 kg are needed for the success of a nest and 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 about 50 kg are needed to meet the foraging needs of the adults and nestling in the first third of the nesting cycle. Considering the relatively low habitat foraging values these short hydroperiod wetlands provide in relationship to corresponding long hydroperiod wetlands, 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 over drainage 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 502 g (live weight) 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 from the nesting colony. Fledglings have relatively high mortality rates within the first 6 months following fledging, most likely because 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 far beyond Florida into Georgia, Alabama, Mississippi, and South Carolina (Coulter et al. 1999; Borkhataria et al. 2004; Borkhataria et al. 2006b). 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.

Adult and juvenile storks return southward in the late fall and early winter months. In a study employing satellite telemetry, Borkhataria et al. (2006b) reported nearly all storks that had been tagged in the southeastern U.S. 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). Range wide occurrence of wood storks in December, recorded during the 1995 to 2008 Audubon Society Christmas Bird Counts for the Southeast U.S. (Audubon 2008) suggests 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 2007). As a result 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 significant 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 wide 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 and a low of 2,500 pairs during a severe drought conditions in 1978 (49 FR 7332). The total number of nesting pairs in 1995 was 7,853 with 11 percent in South Carolina, 19 percent in Georgia, and 70 percent in Florida (Service 1997). However, nesting data from 1981 to 2009 suggest that the wood stork population in the southeastern United States appears to be increasing (Table 1). Population totals indicate the stork population has reached its highest level since it was listed as endangered in 1984. More than 12,700 wood stork pairs nested within their breeding range in the southeastern United States in 2009 (Service, 2010). The nesting and colony data (Table 2) show increases in both the number of nests and the number of colonies, with the greatest increases in both nests and colonies in Georgia, South Carolina, and North Carolina. Recent data also show a decrease in the average size of colonies (Frederick and Meyer 2008). The Florida nesting population appears to fluctuate yearly and vary around a 3-year running average of 54 colonies and 4,273 nests (data through 2009). All south Florida colonies have been continuously monitored since listing and, south Florida nesting data show a significant drop in nesting pairs from 2,648 in 2006 to 696 in 2007, 344 in 2008, and 5,816 in 2009 (Cook and Herring 2007, Cook and Kobza 2008, 2009) (Table 8). Researchers attribute this drop to the severe drought conditions present in south Florida during the nesting periods.

However, 2009 nesting data for Corkscrew Rookery noted 1,120 nests producing 2,570 nestlings (Audubon 2009). Similar rebounds in nest production were recorded for other south Florida rookeries as well with probably the largest number of nest starts since 2004 (South Florida Wading Bird Report [Cook and Kobza 2009]}. Nests starts were estimated to be approximately 3,000 nests throughout the WCAs and the Tamiami West colony (District 2009). Data reported by Cook and Kobza (2009) noted approximately 6,452 nests in south Florida during the 2009 breeding season. The final nest count was 5,816 nests in 2009 for south Florida (Service 2010). Data reports from rookeries in north Florida and Georgia also noted record numbers of wood stork nests (GDNR 2009, W.B. Brooks, Service, personal communication 2009).

A review of the historic data show that, since the 1960s, the wood stork population 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). The number of nesting pairs in northern and central Florida doubled between 1976 and 1986 (Ogden 1991). Although Ogden (1991) attributed this to an increase in the availability of altered wetland and artificial wetland nesting sites, the regional increase coincided with the northward shift of the wood stork breeding population center and the overall population decline in the southeastern United States.

Between 1958 and 1985, the wood stork breeding population center shifted north from Lake Okeechobee to Polk County, a distance of about 132 km (82 miles) (Ogden et al. 1987). The 1976 breeding season was the last year when more pairs nested in south Florida than in central and north Florida. Production 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 and 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 wetlands and food was abundant. The implication is that food resources may be limiting colony sizes in central-north Florida (Ogden et al. 1987). 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 and north Florida that compound population growth in that area.

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). Traditional colony nesting sites may be abandoned completely by storks 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. 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 is found from northern Argentina, eastern Peru and western Ecuador north to Central America, Mexico, Cuba, Hispaniola, and the southeastern United States (AOU 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 is known to occur in Florida, Georgia, South Carolina, and North Carolina. Breeding colonies of wood storks are currently documented 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 (Service 2007).

The decline that led to listing in the United States population of the wood storks 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 (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. Ogden and Nesbitt (1979) also suggest changes in remaining wetland systems in Florida, including drainage and impoundment, may be a larger concern for wood storks than loss of foraging habitat.

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) and 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 sawgrass marshes) and found these south Florida wetland habitat types have been reduced by about 35 percent since 1900.

The alteration of wetlands and the manipulation of wetland hydroperiods to suit human needs have also reduced the amount of 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 may decrease food production 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 utilize, while still supporting smaller prey fish. Water level manipulation can also facilitate 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.

During the 1970s and 1980s, 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 increased from about 10 percent of all nesting pairs from 1959 to 1960 to 60 to 82 percent during 1976 to 1986 (Ogden 1991). Nest trees in these artificially impounded sites often include exotic species such as Brazilian pepper or Australian pine. 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 effect 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 production 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.

Recovery goals

Methods to measure the biological aspect of the recovery of the wood stork are outlined in the Service's recovery plan (1997). The plan's recovery criteria state that reclassification, from endangered to threatened, could be considered when there are 6,000 nesting pairs and annual regional production is greater than 1.5 chicks per nest/year (both calculated over a 3-year average). Delisting could be considered when there are 10,000 nesting pairs calculated over a 5-year period beginning at the time of reclassification and annual regional production is greater than 1.5 chicks per nest/year (calculated over a 5-year average). As a subset of the 10,000 nesting pairs, a minimum of 2,500 nesting pairs must occur in the Everglades and Big Cypress systems in south Florida. In 2001, the Service reinitiated another 5-year synoptic aerial survey effort for wood stork colonies throughout the southeast range of the species (Service 2003), and surveys have been conducted annually through 2006. Three-year averages calculated from nesting data from 2001 through 2006 indicate that the total nesting population has been consistently above the 6,000 threshold, and the averages have ranged from about 7,400 to over 8,700 during this time period.

Wood Stork nesting

Southeastern United States: Population totals for the southeast U.S. indicate the wood stork has reached its highest level since it was listed as endangered in 1984 (Service 2010) (Table 1). In 2009, an estimated 12,720 wood stork pairs nested within their breeding range in the southeastern U.S. Corresponding data in 2010 recorded 8,141 nests, a 36 percent reduction from 2009, although colonies increased from 86 in 2009 to 94 in 2010.

New colonies and increases in nesting wood storks were recorded in 2008 and 2010 in Georgia and South Carolina, with a nesting increase from 1,676 to 2,708 in Georgia colonies and 134 to and 220 in South Carolina colonies. The number of rookeries in Georgia also increased from 19 to 28 (Service 2010a). Wood stork nesting was recorded in North Carolina every year from

2006 through 2010, after it was first documented there in 2005. The above data continue to suggest the northward expansion of wood stork nesting.

Although the total number of colonies in Florida peaked at 63 in 2004 (Service 2010), which is the highest to date in any year, the number of colonies and nesting wood storks in Florida appears to fluctuate yearly and varies around 43 colonies and 4,540 nests annually. Current nesting data for the wood stork population in Florida show reduced population numbers in 2007, 2008, and 2010, with an increase in 2009 for most nests monitored. Significant reductions in nest production in 2007, 2008, and 2010 in the south Florida rookeries were reported. The 2007 and 2008 reductions were likely due to severe drought conditions (Cook and Herring 2007, Cook and Kobza 2008) and the reduction in the 2010 was attributed to a series of south Florida cold fronts resulting in higher water stages than average and generally poor foraging conditions for the remainder of the breeding season (Cook and Kobza 2010).

Everglades and Big Cypress Systems: The *South Florida Multi-Species Recovery Plan* (MSRP) (Service 1999) defines the Everglades and Big Cypress systems as the region south of Lake Okeechobee from Lee County on the west coast to Palm Beach County on the East Coast. Total nesting pairs for colonies in this region have been variable, but have shown a general pattern of decline (Crozier and Gawlik 2003, Service 2003, Crozier and Cook 2004, Cook and Call 2005). However, in a review of the 10-year nesting data (Figure 14), wood stork nesting success increased from the mid-1990s (an average of 400 to 500 pairs) to a high of 6,452 pairs in 2009 (Cook and Kobza 2009). In 2010, wood stork nesting started relatively early but was very much reduced (81percent) relative to the record numbers of nests in 2009 and most colonies eventually failed. The 2010 productivity in the South Florida colonies was estimated at 1,282 nests associated with 13 colonies (Cook and Kobza 2010).

In 2006, the largest wood stork rookery complex in the U.S., the Corkscrew Sanctuary rookeries, with optimal foraging conditions in the watersheds, yielded high nesting success (600 nests, 1,428 chicks). The 2-year drought that followed in 2007 and 2008 resulted in no nesting (Cook and Herring 2007, Cook and Kobza 2008). However, optimal foraging conditions in 2009 resulted in the development of 1,120 nests, producing 2,570 nestlings (Audubon 2009). Nesting data in 2010, (Cook and Kobza 2010) noted the Corkscrew and Caloosahatchee East colonies produced no successful nests and the Lenore Island and Barron Collier 29 rookeries produced 44 nests. Cook and Kobza (2010) suggest the reduced nests productivity in the 2010 nesting year were attributed to a series of south Florida cold fronts produced freezing weather, large rain events and associated water level reversals. These weather systems resulted in higher water stages than average and generally poor foraging conditions for the remainder of the breeding season and may also be applicable to the Corkscrew Sanctuary rookeries.

ENVIRONMENTAL BASELINE

The environmental baseline includes the effects of past and ongoing human and natural factors leading to current status of the species and their habitats.

Status of the species within the action area

Current nesting data for the wood stork population in Florida show reduced population numbers in 2007, 2008, and 2010, with an increase in 2009 for most nests monitored. Significant reductions in nest production in 2007, 2008, and 2010 in the south Florida rookeries were reported. The 2007 and 2008 reductions were likely due to severe drought conditions (Cook and Herring 2007, Cook and Kobza 2008) and the reduction in 2010 was attributed to a series of south Florida cold fronts resulting in higher water stages than average and generally poor foraging conditions for the remainder of the breeding season (Cook and Kobza 2010). The 2010 productivity in the South Florida colonies was estimated at 1,282 nests associated with 13 colonies (Cook and Kobza 2010).

No critical habitat has been designated for the wood stork.

Factors affecting species environment within the action area

Within the action area, significant urban development has occurred, especially around major metropolitan centers such as Miami, Fort Lauderdale, West Palm Beach, Orlando, and Naples. Other anthropogenic activities, such as roadways, agriculture, industry, and residential development have resulted in habitat destruction, degradation, and fragmentation in south Florida, especially along the coast. In addition, water levels have been stabilized, many areas have been drained to improve agricultural production and allow for development, fire has been suppressed, and exotics have invaded resulting in further habitat alteration and degradation. These activities and the resulting habitat changes are responsible for the past and current status of the wood stork.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities. All activities authorized by the Service under section 10(a)(1)(A) of the Act must meet permit issuance criteria at 50 CFR 17.22 and 17.32. All activities considered must be justified in relation to enhancement of survival and recovery, effects to the wildlife species, peer review, and qualifications of permittees. By definition, authorized activities should benefit species recovery with minimal adverse effects by qualified permittees.

Factors to be considered

Recent nesting wading bird studies suggest that species such as the wood stork may be able to shift their diets dramatically from year-to-year in response to changing prey communities and hydrologic patterns. However, the last study conducted specifically on wood stork dietary preferences occurred in 1976. The proposed research is designed to determine the current type and size of prey species fed on by wood storks, as well as temporal trends in prey taken during the breeding season.

Analysis for effects of the action

Beneficial Effects – Results of this research will help assess if the wood stork is able to shift dietary preferences dramatically from year-to-year in response to changing prey communities and hydrologic patterns. These studies may help to gauge if hydrologic changes from ecosystem restoration or management will affect the species.
Adverse Effects – Handling and monitoring of wood stork nestlings may result in incidental harassment, injury or death of individuals. While injury or mortality is uncommon with proper training or experience in handling of birds, the potential for such injuries or deaths remains.

Species' response to the proposed action

Although the Applicant does not anticipate any injury or mortality of wood stork nestlings, the handling, bolus collection, and monitoring may result in injury or mortality of some individuals.

The Applicant has 30 years of field research, including the handling and monitoring of wood storks and other wading birds, without incident. Only personnel trained to safely remove wading birds from nests, properly handle wood stork nestlings, and collect bolus samples will be allowed to assist in this research. Therefore, few adverse impacts are anticipated to occur as a result of this research. The expected benefit of the proposed research is that it will ultimately aid in the recovery of the wood stork.

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 require separate consultation pursuant to section 7 of the Act.

Because nearly the entire action area occurs within publicly-owned land, actions resulting in cumulative effects are unlikely. Management activities within ENP and WCA3 are conservation-oriented. The Service is not aware of any State, local, or private activities that are reasonably certain to occur within the action area that would adversely affect the wood stork.

SUMMARY OF EFFECTS

Although short-term and permanent minimal adverse effects may occur, this type of effect is uncommon during research activities, especially given the nature of the techniques proposed and experience of the Applicant. The proposed studies are designed to determine the current type and size of prey species fed on by wood storks, as well as temporal trends in prey taken during the breeding season. These studies may help to gauge if hydrologic changes from ecosystem restoration or management will affect the species. The net effect of the research is beneficial.

CONCLUSION

After reviewing the status of the 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 the issuance of a recovery permit to conduct research, as proposed, is not likely to jeopardize the continued existence of the species. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 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 of 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 Service so 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 Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service (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 Applicant 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

The Service anticipates the proposed action will result in unintentional injury and mortality to wood stork nestlings during handling, bolus collection, and monitoring. Handling, bolus collection, and monitoring associated with this research may result in the injury or death of up to one wood stork nestling per year. Incidental take is expected to be in the form of kill or harass.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 7 03-712), 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 this level of anticipated take is not likely to result in jeopardy to the species. Because critical habitat has not been designated, destruction or adverse modification of critical habitat will not result.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of wood stork nestlings:

1. The Applicant and designated agents must be qualified to carry out the activities described in the Biological Opinion.

2. All reports shall be submitted to the FWC and Service.

3. State and Federal agencies shall be notified immediately upon locating a dead, injured, or sick wood stork nestling.

4. Permittee must cease all activities if take in the form of injury or mortality occurs.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 if the Act, the Service 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 non-discretionary:

(1) The Service shall require the Applicant and designated agents acting on behalf of the Applicant to furnish resumes or summary of qualifications demonstrating their ability to safely conduct the proposed research. Only those individuals who can demonstrate they have sufficient experience and training with wood stork nestlings will be permitted to conduct the proposed research.

(2) The Service shall specify annual reporting requirements in the permit. Those reporting requirements that are normally outlined in the section 10(a)(1)(A) permit will satisfy the reporting/monitoring requirements pursuant to section 7 of the Act and its implementing regulations.

(3) The Service shall include the following condition in the permit: Upon locating a dead, injured, or sick specimen, initial notification must be made within 24 hours 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 FWC, South Region (3900 Drane Field Road; Lakeland, Florida 33811-1299; 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 evidence intrinsic to the specimen is not unnecessarily disturbed.

(4) Permittee and designated agents acting on behalf of the permittee will be conditioned to immediately cease all activities if an individual wood stork nestling is injured or killed due

to handling and to report any such injury or mortality to the Service (Field Supervisor, South Florida Ecological Services Office; 1339 20th Street; Vero Beach, FL 32960; 772-562-3909; and Permit Coordinator; 1875 Century Boulevard, Suite 200; Atlanta, Georgia 30345-3301; 404-679-4176).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize 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.

In order 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 this action as outlined in the request. As required by 50 CFR 402.16, reinitiation of formal consultation is required if:

1. The amount or extent of incidental take is exceeded;
2. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
3. The action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or
4. 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.

If you have any questions, please contact Elizabeth Landrum at 772-469-4304.

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Table 1. Wood Stork Nesting Data in the Southeastern U.S. (Gawlik 1987, Service 2009)

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	5,835	36	5,067	29	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	5,166	59	2,870	36	1,379	15	917	8		
1998			**		1,665	15	1,093	10		
1999	9,978	71	7341	42	1,139	13	520	8		
2000			**		566	7	1,236	11		
2001	5,582	44	3,246	23	1,162	12	1,174	9		
2002	7,855	70	5,463	46	1,256	14	1,136	10		
2003	8,813	78	5,804	49	1,653	18	1,356	11		
2004	8,379	93	4,726	63	1,596	17	2,034	13		
2005	5,572	73	2,304	40	1,817	19	1,407	14	32	1
2006	11,279	82	7,216	47	1,928	21	1,963	12	132	1
2007	4,406	55	1,553	25	1,054	15	1,607	14	192	1
2008	6,118	73	1,838	31	2,292	24	1,839	16	149	1
2009	12,720	86	9,428	54	1,676	19	1,482	12	134	1

**Some data from Florida not readily available due to inconsistent survey or reporting.

Table 2. Total Number of Wood Stork Nesting Pairs within the Everglades and Big Cypress Basins, 1996 to Present

Year	Nesting Pairs	Colonies	3-Year Running Average	
			Nesting Pairs	Colonies
1996	1,215	1	--	--
1997	445	4	--	--
1998	478	3	713	3
1999	2,674	16	1,199	8
2000	3,996	8	2,383	9
2001	2,888	9	3,186	11
2002	3,463	11	3,449	9
2003	1,747	9	2,669	10
2004	1,485	9	2,232	10
2005	591	3	1,274	7
2006	2,648	9	1,575	7
2007	696	7	1,312	6
2008	344	4	1,229	7
2009	5,816	25	2,285	12