APPENDIX 10.7.1

ECOLOGY

BIOLOGICAL ASSESSMENT REPORT

Florida Power & Light Company

Lauderdale Plant Combustion Turbine Project

REPORT

Submitted For:

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133-87588

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1.0 INTRODUCTION

Florida Power & Light Company (FPL) is proposing to replace 24 simple cycle gas turbines at their Lauderdale Plant (Plant) and an additional 12 simple cycle gas turbines at nearby Port Everglades Plant with five simple cycle combustion turbines to be installed at the Lauderdale Plant (the Project). Pursuant to the Clean Air Act, approval to conduct these activities requires submittal of an Air Construction Permit/Prevention of Significant Deterioration (PSD) Application to the United States Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP). An application is being filed for the purpose of obtaining an air construction/PSD permit for the Project in accordance with FDEP's federally approved major source air construction permit program under Florida's federally required State Implementation Plan. A separate application is submitted to EPA Region 4 for PSD review and approval of greenhouse gas (GHG) emissions. As part of EPA's review, the U.S. Fish and Wildlife Service (USFWS) is consulted to evaluate the potential for federally threatened or endangered species to be affected by the proposed project, in accordance with Section 7 of the Endangered Species Act.

This Biological Assessment report provides supporting information regarding the existing ecological resources within the Project area, description of proposed impacts resulting from construction of the project, and potential for federally threatened and endangered species to be affected by the proposed project. The evaluation was conducted through a combination of site surveys on July 15 and August 15-16, 2013 and desktop analysis utilizing a variety of data sources, including USFWS and Florida Fish and Wildlife Conservation Commission (FWC) literature and databases, the Florida Natural Areas Inventory (FNAI) database of documented threatened and endangered species occurrences, South Florida Water Management District landuse/landcover data, and the Natural Resources Conservation Service (NRCS) soil survey of Broward County.

2.0 PROJECT AREA EXISTING CONDITIONS

2.1 Location

The FPL Lauderdale Plant is located east of U.S. Highway 441, north of Griffin Road, west of SW 30th Avenue, and south of Interstate 595 in Dania Beach, Broward County, Florida (Figure 1). The approximately 392-acre Plant is surrounded by industrial, commercial, and residential areas, along with several major thoroughfares. The only undeveloped natural environment in the vicinity of the Plant is Pond Apple Slough, located just north of the Plant. Other significant nearby features include the Ft. Lauderdale-Hollywood International Airport located less than two miles to the east, Port Everglades located less than five miles to the northeast, the South New River Canal directly adjacent to the north, and the Dania Cutoff Canal to the south. Additionally, several heavily utilized highways and interstates (i.e. the Florida Turnpike and Interstates 95 and 595) are all located within two miles of the Plant.

The Project area (Figure 2) comprises approximately 20 acres in the northern portion of the existing Plant site, within Section 30, Township 50 South, Range 42 East, and includes the approximately 6-acre north gas turbine site containing 12 gas turbines as well as approximately 14 acres of surrounding forested wetlands and upland spoil piles.

2.2 Soils

According to the NRCS Soil Survey of Broward County, the Project area is dominated by Okeelanta muck, with Udorthents, shaped as a minor association.

The Okeelanta series consists of very deep, very poorly drained, rapidly permeable soils in large fresh water marshes and small depressional areas. They formed in decomposed hydrophytic non-woody organic material overlying sand. Slopes range from zero to two percent. In un-drained areas the water table is at depths of less than ten inches below the surface or the soil is covered by water 6 to 12 months during most years. Areas of Okeelanta muck within the Project area support a mixed native and exotic hardwood wetland community.

The Udorthents, shaped series consists of a mixture of somewhat poorly drained to moderately well drained soil and geologic soil materials which have been shaped and contoured mainly for golf courses and highways. It consists primarily of limestone fragments and sand. Slopes are nearly level to gently sloping, but can be steep on the short side slopes of highway interchanges. Areas underlain by Udorthents within the Project area are primarily upland spoil piles dominated by exotic hardwood species.

2.3 Habitat Classification

Figure 2 illustrates the vegetative habitats and land uses present within and surrounding the Project area based on the Florida Land Use, Cover and Forms Classification System (FLUCFCS). Vegetative communities within the Project area are dominated by a mixture of native and exotic hardwood wetlands, with additional areas comprised of the existing developed gas turbine site and areas of upland spoil piles. Dominant vegetative species within the Project area are described below. Areas to the east and north of the Project area include parcels of mixed wetland hardwoods and sawgrass marsh preserved for wetland mitigation, while areas south of the Project area include the existing Plant, transmission line rights-of-way, exotic wetland hardwoods, and mangrove wetlands adjacent to the Plant's discharge canal.

2.3.1 Vegetative Community Composition

The forested wetlands within the Project area consist of a combination of native and nuisance exotic species. The dense canopy layer is dominated by the exotic species Australian pine (*Casuarina equisetifolia*) and melaleuca (*Melaleuca quinquenervia*), as well as the native species pond apple (*Annona glabra*) and red maple (*Acer rubrum*). The understory/shrub layer is dominated by the nuisance exotic species Brazilian pepper (*Schinus terebinthifolius*), with a variety of subdominant species including

Carolina willow (*Salix caroliniana*), myrsine (*Myrsine cubana*), wax myrtle (*Myrica cerifera*), dahoon holly (*Ilex cassine*), coco plum (*Chrysobalanus icaco*), and the exotic species shoebutton ardisia (*Ardisia elliptic*a). The groundcover consists of a variety of mainly native species such as swamp fern (*Blechnum serrulatum*), royal fern (*Osmunda regalis*), and sawgrass (*Cladium jamaicense*).

Vegetation in the upland spoil pile area to the west of the existing is dominated by the invasive exotic species Australian pine, which has formed a dense monoculture and inhibited groundcover and shrub layer vegetation by creating a thick mat of needles, suppressing growth of native species in these vegetative layers. The understory/shrub layer is dominated by the nuisance exotic species Brazilian pepper and shoebutton ardisia. The sparse groundcover vegetation is primarily comprised of non-native species such as wandering-jew (*Tradescantia zebrina*).

2.4 Impacts of Construction

The proposed replacement of the 36 existing gas turbines with five more efficient simple cycle combustion turbines will require permanent impact to approximately 13 acres of native and exotic forested wetlands and one acre of spoil piles dominated by exotic upland hardwoods surrounding the approximately six-acre existing north gas turbine area. In accordance with the USACE's Section 404 guidance, wetland impacts have been minimized through reduction of the Project footprint and utilization of existing developed areas, uplands, and disturbed wetlands to the greatest extent practicable. All unavoidable wetland impacts will be fully mitigated to replace the loss of wetland functions through on or off-site wetland enhancement, restoration, and/or preservation activities.

3.0 THREATENED AND ENDANGERED SPECIES

3.1 Background and Desktop Analysis

The probability of federally-listed species occurrence within the Project area was evaluated based upon the habitat preferences of listed species known to occur within Broward County, a field assessment for the presence of suitable habitat within the Project area, and the FNAI GIS database of documented listed species occurrences. Listed flora are those plant species that are classified as threatened, endangered, or candidates for listing by the USFWS. Listed fauna are those animal species classified as threatened, endangered, or candidates for listing by the USFWS under 50 Code of Federal Regulations (CFR) 17. Table 1 summarizes the federally listed species known to occur in Broward County, their preferred habitats, likelihood of occurrence within the Project area, and potential for adverse impact resulting from the Project.

Although no longer classified as threatened or endangered, the proximity of bald eagle (*Haliaeetus leucocephalus*) nests to the Project area was evaluated using the FWC bald eagle nest database. The FWC database is current through the 2011-2012 nesting season. No documented bald eagle nests were

located within 660 feet of the Project area. The closest documented nest (BO002) is approximately 15 miles southwest of the Project area. In addition, wading bird rookery and nest colony records were researched using the FWC wading bird rookery and nest colony locator. The closest wood stork (*Mycteria americana*) colony (unnamed) is located approximately 10.5 miles from the Project Area. The closest named colony (Colony #2B Melaleuca) is located approximately 10.9 miles from the Project area (Figure 3).

3.2 Field Assessment

The Project area is dominated by forested wetlands with a relatively dense, closed canopy of exotic and native species. Upland areas are limited to the existing north gas turbine area and adjacent upland spoil piles supporting the exotic species Australian pine. Based upon the presence of potentially suitable habitat, the focal species for the field assessment consisted of wetland dependent species such as the mangrove rivulus (*Rivulus marmoratus*), American alligator (*Alligator mississippiensis*), American crocodile (*Crocodylus acutus*), and wood stork (*Mycteria americana*). In addition, the upland spoil piles within the Project area were evaluated for the potential presence of gopher tortoises (*Gopherus polyphemus*) or Eastern indigo snakes (*Drymarchon couperi*).

Larger fauna with wide ranges and varied habitat needs such as the Florida panther (*Puma concolor coryi*) are unlikely to utilize the Project area due to its location within an active power plant and the surrounding regional urban landscape. Due to lack of suitable marine, beach, or riverine habitat within the Project area, the West Indian manatee (*Trichechus manatus*), piping plover (*Charadrius melodus*), or sea turtles are not likely to be present. Similarly, due to lack of pine rockland, scrub, or maritime hammock habitat within the Project area, it is highly unlikely that the endangered plant species beach jacquemontia (*Jacquemontia reclinata*) or tiny polygala (*Polygala smallii*) would occur. It is also highly unlikely that the Florida scrub-jay (*Aphelocoma coerulescens*) or crested caracara (*Caracara cheriway*) would occur within the Project area due to the lack of suitable xeric oak scrub or open pastures with scattered cabbage palm/live oak hammocks within the Project area.

Pedestrian and vehicular surveys were conducted throughout the Project area to determine the presence of listed species based on direct observation, calls, tracks, scat, or burrows. The surveys were conducted during daylight hours at times when it was more likely to observe species or note signs of their presence (i.e. tracks, scat, markings). Throughout the survey area, the vegetative composition of the habitats was assessed to determine if they support full or partial life-cycle needs of the species with the potential to utilize the habitat. Table 1 summarizes the federally listed species known to occur in Broward County, their preferred habitats, likelihood of occurrence within the Project area, and potential for adverse impact resulting from the Project. Attachment A provides species descriptions.

3.3 Field Assessment Results

No federally listed flora or fauna were identified during the pedestrian and vehicular transects conducted within the Project area on July 15 and August 15-16, 2013. Additionally, no signs of any federally listed species were observed which would indicate utilization of the Project area. No indications of nesting activity or burrows were observed within the Project area. Listed species utilization of the Project area for foraging, roosting, or breeding is limited due to the surrounding industrial, commercial, and residential development, as well as the proximity of the Ft. Lauderdale-Hollywood International Airport and the location of the Project area immediately within the flight path of large commercial passenger airplanes, resulting in significant and regular noise disturbance.

The closed canopy and lack of open surface water features or marshes reduces the habitat suitability of forested wetlands within the Project area for wood stork, American crocodile, American alligator, or the snail kite. The upland spoil piles do not provide desirable substrate conditions (sandy soils, water table depth several feet below ground surface) preferred by gopher tortoises. The forested wetlands within the Project area are freshwater systems, which are not preferred habitat for the mangrove rivulus. The distribution of mangrove rivulus is closely tied to the presence of mangroves (Taylor, 1999; Taylor et al., 2008), with its preferred microhabitat on the east coast of Florida being burrows of the land crab (*Cardisoma* sp.) (NMFS, 2009). Based in part on results of recent studies (McIvor and Silverman, 2010), the FWC's Biological Status Review for the Mangrove Rivulus (2011) recommends the mangrove rivulus be removed from the state species of special concern list. Due to lack of documented observations within the Project area, lack of preferred habitat, and recent data indicating a relatively stable population within the species' range, the potential for adverse impact to the mangrove rivulus resulting from the Project is minimal.

Several exotic wildlife species were observed within or immediately surrounding the Project area, including green iguana (*Iguana iguana*), brown basilisk (*Basiliscus vittatus*), and Cuban brown anole (*Anolis sagrei*). Other non-listed species observed within or immediately surrounding the Project area include green tree frog (*Hyla cinera*), anhinga (*Anhinga anhinga*), green heron (*Butorides virescens*), mourning dove (*Zenaida macroura*), Eurasian-collared dove (*Streptopelia decaocto*), pileated woodpecker (*Dryocopus pileatus*), northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), chimney swift (*Chaetura pelagica*), Carolina wren (*Thryothorus ludovicianus*), starling (*Sturnus vulgaris*), and raccoon (*Procyon lotor*).

The USFWS/U.S. Army Corps of Engineers programmatic effect determination keys for the Eastern indigo snake (2013) and wood stork (2010) (Attachment B) were utilized to further assess the likelihood of the Project resulting in adverse effects to these species. In the case of the wood stork, a determination of "no effect" is indicated, while in the case of the Eastern indigo snake, a determination of "may affect, not likely to adversely affect" (NLAA) is indicated.

With respect to the Eastern indigo snake, the NLAA determination is supported by the adherence to the USFWS Standard Protection Measures for the Eastern Indigo Snake during site preparation and construction, and the lack of gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured during project activities.

The completed Eastern indigo snake effect determination key for the Project is provided below:

FPL Lauderdale Combustion Turbine Project
Eastern Indigo Snake Effect Determination Key

A	Project is not located in open water or salt marsh	**Go to B**	**X**
	Project is located solely in open water or salt marsh	"no effect"[1]	
B	Permit will be conditioned for use of the Service's *Standard Protection Measures for the Eastern Indigo Snake* during site preparation and project construction	**Go to C**	**X**
	Permit will not be conditioned as above for the eastern indigo snake, or it is not known whether an applicant intends to use these measures and consultation with the Service is requested[2]	"may affect"	
C	There are gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured during project activities	**Go to D**	
	There are no gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured during project activities	"not likely to adversely affect (NLAA)" [1]	**X**
D	The project will impact less than 25 acres of xeric habitat supporting less than 25 active and inactive gopher tortoise burrows	**Go to E**	
	The project will impact more than 25 acres of xeric habitat or more than 25 active and inactive gopher tortoise burrows and consultation with the Service is requested[2]	"may affect"	
E	Any permit will be conditioned such that all gopher tortoise burrows, active or inactive, will be evacuated prior to site manipulation in the vicinity of the burrow[3]. If an indigo snake is encountered, the snake must be allowed to vacate the area prior to additional site manipulation in the vicinity. Any permit will also be conditioned such that holes, cavities, and snake refugia other than gopher tortoise burrows will be inspected each morning before planned site manipulation of a particular area, and, if occupied by an indigo snake, no work will commence until the snake has vacated the vicinity of proposed work.	**"NLAA"** [1]	
	Permit will not be conditioned as outlined above and consultation with the Service is requested[2]	"may affect"	

[1] With an outcome of "no effect" or "NLAA" as outlined in this key, the requirements of Section 7 of the Act are fulfilled for the Eastern indigo snake and no further action is required.

[2] Consultation may be concluded informally or formally depending on project impacts.

[3] If burrow excavation is utilized, it should be performed by experienced personnel. The method used should minimize the potential for injury of an indigo snake. Applicants should follow the excavation guidance provided within the Florida Fish and Wildlife Conservation Commission's revised April 2009 Gopher Tortoise Permitting Guidelines located at http://myfwc.com/License/Permits_ProtectedWildlife.htm#gophertortoise. A member of the excavation team should be authorized for Incidental Take during excavation through an incidental take permit issued by the Florida Fish and Wildlife Conservation Commission.

The USFWS and the FWC consider the area within 18.6 miles (30 km) of a wood stork nesting colony as the Core Foraging Area (CFA) for wood storks (DOI, 2010a, 2010b). The USFWS believes loss of suitable wetlands within these CFAs may reduce foraging opportunities for the wood stork. Impacts to wetlands within a CFA that provide suitable foraging habitat for the wood stork must be compensated through provision of mitigation that provides for equal or greater wood stork foraging habitat value.

Although the Project is located within the CFA of two wood stork colonies (unnamed colony and Colony 2B Melaleuca), the "no effect" determination is supported by the lack of impacts to suitable foraging habitat associated with the Project. Typical foraging sites for the wood stork include freshwater marshes and stock ponds, shallow, seasonally flooded roadside and agricultural ditches, narrow tidal creeks and shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs (Ogden, 1990). Because of their specialized feeding behavior (tactile feeding), wood storks forage most effectively in shallow-water areas with highly concentrated prey; suitable foraging habitat includes wetlands that typically have shallow-open water areas that are relatively calm and have a permanent or seasonal water depth between 5 to 38 cm (2 to 15 inches). The densely forested wetlands within the Project area do not provide suitable foraging opportunities for wood stork.

The completed wood stork effect determination key for the Project is provided below:

FPL Lauderdale Combustion Turbine Project
Wood Stork Key

A	Project within 0.76 km (0.47 mile)[2] of an active colony site[3]	May effect[4]	
	Project impacts suitable foraging habitat (SFH)[5] at a location greater than 0.76 km (0.47 mile) from a colony site	**Go to B**	
	Project does not affect suitable foraging habitat (SFH)	No effect[1]	**X**
B	Project impact to SFH less than 0.20 hectare (one-half acre)[6]	NLAA[1]	
	Project impact to SFH is greater in scope than 0.20 hectare (one-half acre)	**Go to C**	
C	Project impacts to SFH not within the CFA (29.9 km, 18.6 miles) of a colony site	Go to D	
	Project impacts to SFH within the CFA of a colony site	**Go to E**	
D	Project impacts to SFH have been avoided and minimized to the extent practicable; compensation (Service approved mitigation bank or as provided in accordance with Mitigation Rule 33 CFR Part 332) for unavoidable impacts is proposed in accordance with the CWA section 404(b)(1) guidelines; and habitat compensation replaces the foraging value matching the hydroperiod[7] of the wetlands affected and provides foraging value similar to, or higher than, that of impacted wetlands. See Enclosure 3, *Wood Stork Foraging Analysis*, for a detailed discussion of the hydroperiod foraging values, an example, and further guidance[8]	NLAA	
	Project not as above	May affect[4]	
E	Project provides SFH compensation in accordance with the CWA section 404(b)(1) guidelines and is not contrary to the *Habitat Management Guidelines for the Wood Stork in the Southeast Region*; habitat compensation is within the appropriate CFA or within the	**NLAA**[1]	

	service area of a Service-approved mitigation bank; and habitat compensation replaces foraging value, consisting of wetland enhancement or restoration matching the hydroperiod[7] of the wetlands affected, and provides foraging value similar to, or higher than, that of impacted wetlands. See Enclosure 3, *Wood Stork Foraging Analysis*, for a detailed discussion of the hydroperiod foraging values, an example, and further guidance[8]		
	Project does not satisfy these elements	May effect[4]	

[1] With an outcome of "no effect" or "NLAA" as outlined in this key, and the project has less than 20.2 hectares (50 acres) of wetland impacts, the requirements of section 7 of the Act are fulfilled for the wood stork and no further action is required. For projects with greater than 20.2 hectares (50 acres) of wetland impacts, written concurrence of NLAA from the Service is necessary.

[2] Within the secondary zone (the average distance from the border of a colony to the limits of the secondary zone is 0.76 km (2,500 feet, or 0.47 mile).

[3] An active colony is defined as a colony that is currently being used for nesting by wood storks or has historically over the last 10 years been used for nesting by wood storks.

[4] Consultation may be concluded informally or formally depending on project impacts.

[5] Suitable foraging habitat (SFH) includes wetlands that typically have shallow-open water areas that are relatively calm and have a permanent or seasonal water depth between 5 to 38 cm (2 to 15 inches) deep. Other shallow non-wetland water bodies are also SFH. SFH supports and concentrates, or is capable of supporting and concentrating small fish, frogs, and other aquatic prey. Examples of SFH include, but are not limited to freshwater marshes, small ponds, shallow, seasonally flooded roadside or agricultural ditches, seasonally flooded pastures, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs.

[6] On an individual basis, SFH impacts to wetlands less than 0.20 hectare (one-half acre) generally will not have a measurable effect on wood storks, although we request that the Corps require mitigation for these losses when appropriate. Wood storks are a wide ranging species, and individually, habitat change from impacts to SFH less than one-half acre are not likely to adversely affect wood storks. However, collectively they may have an effect and therefore regular monitoring and reporting of these effects are important.

[7] Several researchers (Fleming 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 early nestling survivor value for wood storks than the foraging base (grams of fish per square meter) than long hydroperiod wetlands provide. Although the short hydroperiod wetlands may provide less fish, these prey bases historically were more extensive and met the foraging needs of the pre-nesting storks and the early-age nestlings. Nest productivity may suffer as a result of the loss of short hydroperiod wetlands. We believe that most wetland fill and excavation impacts permitted in south Florida are in short hydroperiod wetlands. Therefore, we believe that it is especially important that impacts to these short hydroperiod wetlands within CFAs are avoided, minimized, and compensated for by enhancement/restoration of short hydroperiod wetlands.

[8] For this Key, the Service requires an analysis of foraging prey base losses and enhancements from the proposed action as shown in the examples in Enclosure 3, Wood Stork Foraging Analysis, for projects with greater than 2.02 hectares (5 acres) of wetland impacts. For projects with less than 2.02 hectares (5 acres) of wetland impacts, an individual foraging prey base analysis is not necessary although type for type wetland compensation is still a requirement of the Key.

4.0 CONCLUSION

Based upon the field assessment conducted on July 15 and August 15-16, 2013, review of USFWS and FWC literature and databases, the FNAI database of documented listed species occurrences, and the lack of suitable habitat, federally listed species are not anticipated to utilize the Project area. The potential occurrence of listed flora and fauna within the Project area is limited due to the surrounding land uses (industrial, commercial, and residential areas, as well as Ft. Lauderdale-Hollywood International Airport), and lack of suitable habitat within and surrounding the Project area to support partial or full life-cycle requirements of federally listed species known to occur within Broward County. The USFWS programmatic effect determination key for the Eastern indigo snake indicates that the Project "may affect, but is not likely to adversely affect" the Eastern indigo snake, as the Project will comply with the USFWS Standard Protection Measures for the Eastern Indigo Snake during site preparation and no gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured are present within the Project area. Although the Project is located approximately 10.5 miles from an unnamed wood stork colony and approximately 10.9 miles from wood stork colony #2B Melalueca, a "no effect" determination is indicated in accordance with the USFWS programmatic effect determination key for the wood stork, as the proposed wetland impacts are not within areas suitable for wood stork foraging.

GOLDER ASSOCIATES INC.

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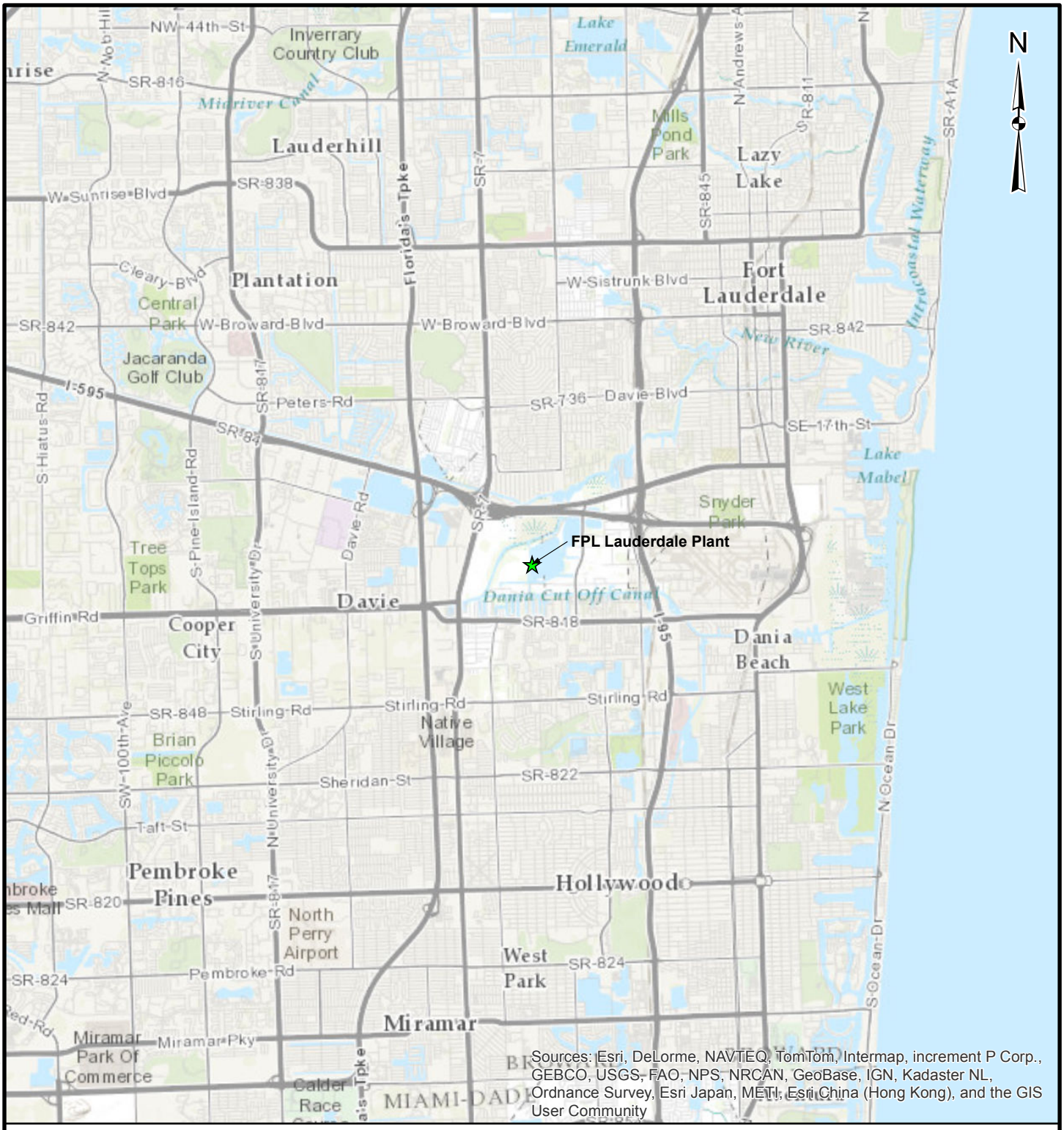
TABLES

TABLE 1 - FEDERALLY LISTED SPECIES KNOWN TO OCCUR IN BROWARD COUNTY, FL AND PROBABILITY OF OCCURRENCE WITHIN PROJECT AREA

Scientific Name	Common Name	Federal Status	Preferred Habitat*	Probability of Occurrence within Project Area	Potential Impact Resulting from Project
FISH					
Rivulus marmoratus	Mangrove Rivulus	Special Concern	Microhabitats of mangrove swamps including crab burrows, stagnant pools, intermittently dry sloughs or ditches, and fossorial niches inside or under logs, debris, leaf litter, etc. (NMFS 2009)	Low, suboptimal habitat within Project area	Not likely to affect
REPTILES					
Alligator mississippiensis	American Alligator	Threatened (Similarity of Appearance)	Most permanent bodies of fresh water, including marshes, swamps, lakes, and rivers. Occasionally wanders into brackish and saltwater but rarely remains there.	Low, due to dense canopy and lack of open surface waters within Project area	Not likely to affect
Caretta caretta	Loggerhead Sea Turtle	Threatened	Marine coastal and oceanic waters; nest on coastal sand beaches, often near the dune line, sufficiently high to avoid tidal inundation. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, and lagoons.	Unlikely, due to lack of suitable habitat	Not likely to affect
Chelonia mydas	Green Sea Turtle	Endangered	Estuarine and marine coastal and oceanic waters; nests on coastal sand beaches, often near dune line, sufficiently high to avoid tidal inundation. Large juveniles and adults feed on seagrasses and algae. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, lagoons, and offshore worm reefs.	Unlikely, due to lack of suitable habitat	Not likely to affect
Crocodylus acutus	American Crocodile	Threatened	Coastal estuarine marshes, tidal swamps, and creeks along edges of mainland and islands. Usually associated with mangroves. Nests on beaches, stream banks, and levees.	Unlikely, due to lack of suitable habitat	Not likely to affect
Dermochelys coriacea	Leatherback Sea Turtle	Endangered	Oceanic waters; nests on coastal sand beaches.	Unlikely, due to lack of suitable habitat	Not likely to affect
Drymarchon couperi	Eastern Indigo Snake	Threatened	Broad range of habitats, from scrub and sandhill to wet prairies and mangrove swamps.	Unlikely, due to lack of suitable habitat - no impact to xeric habitat, no gopher tortoise burrows or refugia	May affect, not likely to adversely affect
Eretmochelys imbricata	Hawksbill Sea Turtle	Endangered	Marine coastal and oceanic waters, commonly associated with coral reefs, keys, and mangroves. Nests on coastal sand beaches, often in vegetation.	Unlikely, due to lack of suitable habitat	Not likely to affect
Gopherus polyphemus	Gopher Tortoise	Candidate	Typically found in dry upland habitats, including sandhills, scrub, xeric oak hammock, and dry pine flatwoods; also commonly uses disturbed habitats such as pastures, oldfields, and road shoulders.	Unlikely, due to lack of suitable habitat	Not likely to affect
BIRDS					
Aphelocoma coerulescens	Florida Scrub-Jay	Threatened	Inhabits fire-dominated, low-growing, oak scrub habitat found on well-drained sandy soils. May persist in areas with sparser oaks or scrub areas that are overgrown, but at much lower densities and with reduced survivorship.	Unlikely, due to lack of suitable habitat	Not likely to affect
Caracara cheriway	Crested Caracara	Threatened	Open country, including dry prairie and pasture lands with cabbage palm, cabbage palm/live oak hammocks, and shallow ponds and sloughs. Preferred nest trees are cabbage palms, followed by live oaks.	Unlikely, due to lack of suitable habitat	Not likely to affect
Charadrius melodus	Piping Plover	Threatened	Found on open, sandy beaches and on tidal mudflats and sandflats along both coasts of Florida.	Unlikely, due to lack of suitable habitat	Not likely to affect
Mycteria americana	Wood Stork	Endangered	Nests colonially in a variety of inundated forested wetlands, including cypress strands and domes, mixed hardwood swamps, sloughs and mangroves. Increasingly nesting in artificial habitats (e.g., impoundments and dredged areas with native or exotic vegetation) in north and central Florida. Forages mainly in shallow water in freshwater marshes, swamps, lagoons, ponds, tidal creeks, flooded pastures and ditches, where they are attracted to falling water levels that concentrate food sources (mainly fish).	Moderate, although dense canopy reduces suitability of wetlands as foraging habitat	May affect, not likely to adversely affect
Rostrhamus sociabilis plumbeus	Snail Kite	Endangered	Large open freshwater marshes and lakes with shallow water, < 4 ft. (1.2 m) deep, and a low density of emergent vegetation are preferred foraging habitat. Dependent upon apple snails (*Pomacea paludosa*) caught at water surface. Nests usually over water in a low tree or shrub (commonly willow, wax myrtle, pond apple, or buttonbush, but also in non-woody vegetation like cattail or sawgrass).	Unlikely, due to lack of suitable habitat	Not likely to affect
MAMMALS					
Puma concolor coryi	Florida Panther	Endangered	Requires extensive blocks of mostly forested communities. Large wetlands that are generally inaccessible to humans are important for diurnal refuge. Will tolerate improved areas in a mosaic of natural communities.	Unlikely, due to lack of suitable habitat	Not likely to affect
Trichechus manatus	East Indian Manatee	Endangered	Coastal waters, bays, rivers, and (occasionally) lakes. Requires warm-water refugia such as springs or cooling effluent during cold weather. Sheltered coves are important for feeding, resting, and calving.	Unlikely, due to lack of suitable habitat	Not likely to affect
PLANTS					
Jacquemontia reclinata	Beach Jacquemontia	Endangered	Lee side of stable, vegetated dunes; disturbed openings in maritime hammock, coastal strand, and coastal scrub, often with sea grape, sand spurs, poisonwood, and prickly pear cactus.	Unlikely, due to lack of suitable habitat	Not likely to affect
Polygala smallii	Tiny Polygala	Endangered	Pine rockland, scrub, sandhill, and open coastal spoil piles.	Unlikely, due to lack of suitable habitat	Not likely to affect

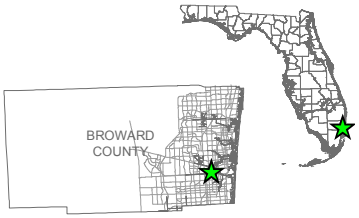
*Unless otherwise noted, Source: Florida Natural Areas Inventory, 2001. *Field Guide to the Rare Animals of Florida*

FIGURES



LEGEND

★ Project Location



10,000 0 10,000 Feet

REV.	DATE	DES	REVISION DESCRIPTION	GIS	CHK	RVW
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PROJECT

FPL

LAUDERDALE PLANT

TITLE

LOCATION MAP

REFERENCES

1. Lauderdale Plant Location, FPL and Golder Associates Inc., 2013

Coordinate System: NAD 1983 StatePlane Florida East FIPS 0901 Feet
Projection: Transverse Mercator
Datum: North American 1983

PROJECT No. 133-87588

Golder Associates

	FILE No.		13387588_B001	
DESIGN	SM	16 Jul. 2013	SCALE: AS SHOWN	REV. 0
GIS	NRL	23 Jul. 2013		
CHECK		23 Jul. 2013		
REVIEW	KFK	23 Jul. 2013		

FIGURE: 1

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LEGEND

- Project Area (20.41 acres)
- Property Boundary (Approximate)
- Land Use
  - 140 - Commercial and Services
  - 241 - Tree Nurseries
  - 320 - Upland Shrub and Brushland
  - 437 - Australian Pine
  - 512 - Channelized Waterway
  - 612 - Mangrove Swamp
  - 617 - Mixed Wetland Hardwoods
  - 617 / 619 - Mixed Wetland Hardwoods / Exotic Wetland Hardwoods
  - 619 - Exotic Wetland Hardwoods
  - 6411 - Sawgrass
  - 743 - Spoil Area
  - 814 - Roads
  - 831 - Electric Power Facilities

REFERENCES

1. Land Use, Project Area (Approximate), Golder Associates Inc., 2013
2. Property Boundary (Approximate), Broward County Property Appraiser, 2013

Coordinate System: NAD 1983 StatePlane Florida East FIPS 0901 Feet

400 0 400
Feet

REV.	DATE	DES	REVISION DESCRIPTION	GIS	CHK	RVW
0						

PROJECT

FPL
FORT LAUDERDALE PLANT

TITLE

PROJECT AREA
LAND USE/ LAND COVER

Golder Associates

PROJECT NO. 133-87588			FILE No.	13387588_B003	
DESIGN	KAB	5 Jun. 2013	SCALE: AS SHOWN	REV. 0	
GIS	NRL	26 Jul. 2013			
CHECK	AZ	26 Jul. 2013	**FIGURE: 2**		
REVIEW	MEH	26 Jul. 2013			

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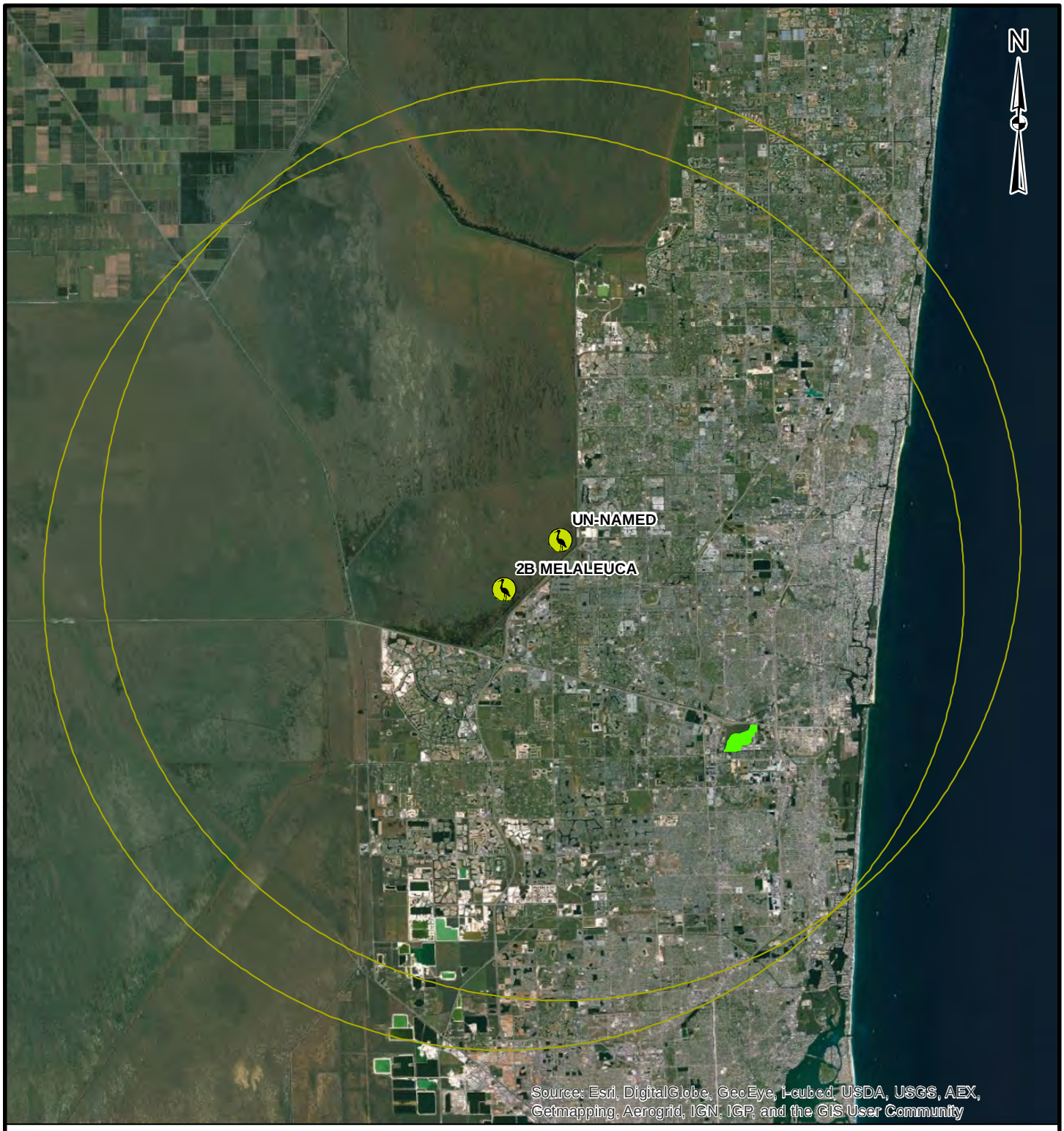

LEGEND

- Wood Stork Nests
- Wood Stork Core Foraging Area
- Property Boundary

30,000 0 30,000 Feet

REV.	DATE	DES	REVISION DESCRIPTION	GIS	CHK	RVW
0						

PROJECT

FPL
FORT LAUDERDALE PLANT

TITLE

WOODSTORK CORE FORAGING AREAS

REFERENCES

1. Wood Stork Nests, and Core Foraging Areas, USFWS, 2010

Coordinate System: NAD 1983 StatePlane Florida East FIPS 0901 Feet
Projection: Transverse Mercator
Datum: North American 1983

Golder Associates

PROJECT NO. 133-87610			FILE No.	13387610_B003
DESIGN	KAB	23 Aug. 2013	SCALE: AS SHOWN	REV. 0
GIS	NRL	23 Aug. 2013		
CHECK	KAB	23 Aug. 2013		
REVIEW	KAB	23 Aug. 2013		

FIGURE: 3

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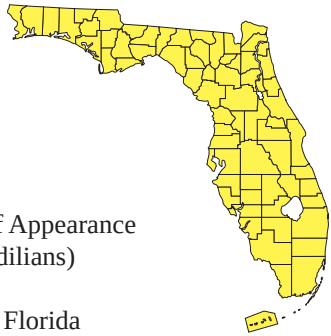
ATTACHMENT A

SPECIES DESCRIPTIONS

AMERICAN ALLIGATOR
Alligator mississippiensis



Order: Crocodylia
Family: Alligatoridae
FNAI Ranks: G5/S4
U.S. Status: Threatened by Similarity of Appearance (to more endangered crocodilians)
FL Status: Species of Special Concern
Harvest of alligators and eggs is regulated by Florida Fish and Wildlife Conservation Commission.

© D. Bruce Means

juvenile © Jim Solomon

Description: A large, mostly black crocodilian with a broadly rounded snout. Young with yellow crossbands on back, tail, and sides; throat and belly white to creamy yellow at all ages. Head smooth in front of eyes; no prominently visible tooth in lower jaw when mouth is closed. Adults 6 -15 ft. (1.8 - 4.6 m); hatchlings about 9 in. (230 mm).

AMERICAN ALLIGATOR *Alligator mississippiensis*

Similar Species: Spectacled caiman (*Caiman crocodilus*), introduced in southern Florida, shares broadly rounded snout but rarely exceeds 6 ft. (1.8 m) and has curved bony crosswise ridge in front of eyes; varies from yellow-green to gray-brown with dark crossbands. American crocodile (*Crocodylus acutus*; see species account) is gray to brown and has long, tapered snout with prominently projecting fourth lower tooth when mouth is closed (except in very young).

Habitat: Most permanent bodies of fresh water, including marshes, swamps, lakes, and rivers. Occasionally wanders into brackish and salt water but rarely remains there.

Seasonal Occurrence: Most active from spring through fall, with nesting in late spring and hatching in summer. Inactive during cold weather, though some may bask on sunny winter days.

Florida Distribution: Statewide, though rare in Keys.

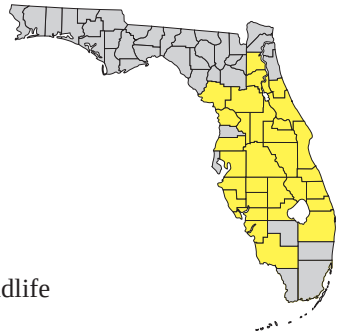
Range-wide Distribution: Southeastern Coastal Plain from North Carolina to Texas.

Conservation Status: Has recovered dramatically since 1960s. Populations are present on most federal, state, and private conservation lands where there is permanent fresh water. Several populations are now large enough to support controlled harvest. Threats include destruction and pollution of wetlands, including lakes and rivers.

Protection and Management: Protect wetlands of all types from ditching, filling, and pollution.

Selected References: Ashton and Ashton 1991, Bartlett and Bartlett 1999, Conant and Collins 1991, Deitz and Hines 1980, Delany and Abercrombie 1986, Kushlan 1974, Lazell 1989, Mount 1975, Neill 1971.

FLORIDA SCRUB-JAY
Aphelocoma coerulescens



Order: Passeriformes
Family: Corvidae
FNAI Ranks: G3/S3
U.S. Status: Threatened
FL Status: Threatened
U.S. Migratory Bird Treaty Act and state Wildlife Code prohibit take of birds, nests, or eggs.

© Tom Vezo

Description: Similar in size and shape to the familiar blue jay (*Cyanocitta cristata*). Crestless head, nape, wings, and tail are pale blue, and the back and belly pale gray. Juveniles have fluffy brown heads.

Similar Species: The scrub-jay lacks the crest and white spotting on wings and tail that are characteristic of the blue jay.

Habitat: Inhabits fire-dominated, low-growing, oak scrub habitat found on well-drained sandy soils. May persist in areas with sparser oaks or scrub areas that are overgrown, but at much lower densities and with reduced survivorship.

Seasonal Occurrence: Extremely sedentary.

Florida Distribution: Restricted to peninsular Florida, with largest populations occurring in Brevard, Highlands, Polk, and Marion counties.

FLORIDA SCRUB-JAY *Aphelocoma coerulescens*

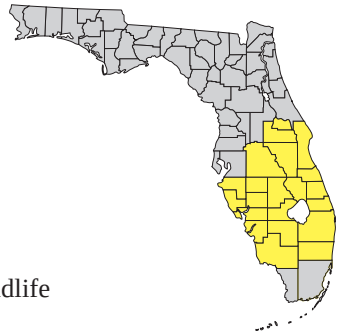
Range-wide Distribution: Same as Florida distribution.

Conservation Status: Recognized in 1995 as a distinct species from the scrub-jays in the western U.S., making it the only bird species whose entire range is restricted to Florida. Continuing loss, fragmentation, and degradation of scrub habitat has resulted in a decline of greater than 90 percent of the original pre-settlement population of Florida scrub-jays. Precipitous decline since the 1980s. A 1992 range-wide estimate gives an overall population of approximately 10,000 birds. Largest populations are found on federal lands (Merritt Island National Wildlife Refuge and Ocala National Forest), but are declining. Land management practices on these lands are of concern. Smaller populations are found scattered along Lake Wales Ridge in Polk and Highlands counties, with a major protected population at Archbold Biological Station. Cars and cats take toll on scrub-jays in developed areas. Scrub-jays are susceptible to population crashes because of catastrophic fires or disease, so protection of additional secure populations is essential.

Protection and Management: Acquire suitable xeric habitat in strategic locations among existing scrub-jay preserves to help mitigate the extensive fragmentation of this habitat. Continued existence of this species will depend on preservation and long-term management of suitable scrub habitat. Prescribed fire every 8 - 15 years that burns patchily, where few territories are burned completely, is optimal. Mechanical treatments, at least initially, may be required where fire cannot be used, although the long-term effects of this management practice are unknown.

Selected References: Fitzpatrick et al. 1991, Poole and Gill (eds.) 1996, Robertson and Woolfenden 1992, Rodgers et al. (eds.) 1996, Stevenson and Anderson 1994, Thaxton and Hingtgen 1996.

CRESTED CARACARA
Caracara cheriway



Order: Falconiformes
Family: Falconidae
FNAI Ranks: G5/S2
U.S. Status: Threatened
FL Status: Threatened
U.S. Migratory Bird Treaty Act and state Wildlife Code prohibit take of birds, nests, or eggs.

© Tom Vezo

Description: Large, distinctive raptor; large head with black cap and crest. Long neck, hooked bill, long legs, and long, rounded wings bent back at the wrist. Mainly black-brown with white throat and neck and bare, red facial skin. Upper back, breast, and tail buffy white with barring, and a broad, dark band at end of tail. White patches at ends of dark wings are conspicuous in flight; steady, shallow wing-beats with minimal soaring. Often seen with vultures because of its scavenging nature. Juveniles have pale edging on brown feathers of upperside and are streaked below. Facial color changes from grayish-pink (juveniles) to yellow (second year) to bright yellow-orange or reddish (adults); also changes depending on blood flow to area.

Similar Species: In flight, may be confused with larger bald eagle (*Haliaeetus leucocephalus*; see species account) at a distance. Caracara's smaller size and the white panels in wings help distinguish the two; caracaras seldom soar and generally fly low above ground.

CRESTED CARACARA *Caracara cheriway*

Habitat: Open country, including dry prairie and pasture lands with cabbage palm, cabbage palm/live oak hammocks, and shallow ponds and sloughs. Preferred nest trees are cabbage palms, followed by live oaks.

Seasonal Occurrence: Nonmigratory. Generally monogamous; adult pairs stay year-round on territory, which may be maintained for years.

Florida Distribution: Based on 1987 - 1991 data, most abundant in south central Florida in Osceola, Highlands, Okeechobee, De Soto, Glades, and Hendry counties; fewer records (1 - 6) from surrounding counties. Occasional reports outside known breeding range, north to Nassau County, west to Bay County, and south to the Keys, are attributed to escapees or wandering individuals.

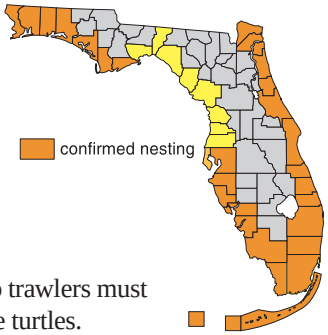
Range-wide Distribution: South-central Florida, southeastern Texas and southern Arizona south throughout parts of Mexico, Central and South America to northern and central Peru and northern Brazil. Rare and local in Cuba, Isle of Pines, and southwestern Louisiana.

Conservation Status: Florida population thought to be relatively stable over a 20-year span (1972 - 1991). Estimate of 400 - 500 individuals, although not all suitable habitat was accessible to surveyors. Overall, range has contracted and become more fragmented. Currently, habitat threatened most by residential development and conversion to more intensive (e.g., citrus) agricultural uses. Three Lakes Wildlife Management Area (WMA), Avon Park Air Force Range, and South Florida Water Management District lands along the Kissimmee River offer limited protected area. Recent state acquisitions of Kissimmee Prairie State Preserve (1997), Fisheating Creek WMA (2000), and the Fisheating Creek Conservation Easement (2000) have helped protect additional significant habitat.

Protection and Management: Because of the large habitat requirements of the caracara, land acquisition alone is unrealistic. Continue acquisition of prairie habitat, habitat restoration, and development of incentives (e.g., tax breaks, conservation easements, cooperative agreements) for private landowners to maintain their ranchlands to bolster the long-term security of the caracara.

Selected References: Poole and Gill (eds.) 1996, Robertson and Woolfenden 1992, Rodgers et al. (eds.) 1996, Stevenson and Anderson 1994.

LOGGERHEAD
Caretta caretta



Order: Testudines
Family: Cheloniidae
FNAI Ranks: G3/S3
U.S. Status: Threatened
FL Status: Threatened

Status applies to eggs as well as turtles. Shrimp trawlers must be fitted with excluder devices to release marine turtles. Some local ordinances regulate beachfront lighting and beach driving.

© courtesy of Caribbean Conservation Corporation

hatchling © Blair Witherington

Description: A large sea turtle with a reddish brown carapace (upper shell) and large, blunt head with yellow cheeks; front limbs reddish brown and modified as flippers. Carapace with five or more large scales (costal scutes) on each side, the first one touching the nuchal scute (small scale over neck). Lower shell (plastron) yellow and usually without a single small scale at its posterior tip. Bridge usually with three large scales, occasionally four, and these lack pores. Two pairs of scales (prefrontals) between eyes. Adults 28 - 49 in. (70 - 125 cm) carapace length, 170 - 350 lbs. (77 - 159 kg). Hatchlings 1.6- 1.9 in. (41 - 48 mm) shell length, with three lengthwise ridges (keels) on upper shell, and two on lower; brown, tan, or light to dark gray above and often lighter below.

Similar Species: The reddish brown coloration is distinctive among sea turtles. Hawksbill and green turtles (*Eretmochelys imbricata* and *Chelonia mydas*; see species accounts) lack contact between first costal and nuchal scutes . Adult Kemp's ridley (*Lepidochelys kempii*; see species account) is

smaller, has a gray to olive-green, nearly circular shell with four large scales (each with a posterior pore) on the bridge, usually a single small scale at rear edge of plastron, and a cusped, parrot-like beak.

Habitat: Marine coastal and oceanic waters; nest on coastal sand beaches, often near the dune line, sufficiently high to avoid tidal inundation. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, and lagoons.

Seasonal Occurrence: Present in Florida waters year-round, but more commonly observed during warmer months when turtles are more active. Nesting occurs late April - early September; hatchlings emerge from nests and head toward the sea July - November.

Florida Distribution: Coastal waters statewide. Nesting occurs along the entire Atlantic coast, in the Keys, and along the Gulf coast from Pinellas County south and Franklin County west, with the greatest numbers from Brevard to Broward counties.

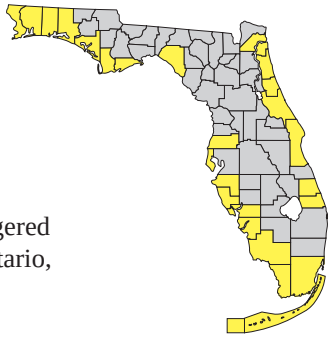
Range-wide Distribution: Temperate and subtropical marine waters worldwide. Nesting in the eastern U.S. is principally confined to Florida, Georgia, and South Carolina, with smaller numbers from North Carolina to Virginia.

Conservation Status: Some nesting beaches are on military lands and state, federal, and private conservation lands on both Atlantic and Gulf coasts. State-designated aquatic preserves partially protect some feeding and developmental habitat.

Protection and Management: Protect beaches and adjacent uplands statewide from development and coastal armoring. Protect estuaries and coastal waters from pollution, dumping of entangling debris, dredging, over-use by boats and ships, and other disturbance. Focus extreme attention on Brevard and Indian River counties. While Turtle Excluder Devices (TEDs) have reduced mortality in shrimp nets, greater regulation of long-line and gill-net fisheries is needed to prevent hooking mortality and incidental drowning. Enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights.

Selected References: Ashton and Ashton 1991, Bartlett and Bartlett 1999, Conant and Collins 1991, Dodd 1988, Ernst et al. 1994, Moler (ed.) 1992.

PIPING PLOVER
Charadrius melodus



Order: Charadriiformes
Family: Charadriidae
FNAI Ranks: G3/S2
U.S. Status: Threatened (except Endangered in U.S. Great Lakes and Ontario, Canada)
FL Status: Threatened

U.S. Migratory Bird Treaty Act and state Wildlife Code prohibit take of birds, nests, or eggs.

Description: Small plover with a short, stout, black bill, yellow to greenish-olive legs, and very pale upperparts. In Florida, usually encountered in winter plumage. Black band across forehead and dark ring partly around neck, present in breeding birds, fade in winter birds and are not present in juveniles.

Similar Species: May be confused with snowy plover (*Charadrius alexandrinus*; see species account), which is similarly colored, but has a longer, slenderer black bill and darker legs. In winter, adult and juvenile piping plovers also have a dark bill, but bill is shorter and thicker, and legs are lighter than those of the snowy plover. In flight, piping plovers show a white rump.

Habitat: Found on open, sandy beaches and on tidal mudflats and sandflats along both coasts.

PIPING PLOVER *Charadrius melodus*

Seasonal Occurrence: Very rare to uncommon winter resident, although may appear locally early July - May.

Florida Distribution: Winters on both Gulf and Atlantic coasts, although much more common on Gulf coast. Of 582 plovers sighted in Florida during the 1991 International Winter Census, 88 percent were recorded on the Gulf coast. Found along beaches from Perdido Key (Escambia County) to Dog Island and Lanark Reef (Franklin County), and from Anclote Key (Pasco County) to Marco Island and vicinity (Collier County). Small numbers overwinter in the Keys. Atlantic coast birds number much fewer (20 - 30 birds) and are scattered from Duval County south to Brevard, St. Lucie, and Miami-Dade counties. No longer believed to overwinter in Broward, Indian River, Nassau, or Palm Beach counties.

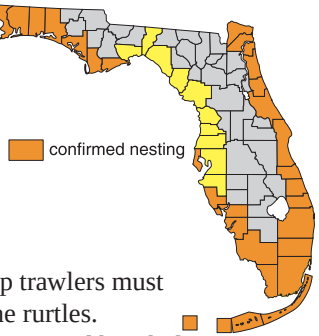
Range-wide Distribution: Mostly breeds locally in the northern Great Plains region of southern Canada, south to Nebraska; formerly throughout much of Great Lakes region, now locally only in northern Michigan and one locality in northern Wisconsin; and on Atlantic coast from Newfoundland south to North Carolina. Most birds winter from North Carolina south to Florida, Gulf coast states, Mexico, and sporadically in the Caribbean, although winter distribution is not completely known.

Conservation Status: Surveys conducted during the 1991 winter census resulted in 582 plovers sighted, of which 511 were on the Gulf coast and 71 on the Atlantic coast (including the Keys). Destruction and degradation of summer and winter habitat, shoreline erosion, human disturbance, and predators (including domestic animals) all contribute to low reproductive success and declines in numbers over much of the plover's range. Although Florida's conservation lands provide considerable suitable habitat, increasing recreational demands result in increased harassment of foraging and roosting birds. U.S. Fish and Wildlife Service is currently reviewing wintering areas to be designated as Critical Habitat.

Protection and Management: Protect high-use wintering areas on public lands from disturbance by educating the public and, if necessary, by posting. Protection of known habitat outside current conservation lands is warranted in light of the rarity of the species and fragile nature of its required habitat.

Selected References: Poole and Gill (eds.) 1992, Robertson and Woolfenden 1992, Rodgers et al. (eds.) 1996, Stevenson and Anderson 1994.

GREEN TURTLE
Chelonia mydas



Order: Testudines
Family: Cheloniidae
FNAI Ranks: G3/S2
U.S. Status: Endangered
FL Status: Endangered

Status applies to eggs as well as turtles. Shrimp trawlers must be fitted with excluder devices to release marine rurtles. Some local ordinances regulate beachfront lighting and beach driving.

hatchling

Description: A large sea turtle that is dark above, light below, and which bears only a single pair of elongate scales (prefrontals) between eyes; front limbs modified as flippers. Upper shell (carapace) of adult: olive with dark spots; juvenile: brown to olive with radiating lines. Carapace without central keel except in young, and with only four large, non-overlapping scales (costal scutes) on each side, the first one not in contact with nuchal scute (small scale over neck). Lower shell (plastron) cream to yellow. Adults reach 35 - 48 in. (88 - 122 cm) shell length and 220 - 450 lbs. (104 - 204 kg). Hatchlings 1.6 - 2.4 in. (41 - 61 mm) shell length, black to dark gray above, white ventrally and along rear margins of flippers, with a low keel on back and two keels on plastron.

Similar Species: Hawksbill (*Eretmochelys imbricata*; see species account) is smaller as adult, has mid-dorsal keel throughout life, and pointed beak and overlapping carapacial scales except in old turtles. Loggerhead and Kemp's ridley (*Caretta caretta* and *Lepidochelys kempii*; see species accounts) have five or more costal scutes, the first touching the nuchal. Loggerhead is distinctively reddish-brown; much smaller Kemp's ridley has

nearly circular, grayish to olive-green shell. All three have two pairs of prefrontal scales between eyes. Hawksbill and loggerhead hatchlings are darker below and have pronounced keels on back.

Habitat: Estuarine and marine coastal and oceanic waters; nests on coastal sand beaches, often near dune line, sufficiently high to avoid tidal inundation. Large juveniles and adults feed on seagrasses and algae. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, lagoons, and offshore worm reefs.

Seasonal Occurrence: Present in Florida waters year-round, but more commonly observed during warmer months. Nests late May - September; hatchlings emerge and head toward sea August - November.

Florida Distribution: Coastal waters statewide. Nests mostly along Atlantic coast, especially from Volusia to Miami-Dade County, with a few nests in Keys and on southwestern and western panhandle coasts. Areas known to be especially important to young green turtles include Gulf coast of Citrus and Levy counties, Indian River Lagoon, shallow hard bottom along southeastern coast, and Florida Bay.

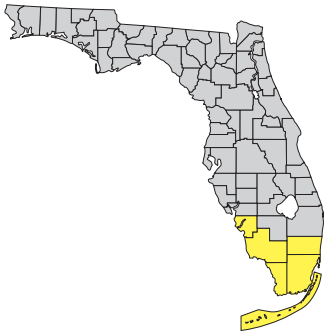
Range-wide Distribution: Tropical and subtropical marine waters worldwide. In the eastern U.S., largely restricted to Florida, although may wander as far north as Massachusetts.

Conservation Status: Some nesting beaches are on military, state, federal, and private conservation lands on both Atlantic and Gulf coasts. State-designated aquatic preserves partially protect some feeding and developmental habitat.

Protection and Management: Protect beaches and adjacent uplands statewide from development and coastal armoring. Protect estuaries and coastal waters from pollution, dumping of entangling debris, dredging, over-use by boats and ships, and other disturbance. Focus extreme attention on Brevard and Indian River counties. While Turtle Excluder Devices (TEDs) have reduced mortality in shrimp nets, greater regulation of long-line and gill-net fisheries is needed to prevent hooking mortality and incidental drowning. Enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights.

Selected References: Ashton and Ashton 1991, Bartlett and Bartlett 1999, Conant and Collins 1991, Ernst et al. 1994, Hirth 1971, Moler (ed.) 1992.

AMERICAN CROCODILE
Crocodylus acutus



Order: Crocodylia
Family: Crocodylidae
FNAI Ranks: G2/S1
U.S. Status: Endangered
FL Status: Endangered

© Barry Mansell

juvenile © Barry Mansell

Description: A large, gray to brown crocodilian with a long, tapered snout. All ages may have dark crossbands or spots on back, tail, and legs; belly whitish. Fourth tooth of lower jaw shows prominently (except in very young) when mouth is closed. Adults 7 - 15 ft. (2.1 - 4.6 m), hatchlings about 10 in. (254 mm). Often basks with mouth open.

AMERICAN CROCODILE *Crocodylus acutus*

Similar Species: Alligator (*Alligator mississippiensis*; see species account) is nearly black above, although juvenile has light crossbands; usually basks with mouth closed. Spectacled caiman (*Caiman crocodilus*), introduced in southern Florida, rarely exceeds 6 ft. (1.8 m) and has curved, bony, crosswise ridge in front of eyes. Both species have broadly rounded snouts without prominently projecting fourth lower tooth.

Habitat: Coastal estuarine marshes, tidal swamps, and creeks along edges of mainland and islands. Usually associated with mangroves. Nests on beaches, stream banks, and levees.

Seasonal Occurrence: Most active from late winter to fall; nests in April and May; eggs hatch in summer. Less active during cool weather, though usually basks on sunny winter days.

Florida Distribution: Chiefly coastal waters at southern end of peninsula, with breeding occurring from southern Biscayne Bay to Cape Sable, as well as on Key Largo and some islands in Florida Bay. Additional nesting, though without apparent success, has been recorded near Marco Island, Collier County. Occasionally wanders into Lower Keys as well as northward up coasts to Lee and Broward counties.

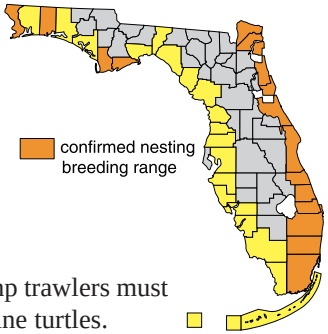
Range-wide Distribution: Florida, Greater Antilles, Mexico, and Central and South America.

Conservation Status: Most of Florida breeding range is protected by Everglades National Park, Crocodile Lake National Wildlife Refuge, and a private corporation. Small population size leaves it vulnerable to catastrophes such as hurricanes and disease. Some individuals are killed by automobiles on U.S. Route 1 and Card Sound Road.

Protection and Management: Devote crocodile habitat to natural resources rather than recreation. Provide several suitable wildlife crossings beneath U.S. Route 1. Educate public about non-aggressive nature of species.

Selected References: Ashton and Ashton 1991, Bartlett and Bartlett 1999, Conant and Collins 1991, Gaby et al. 1985, Kushlan and Mazzotti 1989, Moler (ed.) 1992, Neill 1971, U.S. Fish and Wildlife Service 1984.

LEATHERBACK
Dermochelys coriacea



Order: Testudines
Family: Dermochelyidae
FNAI Ranks: G3/S2
U.S. Status: Endangered
FL Status: Endangered

Status applies to eggs as well as turtles. Shrimp trawlers must be fitted with excluder devices to release marine turtles. Some local ordinances regulate beachfront lighting and beach driving.

© courtesy of Caribbean Conservation Corporation

hatchling
© Blair Witherington

Description: A huge sea turtle with a dark gray to black body covered by leathery skin and bearing seven prominent longitudinal ridges; five similar ridges occur on the mostly white lowe shell (plastron). Front limbs modified as flippers. Adults typically reach 53 - 70 in. (135 - 178 cm) shell length and 650 - 1300 lbs. (295 - 590 kg). Young are black dorsally with white ridges and are covered by small beady scales; hatchlings measure 2.4 - 3 in. (61 - 76 mm).

LEATHERBACK *Dermochelys coriacea*

Similar Species: None. The shells of all other sea turtles are covered with a series of hard plates (scutes).

Habitat: Oceanic waters; nests on coastal sand beaches. Leatherbacks are rarely seen in coastal waters except as hatchlings dispersing from nesting beaches and as adult females approaching the beach to nest.

Seasonal Occurrence: Present in Florida waters year-round, though concentrations of adults are known to occur from Nassau through Brevard counties from fall through early spring. Nests from early spring through early summer, with hatchlings emerging and heading toward sea in late spring and summer.

Florida Distribution: Entire coast of Florida, with nesting known from every Atlantic coastal county and in panhandle. Approximately half of Florida nests are in Palm Beach County.

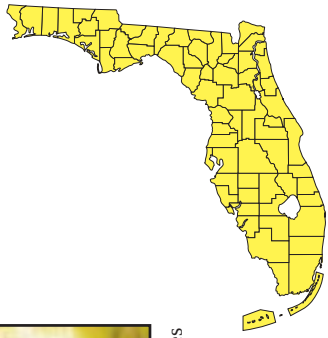
Range-wide Distribution: Tropical and temperate marine waters worldwide, but venturing farther into cooler waters than other sea turtles. Nesting in U.S. confined principally to Florida and St. Croix, Virgin Islands, with a few nests in southern Georgia.

Conservation Status: Believed to be in severe decline worldwide. Some Florida nesting beaches are on state, federal (including military), and private conservation lands on both coasts.

Protection and Management: Protect beaches and adjacent uplands statewide from development and coastal armoring. Protect coastal and oceanic waters from pollution, dumping of plastic debris which leatherbacks mistake for their jellyfish prey, dredging, overuse by boats and ships, and other disturbance. While Turtle Excluder Devices (TEDs) have reduced general sea turtle mortality in shrimp nets, their openings must be enlarged to allow leatherbacks to escape as well. Enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights.

Selected References: Ashton and Ashton 1991, Bartlett and Bartlett 1999, Conant and Collins 1991, Ernst et al. 1994, Moler (ed.) 1992, Spotila et al. 1996.

EASTERN INDIGO SNAKE
Drymarchon corais couperi



Order: Squamata
Family: Colubridae
FNAI Ranks: G4T3/S3
U.S. Status: Threatened
FL Status: Threatened

© Dan Hipes

© Dan Hipes

Description: A very large, stout-bodied, shiny black snake reaching lengths as great as 8 ft. (244 cm). Black ventrally, but chin, throat, and sides of head may be reddish or (rarely) white. Scales typically smooth (no ridges), though adult males have keel on front half of some scales along back; anal scale undivided. Young similar to adults though often more reddish anteriorly, 17 - 24 in. (430 - 610 mm) at hatching. When encountered, often hisses, flattens neck vertically (from side to side), and vibrates tail, but rarely bites.

EASTERN INDIGO SNAKE *Drymarchon corais couperi*

Similar Species: Black racer (*Coluber constrictor*), which rarely exceeds 5 ft. (152 cm), is more slender, a duller sooty black usually with a white chin and throat, and has a divided anal scale. The mostly aquatic mud snake (*Farancia abacura*) is glossy black above and can grow to 6 ft. (183 cm), but has a reddish, rarely white, belly, with the coloration encroaching the sides, and a sharp-pointed tail tip.

Habitat: Broad range of habitats, from scrub and sandhill to wet prairies and mangrove swamps. In northern part of range, often winters in gopher tortoise burrows in sandy uplands but forages in more hydric habitats. Requires very large tracts to survive.

Seasonal Occurrence: Active nearly year-round in southern Florida but winters underground farther north. Lays eggs in May and June.

Florida Distribution: Statewide, including Upper and Lower Keys, but rare in panhandle.

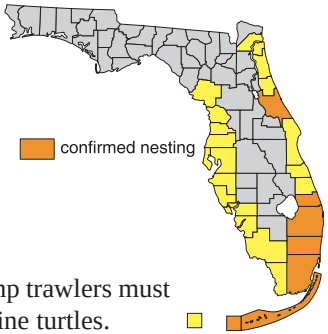
Range-wide Distribution: Florida and southern Georgia; formerly extended from southern South Carolina to southeastern Mississippi.

Conservation Status: Rare in most areas, though species has been recorded from many public lands statewide; however, whether most of these support viable populations is uncertain. Major threats are habitat loss, degradation, and fragmentation, with associated highway mortality. Other threats include gassing of tortoise burrows for rattlesnakes, collection for pets, and deliberate persecution, all of which are illegal.

Protection and Management: Protect very large tracts (> 5000 acres = 2025 ha) of appropriate natural habitat unfragmented by roads; use prescribed fire as needed. Maintain gopher tortoise populations and dead stumps to provide natural subterranean refugia. Enforce bans on tortoise burrow gassing and on collection or molestation of snake. Avoid construction of roads through unfragmented habitat. Educate public to avoid wanton destruction of large snakes.

Selected References: Ashton and Ashton 1988b, Conant and Collins 1991, Ernst and Barbour 1989, Georgia DNR 1999, Lazell 1989, Moler (ed.) 1992, Mount 1975, Tenant 1997.

HAWKSBILL TURTLE
Eretmochelys imbricata



Order: Testudines
Family: Cheloniidae
FNAI Ranks: G3/S1
U.S. Status: Endangered
FL Status: Endangered

Status applies to eggs as well as turtles. Shrimp trawlers must be fitted with excluder devices to release marine turtles. Some local ordinances regulate beachfront lighting and beach driving.

© Robert S. Simmons

hatchling
© Blair Witherington

Description: A medium-sized sea turtle with a brown, somewhat heart-shaped upper shell (carapace), often marked with "tortoiseshell" pattern of light and dark streaks. Front limbs modified as flippers, upper jaw narrowly pointed as a beak, two pairs of scales (prefrontals) between eyes. Unlike other sea turtles, large scales of carapace overlap except in very young and very old. Carapace bears central ridge (keel) and only four large scales (costal scutes) on each side, the first not touching the nuchal (small scale over neck). Lower shell (plastron) white to yellow, sometimes with dark

blotches. Adults 25 - 37 in. (63 - 94 cm) shell length, 95 - 165 lbs. (43 - 75 kg), record 280 lbs. (127 kg). Hatchlings brown to black above, 1.5 - 1.9 in. (38 - 48 mm) shell length, with one central ridge on back and pair of ridges below.

Similar Species: Green turtle (*Chelonia mydas*; see species account) also has four pairs of costals and lacks costal-nuchal contact, but has non-overlapping carapacial scales and only one long pair of prefrontal scales between eyes; jaws are U-shaped rather than sharply pointed, and bear small ridges along inner surfaces. Loggerhead and Kemp's ridley (*Caretta caretta* and *Lepidochelys kempii*; see species accounts) have five or more costal scales on each side, the first touching the nuchal.

Habitat: Marine coastal and oceanic waters, commonly associated with coral reefs, keys, and mangroves. Nests on coastal sand beaches, often in vegetation.

Seasonal Occurrence: Present year-round in southern Florida. Nests late spring through fall; hatchlings emerge late summer and fall.

Florida Distribution: Southern half of Florida, chiefly Florida Keys and reefs along southeastern peninsular coast. Nesting infrequent (1 - 4 per year) but recorded from Volusia County to the Marquesas.

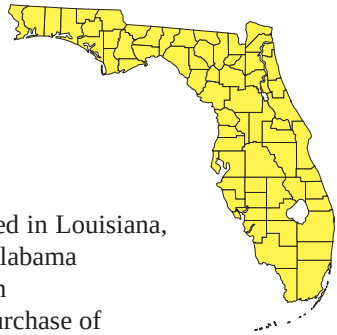
Range-wide Distribution: Tropical and subtropical marine waters worldwide. In U.S., principally Florida.

Conservation Status: Some small island nesting beaches are on federal land, especially Key West National Wildlife Refuge.

Protection and Management: Worldwide, populations have plummeted from centuries of harvest, principally to make jewelry; ending this trade is critical. Florida reef habitats and Keys and surrounding waters must be protected from further development, pollution, dumping of debris, and other degradation. Oil tankers should not operate within 15 mi. (25 km) of the Keys and lower southeast coast.

Selected References: Ashton and Ashton 1991, Bartlett and Bartlett 1999, Conant and Collins 1991, Ernst et al. 1994, Meylan 1999, Meylan and Donnelly 1999, Moler (ed.) 1992, Witzell 1983.

GOPHER TORTOISE
Gopherus polyphemus



Order: Testudines
Family: Testudinidae
FNAI Ranks: G3/S3
U.S. Status: None in Florida; Threatened in Louisiana, Mississippi, and western Alabama
FL Status: Species of Special Concern
Florida prohibits take, possession, sale, or purchase of tortoises or their parts except by permit.

© Dan Hipes

juvenile
© Dan Hipes

Description: A medium-sized turtle (to 10 in. = 254 mm) fully adapted for life on land. Upper shell brown and relatively flat above; lower shell yellowish, without hinge, and projecting forward, especially in male; skin brown to dark gray. Forelimbs greatly expanded for digging; hind limbs reduced, stumpy, lacking any form of webbing between toes. Lower shell of male somewhat concave. Young: scales of carapace often with yellow centers, skin yellowish to tan; approximately 2 in. (51 mm) shell length at hatching.

Similar Species: The only other native land turtle in Florida, the box turtle (*Terrapene carolina*), is distinguished by its smaller size (to 8 in. =

203 mm), less stout feet, moveable hinge on lower shell, and often but not always by black and yellow upper shell. Tortoise burrows, which are useful in determining species' presence, typically have lower, flatter profile than more rounded burrows of armadillos; this reflects differences in cross-sectional shapes of the two animals.

Habitat: Typically found in dry upland habitats, including sandhills, scrub, xeric oak hammock, and dry pine flatwoods; also commonly uses disturbed habitats such as pastures, oldfields, and road shoulders. Tortoises excavate deep burrows for refuge from predators, weather, and fire; more than 300 other species of animals have been recorded sharing these burrows.

Seasonal Occurrence: Above-ground activity is greatly reduced during cold weather, with tortoises in northern Florida remaining below ground for months. Nonetheless, burrows are relatively conspicuous year-round.

Florida Distribution: State-wide except absent from the Everglades and Keys.

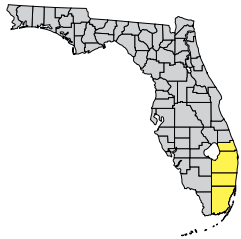
Range-wide Distribution: Lower Southeastern Coastal Plain, extending from southern South Carolina southward through lower Georgia and Florida and westward through southern Alabama, Mississippi, and extreme southeastern Louisiana.

Conservation Status: Despite its widespread occurrence throughout Florida, there is considerable concern about the declining abundance of this species. Much of its native habitat has been lost to agriculture, citriculture, forestry, mining, and urban and residential development. Although protected populations occur on many state, federal, and private conservation lands, recent development of a severe respiratory disease threatens even those.

Protection and Management: Manage large, undivided tracts of upland habitat to maintain native vegetative conditions; this generally requires periodic prescribed fire beneath trees to reduce brush and favor growth of grasses and forbs. Avoid building roads and houses in xeric uplands. Because of risk of introducing tortoises infected with respiratory disease to uncontaminated populations, tortoises should not be relocated except under strictly controlled programs.

BEACH JACQUEMONTIA

Jacquemontia reclinata House ex Small
Synonyms: none
Family: Convolvulaceae (morning-glory)
FNAI Ranks: G1/S1
Legal Status: US–Endangered FL–Endangered
Wetland Status: US–UPL FL–UPL



Jacquemontia reclinata Billy B. Boothe

Jacquemontia curtisii Gil Nelson

Field Description (photo, left, and drawing): Vine with a woody base and non-woody, creeping or twining **stems** to 6 feet long. **Leaves** about 1 inch long, oval, entire, alternate, somewhat fleshy, with rounded or notched tips; young leaves and stems whitened by dense hairs. **Flowers** 1 inch across when open, deeply 5-lobed with a short tube, white; solitary or in clusters on 1 inch long stalks arising in the angle of leaf and stem; **sepals** small with a narrow fringe of hairs. **Fruit** a small, round capsule with persistent sepals.

Similar and Related Rare Species (photo, right): Pineland clustervine (*Jacquemontia curtisii*), state-threatened and federal management concern, closely resembles beach jacquemontia but lacks the fringe of hairs on the sepals and has narrower, non-fleshy leaves; it occurs in pine flatwoods in Collier, Dade, and Monroe counties. Havana clustervine (*Jacquemontia havanensis*), state-endangered, also lacks the fringe of hairs on the sepals and has non-fleshy leaves; it occurs in hammocks in Dade County and Monroe County Keys. See also skyblue clustervine (*Jacquemontia pentanthos*) and wild-potato morning-glory (*Ipomoea microdactyla*) in this guide.

Beach jacquemontia *Jacquemontia reclinata*

Habitat: Lee side of stable, vegetated dunes; disturbed openings in maritime hammock, coastal strand, and coastal scrub, often with sea grape, sand spurs, poisonwood, and prickly pear cactus.

Best Survey Season: Flowers November–May.

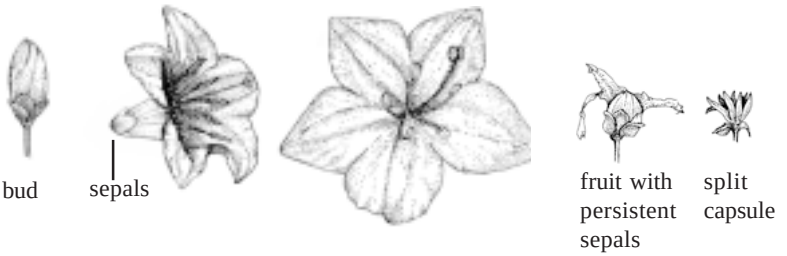
Range-wide Distribution: Endemic to SE coast of FL.

Conservation Status: Fewer than 500 plants at 9 sites are known. Although most are in preserves, they are threatened by exotic plant invasion.

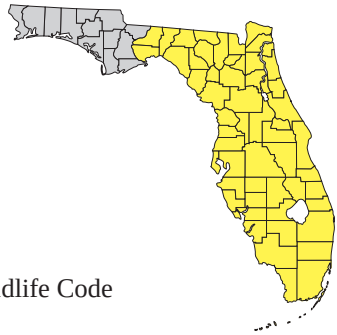
Protection & Management: Protect coastal habitats from development by conservation purchase or easement. Remove exotic pest plants, especially Australian pine, carrotwood, Brazilian pepper, and turf grasses. Establish new populations of this species in protected areas.

References: Coile 2000, IRC 1999, Langeland and Burks 1998, Small 1934, USFWS 1998, Ward 1979, Wunderlin 1998, Wunderlin and Hansen 2000a.

Jacquemontia reclinata

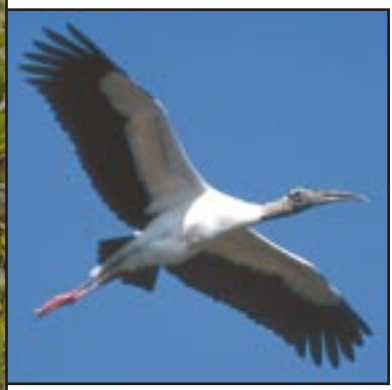


WOOD STORK
Mycteria americana



Order: Ciconiiformes
Family: Ciconiidae
FNAI Ranks: G4/S2
U.S. Status: Endangered
FL Status: Endangered
U.S. Migratory Bird Treaty Act and state Wildlife Code prohibit take of birds, nests, or eggs.

immatures © Barry Mansell



© Barry Mansell

Description: Very large, white wader with black in wings and a short black tail. Soars with neck and legs extended, displaying its long, broad wings; black flight feathers contrast with white along length of wings. Legs are dark and feet are beige. Adults have bare, scaly, dark-gray heads and necks and long, heavy, decurved bills. Head and neck of immature storks have grayish brown feathering, and their bills are yellowish.

Similar Species: American white pelicans (*Pelecanus erythrorynchos*) have a similar wing pattern and also soar but have short legs, white tail, and do not fly with necks extended. White ibis (*Eudocimus albus;* see species account) is much smaller and only has black on wing tips. Great egret (*Ardea alba*) lacks black on wings.

Habitat: Nests colonially in a variety of inundated forested wetlands, including cypress strands and domes, mixed hardwood swamps, sloughs,

and mangroves. Increasingly nesting in artificial habitats (e.g., impoundments and dredged areas with native or exotic vegetation) in north and central Florida. Forages mainly in shallow water in freshwater marshes, swamps, lagoons, ponds, tidal creeks, flooded pastures and ditches, where they are attracted to falling water levels that concentrate food sources (mainly fish).

Seasonal Occurrence: Post-breeding dispersal carries large numbers from more southern locales to more northern parts of range; in winter, northern birds move south. Annual and long-term use of nesting sites is very dependent on feeding conditions, which may be affected dramatically by altered hydrologic patterns. Colonies may form late November - early March in south Florida and February - March in central and northern Florida.

Florida Distribution: Locally rare to abundant in the peninsula and Big Bend, but generally rare or lacking in panhandle and the Florida Keys. Uncommon to rare in winter in north.

Range-wide Distribution: In U.S., breeds locally in South Carolina, Georgia, and Florida (formerly west to Texas). South, locally in lowlands from Mexico and northern Central America to South America (to western Ecuador, eastern Peru, Bolivia, northern Argentina), and rarely in Cuba and the Dominican Republic. Winters throughout breeding range except in South Carolina and Georgia.

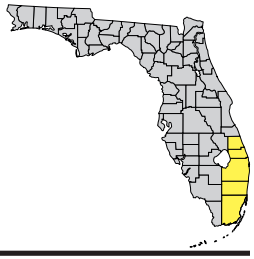
Conservation Status: Many known breeding sites occur within public and private conservation lands. Dramatic decline in the large colonies (>500 individuals) formerly found in south Florida, and trend toward fewer birds distributed among smaller, more numerous colonies in central and northern Florida. Very sensitive to manipulation of water regimes and loss of wetland habitat, which affect both nesting sites and feeding areas.

Protection and Management: Survey colony sites and important feeding areas regularly. Essential to protect wetland areas, closely monitor water quality, and manage hydrologic patterns that consider the needs of the wood stork.

Selected References: Poole and Gill (eds.) 1999, Robertson and Woolfenden 1992, Rodgers et al. (eds.) 1996, Runde et al. 1991, Stevenson and Anderson 1994.

TINY POLYGALA

Polygala smallii R.R. Sm. & D.B. Ward
Synonym: *Polygala arenicola* Small
Family: Polygalaceae (milkwort)
FNAI Ranks: G1/S1
Legal Status: US–Endangered FL–Endangered
Wetland Status: US–none FL–UPL



Roger Hammer

Field Description: Perennial **herb** with 1 - 4 usually unbranched stems to 4 inches tall; if branches are present, they are often buried in sand and the plants appear tufted. **Leaves** to 0.5 inch wide and 2 inches long, often taller than the flower heads, lance-shaped and slightly wider toward the tip, alternate, succulent, crowded on the stem. **Flowers** small, numerous in a crowded head at the top of the stem, yellow-green, with 2 wing-like sepals, 3 small sepals, and petals fused into a keel with a projecting fringe.

Similar Species: Bachelor's buttons or candyroot (*Polygala nana*) flowers are usually bright yellow, sometimes greenish-yellow; its leaves are distinctly wider at the tip, almost spoon-shaped. It occurs in wet pine flatwoods.

Related Rare Species: See Lewton's milkwort (*Polygala lewtonii*) in this guide.

Tiny polygala *Polygala smallii*

Habitat: Pine rockland, scrub, sandhill, and open coastal spoil piles.

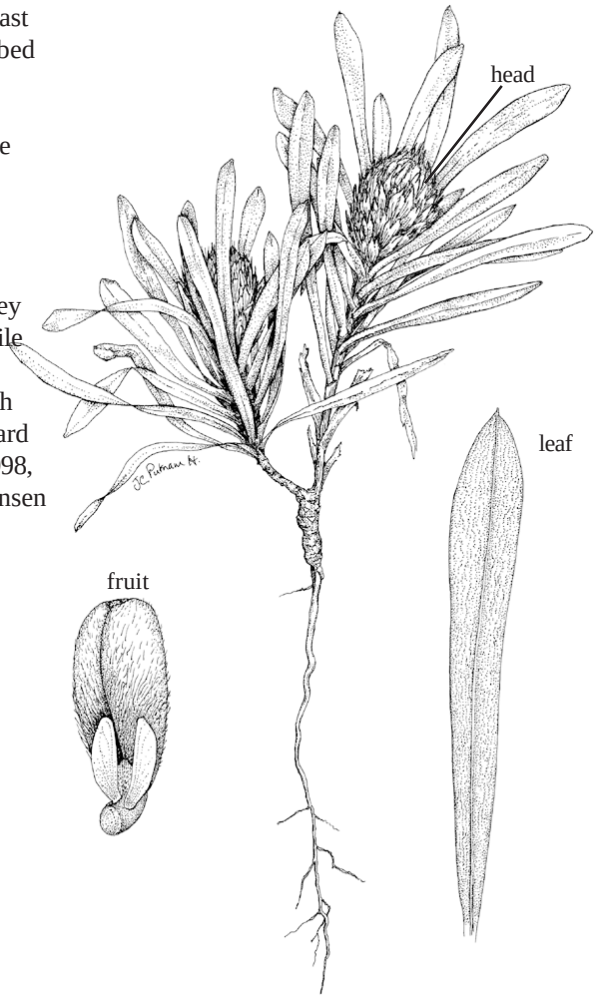
Best Survey Season: Flowers all year.

Range-wide Distribution: Endemic to Atlantic Coast Ridge of SE FL.

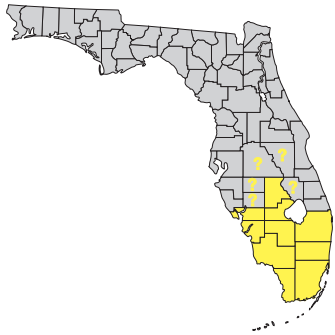
Conservation Status: Of 11 known populations, 7 occur in managed areas and 4 occur on lands that may soon be purchased for conservation.

Protection & Management: Purchase and protect intact habitats on the Atlantic Coast Ridge. Use prescribed fire to create and maintain sandy openings. Eradicate exotic pest plants. Monitor known populations.

References: Bradley and Gann 1995, Coile 2000, IRC 1999, USFWS 1998, Smith and Ward 1976, Ward 1979, Wunderlin 1998, Wunderlin and Hansen 2000a.



FLORIDA PANTHER
Puma concolor coryi



Order: Carnivora
Family: Felidae
FNAI Ranks: G5T1/S1
U.S. Status: Endangered
FL Status: Endangered

Description: A large (70 - 150 lbs. = 32 - 68 kg) cat with a long tail. Fur is dark buff to tawny above and light buff to white below; muzzle and tip of tail are black. The head is broad, and ears are round. Typical track shows four clawless toe pads around a three-lobed heel pad. Defining characteristics of the subspecies are a dorsal hair whorl, a crook in the tail, and white flecking on the neck and shoulders.

FLORIDA PANTHER *Puma concolor coryi*

Similar Species: Bobcat (*Lynx rufus*) has a short tail and is approximately half the size of a Florida panther. Western cougars (panthers, pumas; different subspecies) occasionally escape captivity or have been released and can be mistaken for Florida panthers; defining characteristics listed above may be unreliable in distinguishing these close relatives.

Habitat: Requires extensive blocks of mostly forested communities. Large wetlands that are generally inaccessible to humans are important for diurnal refuge. Will tolerate improved areas in a mosaic of natural communities.

Seasonal Occurrence: Year-round resident.

Florida Distribution: Collier, Glades, and Lee counties are the stronghold for the Florida panther; Miami-Dade and Monroe counties are also important. Dispersing individuals may range well north in the peninsula searching for new territories.

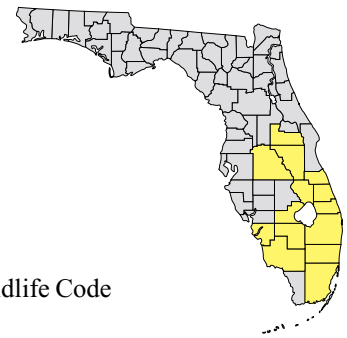
Range-wide Distribution: Subspecies formerly found throughout the southeastern U.S. from Arkansas and Louisiana east to Georgia and south to Florida.

Conservation Status: Found on several public conservation lands, including Big Cypress National Preserve, Florida Panther National Wildlife Refuge, Fakahatchee State Park, Picayune Strand State Forest, and Everglades National Park. Apparently, numbers are increasing as a result of genetic improvement project.

Protection and Management: Preserve large natural or slightly modified landscapes. Maintain viable populations of deer. Develop safe places for crossing highways. Maintain public support for recovery projects.

Selected References: Brown 1997, Humphrey (ed.) 1992, Maehr 1997.

SNAIL KITE
Rostrhamus sociabilis plumbeus



Order: Falconiformes
Family: Accipitridae
FNAI Ranks: G4G5T2/S2
U.S. Status: Endangered
FL Status: Endangered
U.S. Migratory Bird Treaty Act and state Wildlife Code prohibit take of birds, nests, or eggs.

male © Robert Bennetts

female © Robert Bennetts

Description: Medium-sized raptor. Adult male is dark slate gray to black; tail is white with a broad, dark band and pale terminal band; long, hooked bill. Breeding birds have orange-red legs and reddish eyes and facial skin. Adult females are brown with streaking on head, throat, and underparts; soft part colors like males. Juveniles and subadults similar to adult females.

Similar Species: Northern harrier (*Circus cyaneus*) has white on rump and not on tail and has a gliding flight, tilting side to side, unlike the floppy flight of the snail kite.

Habitat: Large open freshwater marshes and lakes with shallow water, < 4 ft. (1.2 m) deep, and a low density of emergent vegetation are preferred foraging habitat. Dependent upon apple snails (*Pomacea paludosa*) caught

at water surface. Nests usually over water in a low tree or shrub (commonly willow, wax myrtle, pond apple, or buttonbush, but also in non-woody vegetation like cattail or sawgrass).

Seasonal Occurrence: Nonmigratory. Nomadic dispersal in response to habitat changes (e.g., water level, food availability, hydroperiod).

Florida Distribution: Formerly in freshwater marshes throughout peninsular Florida. Now, depending on water conditions and food availability, restricted to St. Johns River headwaters, Kissimmee Valley, Lake Okeechobee, Loxahatchee National Wildlife Refuge, and Holey Land Wildlife Management Area; Water Conservation Areas 2A, 2B, 3A, 3B in Palm Beach, Broward and Dade counties; and parts of Everglades National Park and Big Cypress National Preserve. Also smaller wetlands in above counties plus St. Lucie, Martin, Hendry, and Lee counties. May disperse widely in drought years.

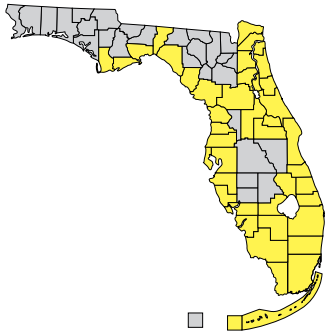
Range-wide Distribution: Subspecies *plumbeus* is restricted to Florida, Cuba, Isle of Pines, and northwest Honduras. Other subspecies occur in the neotropics.

Conservation Status: Much of range lies within conservation areas, although these lands are not necessarily managed for kites. Greatly affected by water management, especially in south Florida. Population fluctuates considerably, declining in drought years. Wetland drainage and conversion and introduction of exotic plants (which prevent foraging success) are major threats. Agricultural runoff has caused pollution, eutrophication, and snail die-offs. Concomitant increase in plant growth has led to continued use of herbicides, which contributes to nest collapse in non-woody nesting substrates.

Protection and Management: Continue mid-winter surveys to monitor population and identify areas used during droughts. Preserve extensive freshwater wetlands, including suitable refuges for kites during droughts; management should allow for the requirements of kites. Coordination among water managers is necessary to prevent drawdowns of lakes in central Florida at the same time drought conditions exist in south Florida.

Selected References: Poole and Gill (eds.) 1995, Robertson and Woolfenden 1992, Rodgers et al. (eds.) 1996, Stevenson and Anderson 1994.

MANATEE
Trichechus manatus



Order: Sirenia
Family: Trichechidae
FNAI Ranks: G2/S2
U.S. Status: Endangered
FL Status: Endangered

© Brad Stith

Description: A large (182 - 400 lbs. = 400 - 900 kg), gray, nearly hairless, walrus-like aquatic mammal. Tail is broad, rounded, and flattened. Front limbs are flipper-like, with three nails; hind limbs are absent. Head is broad and undifferentiated from body. Upper lip deeply cleft and bearing stiff bristles. Eyes are small. No external ears.

Similar Species: Dolphins (Delphinidae) have dorsal fins and long, cylindrical snouts. Mermaids have long, flowing hair.

Habitat: Coastal waters, bays, rivers, and (occasionally) lakes. Requires warm-water refugia such as springs or cooling effluent during cold weather. Sheltered coves are important for feeding, resting, and calving.

Seasonal Occurrence: Wide-ranging during warm months; restricted to springs and other warm-water areas during the winter.

Florida Distribution: May be found in any coastal or estuarine waters, but most common in peninsular Florida.

Range-wide Distribution: During warm-water periods, coastal waters from Texas to North Carolina, but restricted to Florida during the winter.

MANATEE *Trichechus manatus*

Conservation Status: There are no reliable population estimates because of the difficulty in censussing. Recent winter counts at aggregation areas have been in the vicinity of 2,000 individuals. Overall population may be stable, but is threatened by increased boat traffic and other accidents associated with expanding development in Florida. Sanctuaries have been established to protect some wintering and calving areas.

Protection and Management: Reduce boat traffic in waters that manatees use regularly. Provide sanctuaries to prevent accidental collisions and harassment. Implement the manatee protection plan developed by the USGS Caribbean Science Center's Sirenia Project.

Selected References: Brown 1997, Hall 1981, Humphrey (ed.) 1992, Whitaker 1996.

Education

Biological Profiles

MANGROVE RIVULUS
Order - Cyprinodontiformes
Family - Aplocheilidae
Genus - *Rivulus*
Species - *marmoratus*

Taxonomy

Rivulus marmoratus was described by the accomplished Cuban ichthyologist, Felipe Poey in 1880. The synonym, *Rivulus ocellatus* Hensel, 1868 has been suppressed by the International Commission on Zoological Nomenclature (Opinion 1798, Case 2722) in favor of R. *marmoratus*. Other synonyms include R. *heyei* Nichols 1914, *R. marmoratus bonairensis* Hoedeman, 1958, R. *bonairensis* Hoedeman 1958, R. *garciae* de la Cruz and Dubitsky 1976, and R. *garciai* de la Cruz and Dubitsky 1976. The mangrove rivulus is the only rivulus found in North America and its presence in our waters was only recently detected.

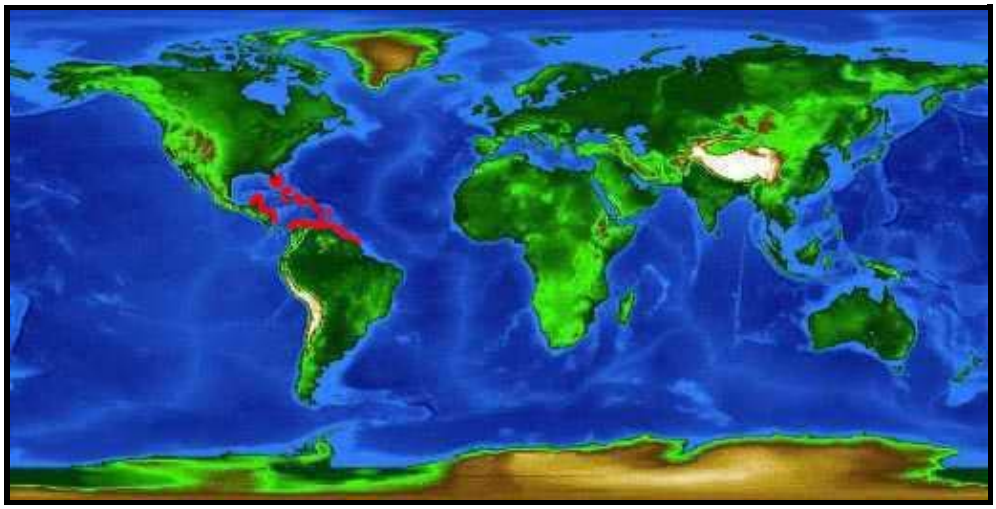
Common Names

Mangrove rivulus, manatanzas rivulus, and rivulus are common English names that refer to *R. marmoratus*. Other common names include kamulibo (Galibi), loangouma (Djuka), marmorierter (German), toumblouc (French/Creole), and wilili (Oyampi).

Geographical Distribution

The mangrove rivulus is found in the tropical and subtropical portions of the western Atlantic/Caribbean basin from central Florida to the Bahamas and Caribbean, south to Brazil including the Yucatan and Venezuela. This range closely parallels that of the range of the red mangrove (*Rhizophora mangle*), the preferred habitat of the mangrove rivulus. Its most northern range is Florida, where it is locally rare. Within the state of Florida, it is found along the Atlantic coast, north to Indian River County and south throughout all of the Keys. On the western coast, the mangrove rivulus may be found north almost to Ft. Myers. The mangrove rivulus is the widest ranging member of

the genus.



World distribution map for the mangrove rivulus

Habitat

Mangrove habitat
courtesy U.S. Geological Survey

The mangrove rivulus is primarily a saltwater or brackish water species, with limited occurrence in freshwater. It can tolerate salinities from 0-68 parts per thousand. Within the Everglades and along Florida's west coast, this fish occurs in stagnant, seasonal ponds and sloughs as well as in mosquito ditches within mangrove habitats. Along the east coast of Florida, it resides in elevated marsh habitats above the intertidal zone, often within the burrows of the great land crab (*Cardisoma guanhumi*). This preferred microhabitat may provide shelter from cool winter temperatures, allowing for a more northerly distribution of what would otherwise be possible. Great land crab burrows also provide areas of refugia during the dry season, when seasonal pools of water dry up. Fish occurring in these burrows are small, with as many as 26 fish having been recorded in a single burrow. Burrows of other crab species may be utilized when the giant land crab is absent, particularly in areas of the west Florida coast. The mangrove rivulus is able to survive in moist detritus without water for up to 60 days during periods of drought, anaerobic, or high sulfide conditions. Intraspecific aggression may also induce individuals to move to other bodies of water. This fish has been observed slithering and flipping across land during the rainy season to reach pools of water or crab burrows containing water. Epidermal capillaries are used for respiratory gas exchange during times of adverse environmental conditions. Tolerating extremes in temperature and salinity, the mangrove rivulus survive in areas where few other fish species can exist. Competitively inferior to other carnivorous fish, it avoids direct competition by residing in the harsh upper intertidal zones of mangrove habitats.

Biology

· *Distinctive Features*

The mangrove rivulus has an elongate, slender, dorso-ventrally flattened body with a rounded caudal fin. Both dorsal and anal fins are set well back on the body with the origin of the dorsal fin directly posterior to the anal fin.

· *Coloration*

The head and body are maroon to dark brown or tan, with small dark spots and speckling on the body, particularly the sides. The dorsal surface is always darker than the creamy ventral surface. The color of the body is reflective of the habitat, with light coloration in areas of light colored sediments and darker coloration in environments with dark leaf litter substrates. A large dark spot surrounded by a band of yellow is located at the upper base of the caudal fin in hermaphroditic individuals. Males lack this dark spot and have a red-orange cast to their flanks and fins.

· *Size, Age & Growth*

This fish can reach a maximum size of 2 inches (5 cm) in length, however it is more commonly observed at lengths between 0.4-1.5 inches (1.0-3.8 cm). Sexual maturity is attained by hermaphroditic fish at 90 days and primary males at 84 days of age. Sexes can be distinguished 8 weeks after fertilization of the egg occurs. Adults may live up to 5 years of age in captivity; lifespan for naturally occurring individuals is unknown.

Mangrove rivulus feeds on flying insects such as the mosquito
courtesy U.S. Department of Agriculture

· *Food Habits*

Feeding on terrestrial and aquatic invertebrates, this carnivorous fish feeds heavily when its habitat becomes flooded. Otherwise, it is an opportunistic feeder when confined to crab burrows. Ants and flying insects as well as aquatic invertebrates such as polychaete worms, gastropods, mollusks, and mosquito larvae make up the majority of the mangrove rivulus diet. The mangrove rivulus has been observed jumping out of the water to capture termites, returning to the water to swallow its prey. It may also be cannibalistic, feeding on other mangrove rivulus, while living in crab burrows containing very limited food resources.

Mangrove rivulus live in burrows of the great land crab
courtesy U.S. Environmental Protection Agency

· *Reproduction*

Functioning as hermaphrodites, the mangrove rivulus is able to fertilize their own eggs internally, producing

viable offspring. Each hermaphroditic fish produces both sperm and eggs in it ovotestes. It is the only natural example of cloning by a vertebrate organism. Males are rarely observed in the wild in Florida, but are more common throughout the Caribbean and Central America. There are two types of males, primary and secondary. Primary males develop directly from fertilized eggs while secondary males develop from hermaphroditic fish under certain environmental conditions. There is evidence that young fish sexually outcross, releasing unfertilized eggs, with the occurrence of both males and females in wild populationsl There may be an age-dependent shift in sex allocation, from female-dominated to one that is hermaphroditic-dominated as older populations have significantly higher numbers of hermaphroditic fishes. This hermaphroditic mode of reproduction may be an evolutionary response to the habitation and possible isolation within crab burrows.

Mature eggs are released near the surface of the water during different stages of development, ranging from those that have been recently fertilized to others already containing a developing embryo. Most eggs hatch 16 days after fertilization, although some may take up to 2 weeks longer. In the meantime, adult mangrove rivulus often eat these released eggs. The number of eggs released by each adult is dependent upon the size of the adult fish as well as the season, with the release of 40-75 eggs being typical. Fertilized eggs will only develop if incubated under damp conditions, hatching simultaneously with flooding of the mangrove.

The wood stork is a predator of the mangrove rivulus

· *Predators*

Predators include other fish and wood storks, as well as possibly the Atlantic saltmarsh snake which is often found in crab burrows containing mangrove rivulus.

Importance to Humans

Because of its genetic homozygosity, this fish is often the subject in toxicology and genetic research. The mangrove rivulus is easy to maintain in captivity and produce siblings that are nearly genetically identical. Along with a short life cycle, these characteristics make this fish ideal for toxicity studies of potential pollutants.

Research lab
courtesy U.S. Fish and Wildlife Service

Conservation

The mangrove rivulus was once listed as a threatened species in the Gulf of Mexico. However, recently additional surveys have revealed the existence of numerous populations. In Florida it has been downlisted as a species of special concern. In 1999, the mangrove rivulus was submitted by the National Marine Fisheries Service as a candidate for protection under the Endangered Species Act. As of yet, it has not been officially listed as endangered or threatened. It is currently considered a species of "Lower Risk/Least Concern" by the World Conservation Union (IUCN) although this classification was determined in 1996 and is noted as "out of date". The IUCN is a global union of states, governmental agencies, and non-governmental organizations in a partnership that assesses the conservation status of species.

The main threat to the survival of the mangrove rivulus is habitat degradation and destruction as well as exposure to pollutants. Disturbances that alter salinity and temperature as well as vegetation cover may also reduce naturally occurring populations of the mangrove rivulus.

Prepared by:

Cathleen Bester

ATTACHMENT B

USFWS/USACE EASTERN INDIGO SNAKE AND WOOD STORK EFFECT DETERMINATION KEYS

United States Department of the Interior
U. S. FISH AND WILDLIFE SERVICE
7915 BAYMEADOWS WAY, SUITE 200
JACKSONVILLE, FLORIDA 32256-7517

IN REPLY REFER TO:
August 13, 2013

Colonel Alan M. Dodd, District Engineer
Department of the Army
Jacksonville District Corps of Engineers
P.O Box 4970
Jacksonville, Florida 32232-0019
(Attn: Mr. David S. Hobbie)

RE: Update Addendum to USFWS Concurrence Letter to U.S. Army Corps of Engineers Regarding Use of the Attached Eastern Indigo Snake Programmatic Effect Determination Key

Dear Colonel Dodd:

This letter is to amend the January 25, 2010, letter to the U.S. Army Corps of Engineers regarding the use of the attached eastern indigo snake programmatic effect determination key (key). It supersedes the update addendum issued January 5, 2012.

We have evaluated the original programmatic concurrence and find it suitable and appropriate to extend its use to the remainder of Florida covered by the Panama City Ecological Services Office.

On Page 2

The following replaces the last paragraph above the signatures:

"Thank you for your continued cooperation in the effort to conserve fish and wildlife resources. Any questions or comments should be directed to Annie Dziergowski (North Florida ESO) at 904-731-3089, Harold Mitchell (Panama City ESO) at 850-769-0552, or Victoria Foster (South Florida ESO) at 772-469-4269."

On Page 3

The following replaces both paragraphs under "Scope of the key":

"This key should be used only in the review of permit applications for effects determinations for the eastern indigo snake within the State of Florida, and not for other listed species or for aquatic resources such as Essential Fish Habitat (EFH)."

On Page 4

The following replaces the first paragraph under Conservation Measures:

"The Service routinely concurs with the Corps' "not likely to adversely affect" (NLAA) determination for individual project effects to the eastern indigo snake when assurances are given that

our *Standard Protection Measures for the Eastern Indigo Snake* (Service 2013) located at: http://www.fws.gov/northflorida/IndigoSnakes/indigo-snakes.htm will be used during project site preparation and project construction. There is no designated critical habitat for the eastern indigo snake."

On Page 4 and Page 5 (Couplet D)

The following replaces D. under Conservation Measures:

D. The project will impact less than 25 acres of xeric habitat (scrub, sandhill, or scrubby flatwoods) or less than 25 active and inactive gopher tortoise burrows.....*go to* E

The project will impact more than 25 acres of xeric habitat (scrub, sandhill, or scrubby flatwoods) or more than 25 active and inactive gopher tortoise burrows and consultation with the Service is requested[2].....*"may affect"*

On Page 5

The following replaces footnote #3:

"[3]If excavating potentially occupied burrows, active or inactive, individuals must first obtain state authorization via a FWC Authorized Gopher Tortoise Agent permit. The excavation method selected should also minimize the potential for injury of an indigo snake. Applicants should follow the excavation guidance provided within the most current Gopher Tortoise Permitting Guidelines found at http://myfwc.com/gophertortoise ."

Thank you for making these amendments concerning the Eastern Indigo Snake Key. If you have any questions, please contact Jodie Smithem of my staff at the address on the letterhead, by email at jodie_smithem@fws.gov, or by calling (904)731-3134.

Sincerely,

Dawn Jennings
Acting Field Supervisor

cc:
Panama City Ecological Services Field Office, Panama City, FL
South Florida Ecological Services Field Office, Vero Beach, FL

United States Department of the Interior

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

January 25, 2010

David S. Hobbie
Chief, Regulatory Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Federal Activity Code: 41420-2009-FA-0642
Service Consultation Code: 41420-2009-I-0467
41910-2010-I-0045
Subject: North and South Florida Ecological Services Field Offices Programmatic Concurrence for Use of Original Eastern Indigo Snake Key(s) Until Further Notice

Dear Mr. Hobbie:

The U.S. Fish and Wildlife Service's (Service) South and North Florida Ecological Services Field Offices (FO), through consultation with the U.S. Army Corps of Engineers Jacksonville District (Corps), propose revision to both Programmatic concurrence letters/keys for the federally threatened Eastern Indigo Snake (*Drymarchon corais couperi*), (indigo snake), and now provide one key for both FO's. The original programmatic key was issued by the South Florida FO on November 9, 2007. The North Florida FO issued a revised version of the original key on September 18, 2008. Both keys were similar in content, but reflected differences in geographic work areas between the two Field Offices. The enclosed key satisfies each office's responsibilities under the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C.1531 *et seq.*).

Footnote number 3 in the original keys indicated "A member of the excavation team should be authorized for Incidental Take during excavation through either a section 10(a)(1)(A) permit issued by the Service or an incidental take permit issued by the Florida Fish and Wildlife Conservation Commission (FWC)." We have removed this reference to a Service issued Section 10(a)(1)(A) permit, as one is not necessary for this activity. We also referenced the FWC's revised April 2009 Gopher Tortoise Permitting Guidelines with a link to their website for updated excavation guidance, and have provided a website link to our Standard Protection Measures. All other conditions and criteria apply.

We believe the implementation of the attached key achieves our mutual goal for all users to make consistent effect determinations regarding this species. The use of this key for review of projects

located in all referenced counties in our respective geographic work areas leads the Service to concur with the Corps' determination of "may affect, not likely to adversely affect" (MANLAA) for the Eastern indigo snake. The biological rationale for the determinations is contained within the referenced documents and is submitted in accordance with section 7 of the Act.

Should circumstances change or new information become available regarding the eastern indigo snake or implementation of the key, the determinations may be reconsidered as deemed necessary.

Thank you for your continued cooperation in the effort to conserve fish and wildlife resources. Any questions or comments should be directed to either Allen Webb (Vero Beach) at 772-562-3909, extension 246, or Jay Herrington (Jacksonville) at 904-731-3326.

Sincerely,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

David L. Hankla
Field Supervisor
North Florida Ecological Services Office

Enclosure

cc: electronic only
FWC, Tallahassee, Florida (Dr. Elsa Haubold)
Service, Jacksonville, Florida (Jay Herrington)
Service, Vero Beach, Florida (Sandra Sneckenberger)

Eastern Indigo Snake Programmatic Effect Determination Key

Scope of the key

This key should be used only in the review of permit applications for effects determinations within the North and South Florida Ecological Services Field Offices Geographic Areas of Responsibility (GAR), and not for other listed species or for aquatic resources such as Essential Fish Habitat (EFH). Counties within the **North** Florida GAR include Alachua, Baker, Bradford, Brevard, Citrus, Clay, Columbia, Dixie, Duval, Flagler, Gilchrist, Hamilton, Hernando, Hillsborough, Lafayette, Lake, Levy, Madison, Manatee, Marion, Nassau, Orange, Pasco, Pinellas, Putnam, St. Johns, Seminole, Sumter, Suwannee, Taylor, Union, and Volusia.

Counties in the **South** Florida GAR include Broward, Charlotte, Collier, De Soto, Glades, Hardee, Hendry, Highlands, Lee, Indian River, Martin, Miami-Dade, Monroe, Okeechobee, Osceola, Palm Beach, Polk, Sarasota, St. Lucie.

Habitat

Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats (Service 1999). Eastern indigo snakes appear to need a mosaic of habitats to complete their life cycle. Wherever the eastern indigo snake occurs in xeric habitats, it is closely associated with the gopher tortoise *(Gopherus polyphemus),* the burrows of which provide shelter from winter cold and summer desiccation (Speake et al. 1978; Layne and Steiner 1996). Interspersion of tortoise-inhabited uplands and wetlands improves habitat quality for this species (Landers and Speake 1980; Auffenberg and Franz 1982).

In south Florida, agricultural sites, such as sugar cane fields, created in former wetland areas are occupied by eastern indigo snakes (Enge pers. comm. 2007). Formerly, indigo snakes would have only occupied higher elevation sites within the wetlands. The introduction of agriculture and its associated canal systems has resulted in an increase in rodents and other species of snakes that are prey for eastern indigo snakes. The result is that indigos occur at higher densities in these areas than they did historically.

Even though thermal stress may not be a limiting factor throughout the year in south Florida, indigo snakes still seek and use underground refugia. On the sandy central ridge of central Florida, eastern indigos use gopher tortoise burrows more (62 percent) than other underground refugia (Layne and Steiner 1996). Other underground refugia used include armadillo (*Dasypus novemcinctus*) burrows near citrus groves, cotton rat (*Sigmodon hispidus*) burrows, and land crab (*Cardisoma guanhumi*) burrows in coastal areas (Service 2006). Natural ground holes, hollows at the base of trees or shrubs, ground litter, trash piles, and crevices of rock-lined ditch walls are also used (Layne and Steiner 1996). These refugia are used most frequently where tortoise burrows are not available, principally in low-lying areas off the central and coastal ridges. In extreme south Florida (the Everglades and Florida Keys), indigo snakes are found in tropical

hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (Steiner et al. 1983). It is suspected that they prefer hammocks and pine forests, because most observations occur in these habitats disproportionately to their presence in the landscape (Steiner et al. 1983). Hammocks may be important breeding areas as juveniles are typically found there. The eastern indigo snake is a snake-eater so the presence of other snake species may be a good indicator of habitat quality.

Conservation Measures

The Service routinely concurs with the Corps' "not likely to adversely affect" (NLAA) determination for individual project effects to the eastern indigo snake when assurances are given that our *Standard Protection Measures for the Eastern Indigo Snake* (Service 2004) located at: http://www.fws.gov/northflorida/IndigoSnakes/indigo-snakes will be used during project site preparation and project construction. There is no designated critical habitat for the eastern indigo snake.

In an effort to reduce correspondence in effect determinations and responses, the Service is providing an Eastern Indigo Snake Effect Determination Key, similar in utility to the West Indian Manatee Effect Determination Key and the Wood Stork Effect Determination Keys presently being utilized by the Corps. If the use of this key results in a Corps' determination of "no effect" for a particular project, the Service supports this determination. If the use of this Key results in a determination of NLAA, the Service concurs with this determination and no additional correspondence will be necessary[1]. This key is subject to revisitation as the Corps and Service deem necessary.

A. Project is not located in open water or salt marsh.....*go to* B

   Project is located solely in open water or salt marsh.....*"no effect"*

B. Permit will be conditioned for use of the Service's *Standard Protection Measures For The Eastern Indigo Snake* during site preparation and project construction.....*go to* C

   Permit will not be conditioned as above for the eastern indigo snake, or it is not known whether an applicant intends to use these measures and consultation with the Service is requested[2] .....*"may affect"*

C. There are gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured during project activities .....*go to* D

   There are no gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured during project activities .....*"NLAA"*

D. The project will impact less than 25 acres of xeric habitat supporting less than 25 active and inactive gopher tortoise burrows.....*go to* E

The project will impact more than 25 acres of xeric habitat or more than 25 active and inactive gopher tortoise burrows and consultation with the Service is requested[2]..... *"may affect"*

E. Any permit will be conditioned such that all gopher tortoise burrows, active or inactive, will be evacuated prior to site manipulation in the vicinity of the burrow[3]. If an indigo snake is encountered, the snake must be allowed to vacate the area prior to additional site manipulation in the vicinity. Any permit will also be conditioned such that holes, cavities, and snake refugia other than gopher tortoise burrows will be inspected each morning before planned site manipulation of a particular area, and, if occupied by an indigo snake, no work will commence until the snake has vacated the vicinity of proposed work..... *"NLAA"*

Permit will not be conditioned as outlined above and consultation with the Service is requested[2] ..... *"may affect"*

---

[1]With an outcome of "no effect" or "NLAA" as outlined in this key, the requirements of section 7 of the Act are fulfilled for the eastern indigo snake and no further action is required.

[2]Consultation may be concluded informally or formally depending on project impacts.

[3] If burrow excavation is utilized, it should be performed by experienced personnel. The method used should minimize the potential for injury of an indigo snake. Applicants should follow the excavation guidance provided within the Florida Fish and Wildlife Conservation Commission's revised April 2009 Gopher Tortoise Permitting Guidelines located at **http://myfwc.com/License/Permits_ProtectedWildlife.htm#gophertortoise**. A member of the excavation team should be authorized for Incidental Take during excavation through an incidental take permit issued by the Florida Fish and Wildlife Conservation Commission.

United States Department of the Interior

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

May 18, 2010

Donnie Kinard
Chief, Regulatory Division
Jacksonville District Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Federal Activity Code: 41420-2007-FA-1494
Service Consultation Code: 41420-2007-I-0964
Subject: South Florida Programmatic Concurrence
Species: Wood Stork

Dear Mr. Kinard:

This letter addresses minor errors identified in our January 25, 2010, wood stork key and as such, supplants the previous key. The key criteria and wood stork biomass foraging assessment methodology have not been affected by these minor revisions.

The Fish and Wildlife Service's (Service) South Florida Ecological Services Office (SFESO) and the U.S. Army Corps of Engineers Jacksonville District (Corps) have been working together to streamline the consultation process for federally listed species associated with the Corps' wetland permitting program. The Service provided letters to the Corps dated March 23, 2007, and October 18, 2007, in response to a request for a multi-county programmatic concurrence with a criteria-based determination of "may affect, not likely to adversely affect" (NLAA) for the threatened eastern indigo snake (*Drymarchon corais couperi*) and the endangered wood stork (*Mycteria americana*) for projects involving freshwater wetland impacts within specified Florida counties. In our letters, we provided effect determination keys for these two federally listed species, with specific criteria for the Service to concur with a determination of NLAA.

The Service has revisited these keys recently and believes new information provides cause to revise these keys. Specifically, the new information relates to foraging efficiencies and prey base assessments for the wood stork and permitting requirements for the eastern indigo snake. This letter addresses the wood stork key and is submitted 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.*). The eastern indigo snake key will be provided in a separate letter.

Wood stork

Habitat

The wood stork is primarily associated with freshwater and estuarine habitats that are used for nesting, roosting, and foraging. Wood storks typically construct their nests in medium to tall

trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water (Ogden 1991, 1996; Rodgers et al. 1996). Successful colonies are those that have limited human disturbance and low exposure to land-based predators. Nesting colonies protected from land-based predators are characterized as those surrounded by large expanses of open water or where the nest trees are inundated at the onset of nesting and remain inundated throughout most of the breeding cycle. These colonies have water depths between 0.9 and 1.5 meters (3 and 5 feet) during the breeding season.

Successful nesting generally involves combinations of average or above-average rainfall during the summer rainy season and an absence of unusually rainy or cold weather during the winter-spring breeding season (Kahl 1964; Rodgers et al. 1987). This pattern produces widespread and prolonged flooding of summer marshes, which maximize production of freshwater fishes, followed by steady drying that concentrate fish during the season when storks nest (Kahl 1964). Successful nesting colonies are those that have a large number of foraging sites. To maintain a wide range of foraging sites, a variety of wetland types should be present, with both short and long hydroperiods. The Service (1999) describes a short hydroperiod as a 1 to 5-month wet/dry cycle, and a long hydroperiod as greater than 5 months. During the wet season, wood storks generally feed in the shallow water of the short-hydroperiod wetlands and in coastal habitats during low tide. During the dry season, foraging shifts to longer hydroperiod interior wetlands as they progressively dry-down (though usually retaining some surface water throughout the dry season).

Wood storks occur in a wide variety of wetland habitats. Typical foraging sites for the wood stork include freshwater marshes and stock ponds, shallow, seasonally flooded roadside and agricultural ditches, narrow tidal creeks and shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs. Because of their specialized feeding behavior, wood storks forage most effectively in shallow-water areas with highly concentrated prey. Through tactolocation, or grope feeding, wood storks in south Florida feed almost exclusively on fish between 2 and 25 centimeters [cm] (1 and 10 inches) in length (Ogden et al. 1976). Good foraging conditions are characterized by water that is relatively calm, uncluttered by dense thickets of aquatic vegetation, and having a water depth between 5 and 38 cm (5 and 15 inches) deep, although wood storks may forage in other wetlands. Ideally, preferred foraging wetlands would include a mosaic of emergent and shallow open-water areas. The emergent component provides nursery habitat for small fish, frogs, and other aquatic prey and the shallow, open-water areas provide sites for concentration of the prey during seasonal dry-down of the wetland.

Conservation Measures

The Service routinely concurs with the Corps' "may affect, not likely to adversely affect" determination for individual project effects to the wood stork when project effects are insignificant due to scope or location, or if assurances are given that wetland impacts have been avoided, minimized, and adequately compensated such that there is no net loss in foraging potential. We utilize our *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Service 1990) (Enclosure 1) (HMG) in project evaluation. The HMG is currently under review and once final will replace the enclosed HMG. There is no designated critical habitat for the wood stork.

The SFESO recognizes a 29.9 kilometer [km] (18.6-mile) core foraging area (CFA) around all known wood stork colonies in south Florida. Enclosure 2 (to be updated as necessary) provides locations of colonies and their CFAs in south Florida that have been documented as active within the last 10 years. The Service believes loss of suitable wetlands within these CFAs may reduce foraging opportunities for the wood stork. To minimize adverse effects to the wood stork, we recommend compensation be provided for impacts to foraging habitat. The compensation should consider wetland type, location, function, and value (hydrology, vegetation, prey utilization) to ensure that wetland functions lost due to the project are adequately offset. Wetlands offered as compensation should be of the same hydroperiod and located within the CFAs of the affected wood stork colonies. The Service may accept, under special circumstances, wetland compensation located outside the CFAs of the affected wood stork nesting colonies. On occasion, wetland credits purchased from a "Service Approved" mitigation bank located outside the CFAs could be acceptable to the Service, depending on location of impacted wetlands relative to the permitted service area of the bank, and whether or not the bank has wetlands having the same hydroperiod as the impacted wetland.

In an effort to reduce correspondence in effect determinations and responses, the Service is providing the Wood Stork Effect Determination Key below. If the use of this key results in a Corps determination of "no effect" for a particular project, the Service supports this determination. If the use of this Key results in a determination of NLAA, the Service concurs with this determination[1]. This Key is subject to revisitation as the Corps and Service deem necessary.

The Key is as follows:

A. Project within 0.76 km (0.47 mile)[2] of an active colony site[3] ..... "*may affect*[4]"

Project impacts Suitable Foraging Habitat (SFH)[5] at a location greater than 0.76 km (0.47 mile) from a colony site..... ....."*go to* B"

---

[1] With an outcome of "no effect" or "NLAA" as outlined in this key, and the project has less than 20.2 hectares (50 acres) of wetland impacts, the requirements of section 7 of the Act are fulfilled for the wood stork and no further action is required. For projects with greater than 20.2 hectares (50 acres) of wetland impacts, written concurrence of NLAA from the Service is necessary.

[2] Within the secondary zone (the average distance from the border of a colony to the limits of the secondary zone is 0.76 km (2,500 feet, or 0.47 mi).

[3] An active colony is defined as a colony that is currently being used for nesting by wood storks or has historically over the last 10 years been used for nesting by wood storks.

[4] Consultation may be concluded informally or formally depending on project impacts.

[5] Suitable foraging habitat (SFH) includes wetlands that typically have shallow-open water areas that are relatively calm and have a permanent or seasonal water depth between 5 to 38 cm (2 to 15 inches) deep. Other shallow non-wetland water bodies are also SFH. SFH supports and concentrates, or is capable of supporting and concentrating small fish, frogs, and other aquatic prey. Examples of SFH include, but are not limited to freshwater marshes, small ponds, shallow, seasonally flooded roadside or agricultural ditches, seasonally flooded pastures, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs.

Project does not affect SFH……..…..*"no effect[1]".*

B. Project impact to SFH is less than 0.20 hectare (one-half acre)[6]……..……*NLAA[1]"*

Project impact to SFH is greater in scope than 0.20 hectare (one-half acre)....……*go to* C

C. Project impacts to SFH not within the CFA (29.9 km, 18.6 miles) of a colony site ……..…….…….…..……*go to* D

Project impacts to SFH within the CFA of a colony site …….…..…...…….*go to* E

D. Project impacts to SFH have been avoided and minimized to the extent practicable; compensation (Service approved mitigation bank or as provided in accordance with Mitigation Rule 33 CFR Part 332) for unavoidable impacts is proposed in accordance with the CWA section 404(b)(1) guidelines; and habitat compensation replaces the foraging value matching the hydroperiod[7] of the wetlands affected and provides foraging value similar to, or higher than, that of impacted wetlands. See Enclosure 3 for a detailed discussion of the hydroperiod foraging values, an example, and further guidance[8]…….. *NLAA[1]"*

Project not as above.……... *"may affect[4]"*

E. Project provides SFH compensation in accordance with the CWA section 404(b)(1) guidelines and is not contrary to the HMG; habitat compensation is within the appropriate CFA or within the service area of a Service-approved mitigation bank; and habitat compensation replaces foraging value, consisting of wetland enhancement or restoration matching the hydroperiod[7] of the wetlands affected, and provides foraging value similar

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[6] On an individual basis, SFH impacts to wetlands less than 0.20 hectare (one-half acre) generally will not have a measurable effect on wood storks, although we request that the Corps require mitigation for these losses when appropriate. Wood storks are a wide ranging species, and individually, habitat change from impacts to SFH less than one-half acre are not likely to adversely affect wood storks. However, collectively they may have an effect and therefore regular monitoring and reporting of these effects are important.

[7] Several 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 early nestling survivor value for wood storks than the foraging base (grams of fish per square meter) than long hydroperiod wetlands provide. Although the short hydroperiod wetlands may provide less fish, these prey bases historically were more extensive and met the foraging needs of the pre-nesting storks and the early-age nestlings. Nest productivity may suffer as a result of the loss of short hydroperiod wetlands. We believe that most wetland fill and excavation impacts permitted in south Florida are in short hydroperiod wetlands. Therefore, we believe that it is especially important that impacts to these short hydroperiod wetlands within CFAs are avoided, minimized, and compensated for by enhancement/restoration of short hydroperiod wetlands.

[8] For this Key, the Service requires an analysis of foraging prey base losses and enhancements from the proposed action as shown in the examples in Enclosure 3 for projects with greater than 2.02 hectares (5 acres) of wetland impacts. For projects with less than 2.02 hectares (5 acres) of wetland impacts, an individual foraging prey base analysis is not necessary although type for type wetland compensation is still a requirement of the Key.

to, or higher than, that of impacted wetlands. See Enclosure 3 for a detailed discussion of the hydroperiod foraging values, an example, and further guidance[8]..... *"NLAA[1]"*

Project does not satisfy these elements ..... *"may affect[4]"*

This Key does not apply to Comprehensive Everglades Restoration Plan projects, as they will require project-specific consultations with the Service.

Monitoring and Reporting Effects

For the Service to monitor cumulative effects, it is important for the Corps to monitor the number of permits and provide information to the Service regarding the number of permits issued where the effect determination was: "may affect, not likely to adversely affect." We request that the Corps send us an annual summary consisting of: project dates, Corps identification numbers, project acreages, project wetland acreages, and project locations in latitude and longitude in decimal degrees.

Thank you for your cooperation and effort in protecting federally listed species. If you have any questions, please contact Allen Webb at extension 246.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

Enclosures

cc: w/enclosures (electronic only)
Corps, Jacksonville, Florida (Stu Santos)
EPA, West Palm Beach, Florida (Richard Harvey)
FWC, Vero Beach, Florida (Joe Walsh)
Service, Jacksonville, Florida (Billy Brooks)

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HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

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HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

Introduction

A number of Federal and state laws and/or regulations prohibit, cumulatively, such acts as harrassing, disturbing, harming, molesting, pursuing, etc., wood storks, or destroying their nests (see Section VII). Although advisory in nature, these guidelines represent a biological interpretation of what would constitute violations of one or more of such prohibited acts. Their purpose is to mainain and/or improve the environmental conditions that are required for the survival and well-being of wood storks in the southeastern United States, and are designed essentially for application in wood stork/human activity conflicts (principally land development and human intrusion into stork use sites). The emphasis is to avoid or minimize detrimental human-related impacts on wood storks. These guidelines were prepared in consultations with state wildlife agencies and wood stork experts in the four southeastern states where the wood stork is listed as Endangered (Alabama, Florida, Georgia, South Carolina).

General

The wood stork is a gregarious species, which nests in colonies (rookeries), and roosts and feeds in flocks, often in association with other species of long-legged water birds. Storks that nest in the southeastern United States appear to represent a distinct population, separate from the nearest breeding population in Mexico. Storks in the southeastern U.S. population have recently (since 1980) nested in colonies scattered throughout Florida, and at several central-southern Georgia and coastal South Carolina sites. Banded and color-marked storks from central and southern Florida colonies have dispersed during non-breeding seasons as far north as southern Georgia, and the coastal counties in South Carolina and southeastern North Carolina, and as far west as central Alabama and northeastern Mississippi. Storks from a colony in south-central Georgia have wintered between southern Georgia and southern Florida. This U.S. nesting population of wood storks was listed as endangered by the U.S. Fish and Wildlife Service on February 28, 1984 (*Federal Register* 49(4):7332-7335).

Wood storks use freshwater and estuarine wetlands as feeding, nesting, and roosting sites. Although storks are not habitat specialists, their needs are exacting enough, and available habitat is limited enough, so that nesting success and the size of regional populations are closely regulated by year-to-year differences in the quality and quantity of suitable habitat. Storks are especially sensitive to environmental conditions at feeding sites; thus, birds may fly relatively long distances either daily or between regions annually, seeking adequate food resources.

All available evidence suggests that regional declines in wood stork numbers have been largely due to the loss or degradation of essential wetland habitat. An understanding of the qualities of good stork habitat should help to focus protection efforts on those sites

that are seasonally important to regional populations of wood storks. Characteristics of feeding, nesting, and roosting habitat, and management guidelines for each, are presented here by habitat type.

I. Feeding habitat.

A major reason for the wood stork decline has been the loss and degredation of feeding habitat. Storks are especially sensitive to any manipulation of a wetland site that results in either reduced amounts or changes in the timing of food availability.

Storks feed primarily (often almost exclusively) on small fish between 1 and 8 inches in length. Successful foraging sites are those where the water is between 2 and 15 inches deep. Good feeding conditions usually occur where water is relatively calm and uncluttered by dense thickets of aquatic vegetation. Often a dropping water level is necessary to concentrate fish at suitable densities. Conversely, a rise in water, especially when it occurs abruptly, disperses fish and reduces the value of a site as feeding habitat.

The types of wetland sites that provide good feeding conditions for storks include: drying marshes or stock ponds, shallow roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, and depressions in cypress heads or swamp sloughs. In fact, almost any shallow wetland depression where fish tend to become concentrated, either through local reproduction or the consequences of area drying, may be used by storks.

Nesting wood storks do most of their feeding in wetlands between 5 and 40 miles from the colony, and occasionally at distances as great as 75 miles. Within this colony foraging range and for the 110-150 day life of the colony, and depending on the size of the colony and the nature of the surrounding wetlands, anywhere from 50 to 200 different feeding sites may be used during the breeding season.

Non-breeding storks are free to travel much greater distances and remain in a region only for as long as sufficient food is available. Whether used by breeders or non-breeders, any single feeding site may at one time have small or large numbers of storks (1 to 100+), and be used for one to many days, depending on the quality and quantity of available food. Obviously, feeding sites used by relatively large numbers of storks, and/or frequently used areas, potentially are the more important sites necessary for the maintenance of a regional population of birds.

Differences between years in the seasonal distribution and amount of rainfall usually mean that storks will differ between years in where and when they feed. Successful nesting colonies are those that have a large number of feeding site options, including sites that may be suitable only in years of rainfall extremes. To maintain the wide range of feeding site options requires that many different wetlands, with both relatively short and long annual hydroperiods, be preserved. For example, protecting only the larger wetlands, or those with longer annual hydroperiods, will result in the eventual loss of smaller, seemingly less important wetlands. However, these small scale wetlands are crucial as the only available feeding sites during the wetter periods when the larger habitats are too deeply flooded to be used by storks.

II. Nesting habitat.

Wood storks nest in colonies, and will return to the same colony site for many years so long as that site and surrounding feeding habitat continue to supply the needs of the birds. Storks require between 110 and 150 days for the annual nesting cycle, from the period of courtship until the nestlings become independent. Nesting activity may begin as early as December or as late as March in southern Florida colonies, and between late February and April in colonies located between central Florida and South Carolina. Thus, full term colonies may be active until June-July in south Florida, and as late as July-August at more northern sites. Colony sites may also be used for roosting by storks during other times of the year.

Almost all recent nesting colonies in the southeastern U.S. have been located either in woody vegetation over standing water, or on islands surrounded by broad expanses of open water. The most dominant vegetation in swamp colonies has been cypress, although storks also nest in swamp hardwoods and willows. Nests in island colonies may be in more diverse vegetation, including mangroves (coastal), exotic species such as Australian pine (*Casuarina*) and Brazilian Pepper (*Schinus*), or in low thickets of cactus (*Opuntia*). Nests are usually located 15-75 feet above ground, but may be much lower, especially on island sites when vegetation is low.

Since at least the early 1970's, many colonies in the southeastern U.S. have been located in swamps where water has been impounded due to the construction of levees or roadways. Storks have also nested in dead and dying trees in flooded phosphate surface mines, or in low, woody vegetation on mounded, dredge islands. The use of these altered wetlands or completely "artificial" sites suggests that in some regions or years storks are unable to locate natural nesting habitat that is adequately flooded during the normal breeding season. The readiness with which storks will utilize water impoundments for nesting also suggests that colony sites could be intentionally created and maintained through long-term site management plans. Almost all impoundment sites used by storks become suitable for nesting only fortuitously, and therefore, these sites often do not remain available to storks for many years.

In addition to the irreversible impacts of drainage and destruction of nesting habitat, the greatest threats to colony sites are from human disturbance and predation. Nesting storks show some variation in the levels of human activity they will tolerate near a colony. In general, nesting storks are more tolerant of low levels of human activity near a colony when nests are high in trees than when they are low, and when nests contain partially or completely feathered young than during the period between nest construction and the early nestling period (adults still brooding). When adult storks are forced to leave their nests, eggs or downy young may die quickly (<20 minutes) when exposed to direct sun or rain.

Colonies located in flooded environments must remain flooded if they are to be successful. Often water is between 3 and 5 feet deep in successful colonies during the nesting season. Storks rarely form colonies, even in traditional nesting sites, when they are dry, and may abandon nests if sites become dry during the nesting period. Flooding in colonies may be most important as a defense against mammalian predators. Studies of stork colonies in Georgia and

Florida have shown high rates of raccoon predation when sites dried during the nesting period. A reasonably high water level in an active colony is also a deterrent against both human and domestic animal intrusions.

Although nesting wood storks usually do most feeding away from the colony site (>5 miles), considerable stork activity does occur close to the colony during two periods in the nesting cycle. Adult storks collect almost all nesting material in and near the colony, usually within 2500 feet. Newly fledged storks, near the end of the nesting cycle, spend from 1-4 weeks during the fledging process flying locally in the colony area, and perched in nearby trees or marshy spots on the ground. These birds return daily to their nests to be fed. It is essential that these fledging birds have little or no disturbance as far our as one-half mile within at least one or two quadrants from the colony. Both the adults, while collecting nesting material, and the inexperienced fledglings, do much low, flapping flight within this radius of the colony. At these times, storks potentially are much more likely to strike nearby towers or utility lines.

Colony sites are not necessarily used annually. Regional populations of storks shift nesting locations between years, in response to year-to-year differences in food resources. Thus, regional populations require a range of options for nesting sites, in order to successfully respond to food availability. Protection of colony sites should continue, therefore, for sites that are not used in a given year.

III. Roosting habitat.

Although wood storks tend to roost at sites that are similar to those used for nesting, they also use a wider range of site types for roosting than for nesting. Non-breeding storks, for example, may frequently change roosting sites in response to changing feeding locations, and in the process, are inclined to accept a broad range of relatively temporary roosting sites. Included in the list of frequently used roosting locations are cypress "heads" or swamps (not necessarily flooded if trees are tall), mangrove islands, expansive willow thickets or small, isolated willow "islands" in broad marshes, and on the ground either on levees or in open marshes.

Daily activity patterns at a roost vary depending on the status of the storks using the site. Non-breeding adults or immature birds may remain in roosts during major portions of some days. When storks are feeding close to a roost, they may remain on the feeding grounds until almost dark before making the short flight. Nesting storks traveling long distances (>40 miles) to feeding sites may roost at or near the latter, and return to the colony the next morning. Storks leaving roosts, especially when going long distances, tend to wait for mid-morning thermals to develop before departing.

IV. Management zones and guidelines for feeding sites.

To the maximum extent possible, feeding sites should be protected by adherence to the following protection zones and guidelines:

A. There should be no human intrusion into feeding sites when storks are present. Depending upon the amount of screening vegetation, human activity should be no closer than between 300 feet (where solid vegetation screens exist) and 750 feet (no vegetation screen).

B. Feeding sites should not be subjected to water management practices that alter traditional water levels or the seasonally normal drying patterns and rates. Sharp rises in water levels are especially disruptive to feeding storks.

C. The introduction of contaminants, fertilizers, or herbicides into wetlands that contain stork feeding sites should be avoided, especially those compounds that could adversely alter the diversity and numbers of native fishes, or that could substantially change the characteristics of aquatic vegetation. Increase in the density and height of emergent vegetation can degrade or destroy sites as feeding habitat.

D. Construction of tall towers (especially with guy wires) within three miles, or high power lines (especially across long stretches of open country) within one mile of major feeding sites should be avoided.

V. Management zones and guidelines for nesting colonies.

A. Primary zone: This is the most critical area, and must be managed according to recommended guidelines to insure that a colony site survives.

1. Size: The primary zone must extend between 1000 and 1500 feet in all directions from the actual colony boundaries when there are no visual or broad aquatic barriers, and never less than 500 feet even when there are strong visual or aquatic barriers. The exact width of the primary zone in each direction from the colony can vary within this range, depending on the amount of visual screen (tall trees) surrounding the colony, the amount of relatively deep, open water between the colony and the nearest human activity, and the nature of the nearest human activity. In general, storks forming new colonies are more tolerant of existing human activity, than they will be of new human activity that begins after the colony has formed.

2. Recommended Restrictions:

a. Any of the following activities within the primary zone, at any time of the year, are likely to be detrimental to the colony:

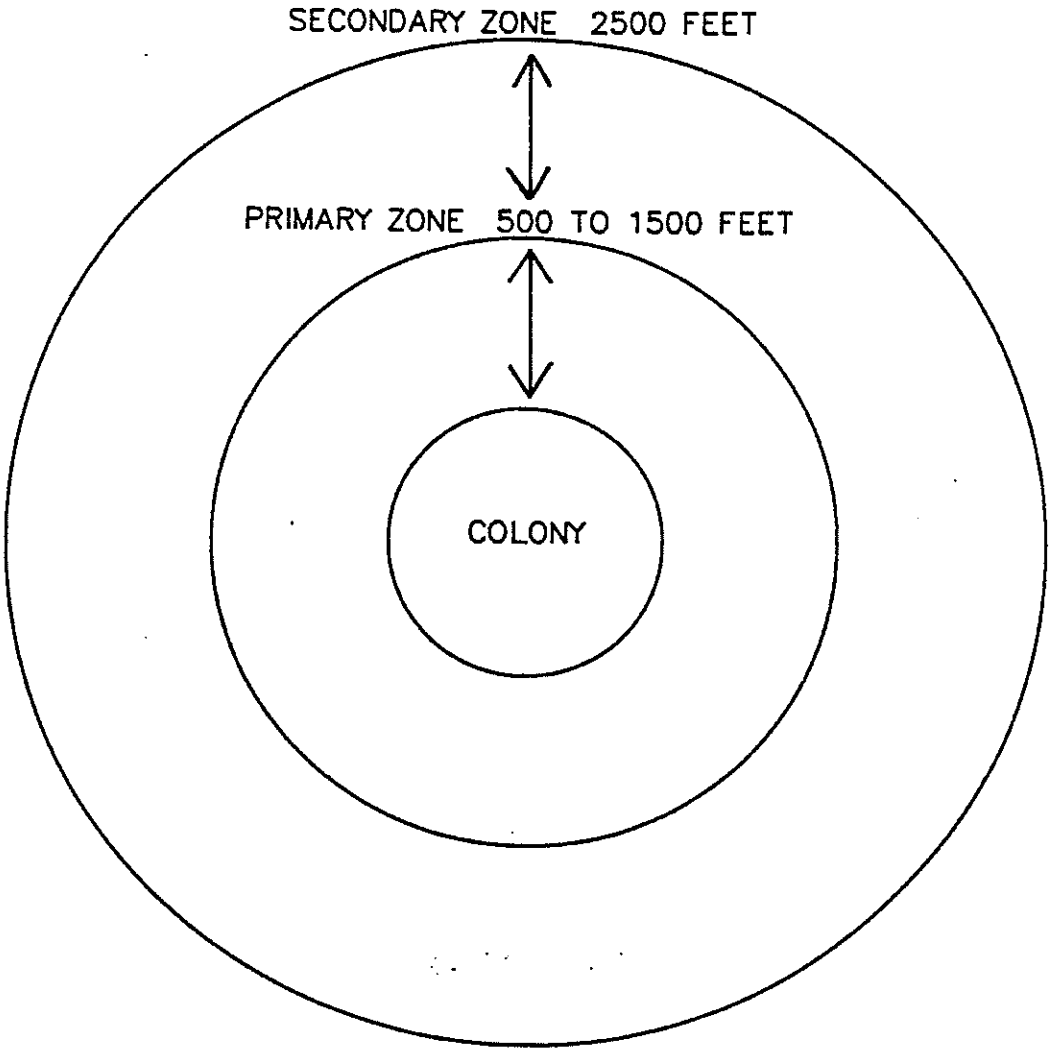
(1) Any lumbering or other removal of vegetation, and

(2) Any activity that reduces the area, depth, or length of flooding in wetlands under and surrounding the colony, except where periodic (less than annual) water control may be required to maintain the health of the aquatic, woody vegetation, and

(3) The construction of any building, roadway, tower, power line, canal, etc.

b. The following activities within the primary zone are likely to be detrimental to a colony if they occur when the colony is active:

(1) Any unauthorized human entry closer than 300 feet of the colony, and


SECONDARY ZONE 2500 FEET
PRIMARY ZONE 500 TO 1500 FEET
COLONY

(2) Any increase or irregular pattern in human activity anywhere in the primary zone, and

(3) Any increase or irregular pattern in activity by animals, including livestock or pets, in the colony, and

(4) Any aircraft operation closer than 500 feet of the colony.

B. Secondary Zone: Restrictions in this zone are needed to minimize disturbances that might impact the primary zone, and to protect essential areas outside of the primary zone. The secondary zone may be used by storks for collecting nesting material, for roosting, loafing, and feeding (especially important to newly fledged young), and may be important as a screen between the colony and areas of relatively intense human activities.

1. Size: The secondary zone should range outward from the primary zone 1000-2000 feet, or to a radius of 2500 feet of the outer edge of the colony.

2. Recommended Restrictions:

a. Activities in the secondary zone which may be detrimental to nesting wood storks include:

(1) Any increase in human activities above the level that existed in the year when the colony first formed, especially when visual screens are lacking, and

(2) Any alteration in the area's hydrology that might cause changes in the primary zone, and

(3) Any substantial (>20 percent) decrease in the area of wetlands and woods of potential value to storks for roosting and feeding.

b. In addition, the probability that low flying storks, or inexperienced, newly-fledged young will strike tall obstructions, requires that high-tension power lines be no closer than one mile (especially across open country or in wetlands) and tall trans-mission towers no closer than 3 miles from active colonies. Other activities, including busy highways and commercial and residential buildings may be present in limited portions of the secondary zone at the time that a new colony first forms. Although storks may tolerate existing levels of human activities, it is important that these human activities not expand substantially.

VI. Roosting site guidelines.

The general characteristics and temporary use-patterns of many stork roosting sites limit the number of specific management recommendations that are possible:

A. Avoid human activities within 500-1000 feet of roost sites during seasons of the year and times of the day when storks may be present. Nocturnal activities in active roosts may be especially disruptive.

B. Protect the vegetative and hydrological characteristics of the more important roosting sites--those used annually and/or used by flocks of 25 or more storks. Potentially, roosting sites may, some day, become nesting sites.

VII. Legal Considerations.

A. Federal Statutes

The U.S. breeding population of the wood stork is protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act). The population was listed as endangered on February 28, 1984 (49 Federal *Register* 7332); wood storks breeding in Alabama, Florida, Georgia, and South Carolina are protected by the Act.

Section 9 of the Endangered Species Act of 1973, as amended, states that it is unlawful for any person subject to the jurisdiction of the United States to take (defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.") any listed species anywhere within the United States.

The wood stork is also federally protected by its listing (50 CFR 10.13) under the Migratory Bird Treaty Act (167 U.S.C. 703-711), which prohibits the taking, killing or possession of migratory birds except as permitted.

B. State Statutes

1. State of Alabama

Section 9-11-232 of Alabama's Fish, Game, and Wildlife regulations curtails the possession, sale, and purchase of wild birds. "Any person, firm, association, or corporation who takes, catches, kills or has in possession at any time, living or dead, any protected wild bird not a game bird or who sells or offers for sale, buys, purchases or offers to buy or purchase any such bird or exchange same for anything of value or who shall sell or expose for sale or buy any part of the plumage, skin, or body of any bird protected by the laws of this state or who shall take or willfully destroy the nests of any wild bird or who shall have such nests or eggs of such birds in his possession, except as otherwise provided by law, shall be guilty of a misdemeanor...

Section 1 of the Alabama Nongame Species Regulation (Regulation 87-GF-7) includes the wood stork in the list of nongame species covered by paragraph (4). " It shall be unlawful to take, capture, kill, possess, sell, trade for anything of monetary value, or offer to sell or trade for anything of monetary value, the following nongame wildlife species (or any parts or reproductive products of such species) without a scientific collection permit and written permission from the Commissioner, Department of Conservation and Natural Resources,..."

2. State of Florida

Rule 39-4.001 of the Florida Wildlife Code prohibits "taking, attempting to take, pursuing, hunting, molesting, capturing, or killing (collectively defined as "taking"), transporting, storing, serving, buying, selling,

possessing, or wantonly or willingly wasting any wildlife or freshwater fish or their nests, eggs, young, homes, or dens except as specifically provided for in other rules of Chapter 39, Florida Administrative Code.

Rule 39-27.011 of the Florida Wildlife Code prohibits "killing, attempting to kill, or wounding any endangered species." The "Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida" dated 1 July 1988, includes the wood stork, listed as "endangered" by the Florida Game and Fresh Water Fish Commission.

3. State of Georgia

Section 27-1-28 of the Conservation and Natural Resources Code states that "Except as otherwise provided by law, rule, or regulation, it shall be unlawful to hunt, trap, fish, take, possess, or transport any nongame species of wildlife..."

Section 27-1-30 states that, "Except as otherwise provided by law or regulation, it shall be unlawful to disturb, mutilate, or destroy the dens, holes, or homes of any wildlife; "

Section 27-3-22 states, in part, "It shall be unlawful for any person to hunt, trap, take, possess, sell, purchase, ship, or transport any hawk, eagle, owl, or any other bird or any part, nest, or egg thereof...".

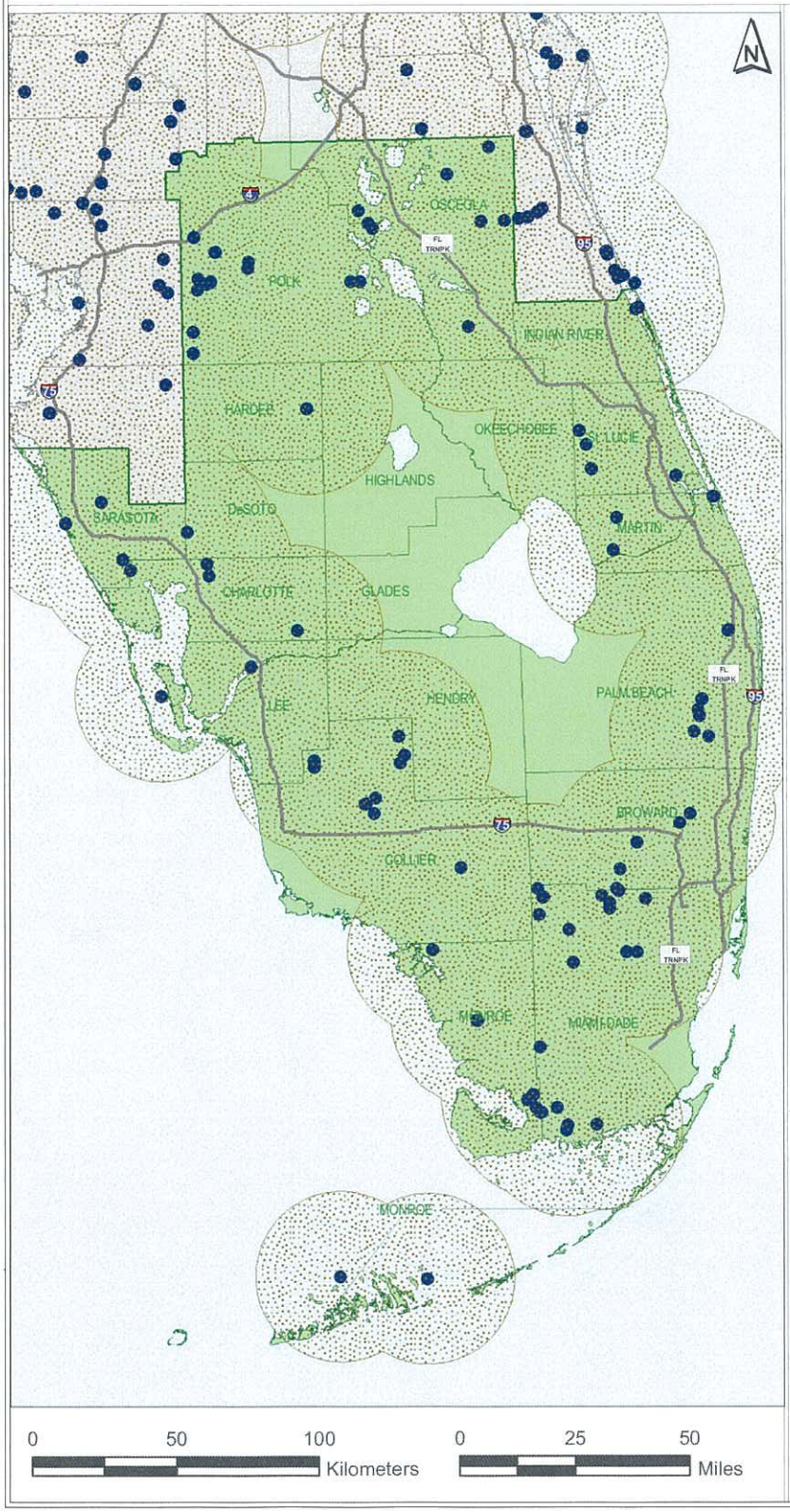
The wood stork is listed as endangered pursuant to the Endangered Wildlife Act of 1973 (Section 27-3-130 of the Code). Section 391-4-13-.06 of the Rules and Regulations of the Georgia Department of Natural Resources prohibits harassment, capture, sale, killing, or other actions which directly cause the death of animal species protected under the Endangered Wildlife Act. The destruction of habitat of protected species on public lands is also prohibited.

4. State of South Carolina

Section 50-15-40 of the South Carolina Nongame and Endangered Species Conservation Act states, "Except as otherwise provided in this chapter, it shall be unlawful for any person to take, possess, transport, export, process, sell, or offer of sale or ship, and for any common or contract carrier knowingly to transport or receive for shipment any species or subspecies of wildlife appearing on any of the following lists: (1) the list of wildlife indigenous to the State, determined to be endangered within the State...(2) the United States' List of Endangered Native Fish and Wildlife... (3) the United States' List of Endangered Foreign Fish and Wildlife ..."

5/21/2010

Wood Stock



Nesting Colonies
Core Foraging Areas

1999 to 2005

- Colony Location
- Core Foraging Area
- South Florida Service Area

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

Produced by:
South Florida Ecological Services Office
http://verobeach.fws.gov
Phone: 772.562.3909

5/21/2010

Enclosure 3

Wood Stork Foraging Analysis: Excerpts of concepts and procedure as presented by the Service in this appendix may be viewed in detail in any one of our recent Biological Opinions for project related impacts to the wood stork. These documents can be found at the internet website address http://www.fws.gov/filedownloads/ftp%5verobeach.

Foraging Habitat

Researchers have shown that wood storks forage most efficiently and effectively in habitats where prey densities are high and the water shallow and canopy open enough to hunt successfully (Ogden et al. 1978, Browder 1984, Coulter 1987). Prey availability to wood storks is dependent on a composite variable consisting of density (number or biomass/m^2) and the vulnerability of the prey items to capture (Gawlik 2002). For wood storks, prey vulnerability appears to be largely controlled by physical access to the foraging site, water depth, the density of submerged vegetation, and the species-specific characteristics of the prey. For example, fish populations may be very dense, but not available (vulnerable) because the water depth is too deep (greater than 30 cm) for storks or the tree canopy at the site is too dense for storks to land. Calm water, about 5-40 cm (2-16 in) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993).

Coulter and Bryan's (1993) study suggested that wood storks preferred ponds and marshes, and visited areas with little or no canopy more frequently. Even in foraging sites in swamps, the canopy tended to be sparse. They suggested that open canopies may have contributed to detection of the sites and more importantly may have allowed the storks to negotiate landing more easily than at closed-canopy sites. In their study, the median amount of canopy cover where wood stork foraging was observed was 32 percent. Other researchers (P.C. Frederick, University of Florida, personal communication 2006; J.A. Rodgers, FWC, personal communication 2006) also confirm that wood storks will forage in woodlands, though the woodlands have to be fairly open and vegetation not very dense. Furthermore, the canopies must be open enough for wood storks to take flight quickly to avoid predators.

Melaleuca-infested Wetlands: As discussed previously, wetland suitability for wood stork foraging is partially dependent on vegetation density. Melaleuca is a dense-stand growth plant species, effectively producing a closed canopy and dense understory growth pattern that generally limits a site's accessibility to foraging by wading birds. However, O'Hare and Dalrymple (1997) suggest moderate infestations of melaleuca may have little effect on some species' productivity (*i.e.*, amphibians and reptiles) as long as critical abiotic factors such as hydrology remain. They also note as the levels of infestation increase, usage by wetland dependent species decreases. Their studies also showed that the number of fish species present in a wetland system remain stable at certain levels of melaleuca. However, the availability of the prey base for wood storks and other foraging wading birds is reduced by the restriction of access caused from dense and thick exotic vegetation. Wood storks and other wading birds can forage in these systems in open area pockets (*e.g.*, wind blow-downs), provided multiple conditions are optimal (*e.g.*, water depth, prey density). In O'Hare and Dalrmyple's study (1997), they identify five cover types (Table 1) and

provide information on the number of wetland dependent bird species and the number of individuals observed within each of these vegetation classes (Table 2).

Table 1: Vegetation classes

DMM	75-100 percent mature dense melaleuca coverage
DMS or (SDM)	75-100 percent sapling dense melaleuca coverage
P75	50-75 percent melaleuca coverage
P50	0-50 percent melaleuca coverage
MAR (Marsh)	0-10 percent melaleuca coverage

The number of wetland-dependent species and individuals observed per cover type is shown below in columns 1, 2, and 3 (Table 2). To develop an estimate of the importance a particular wetland type may have (based on density and aerial coverage by exotic species) to wetland dependent species, we developed a foraging suitability value using observational data from O'Hare and Dalrymple (1997). The Foraging Suitability Value as shown in column 5 (Table 2) is calculated by multiplying the number of species by the number of individuals and dividing this value by the maximum number of species and individuals combined (12*132=1584). The results are shown below for each of the cover types in O'Hare and Dalrymple (1997) study (Table 1). As an example, for the P50 cover type, the foraging suitability is calculated by multiplying 11 species times 92 individuals for a total of 1,012. Divide this value by 1,584, which is the maximum number of species times the maximum number of individuals (12*132 = 1,584). The resultant is 0.6389 or 64 percent 11*92=1012/1584*100=63.89).

Table 2: Habitat Foraging Suitability

Cover Type	# of Species (S)	# of Individuals (I)	S*I	Foraging Suitability
DMM	1	2	2	0.001
DMS	4	10	40	0.025
P75	10	59	590	0.372
P50	11	92	1,012	0.639
MAR	12	132	1,584	1.000

This approach was developed to provide us with a method of assessing wetland acreages and their relationship to prey densities and prey availability. We consider wetland dependent bird use to be a general index of food availability. Based on this assessment we developed an exotic foraging suitability index (Table 3):

Table 3. Foraging Suitability Percentages

Exotic Percentage	Foraging Suitability (percent)
Between 0 and 25 percent exotics	100
Between 25 and 50 percent exotics	64
Between 50 and 75 percent exotics	37
Between 75 and 90 percent exotics	3
Between 90 and 100 percent exotics	0

In our assessment however, we consider DMM to represent all exotic species densities between 90 and 100 percent and DMS to represent all exotic species densities between 75 and 90 percent. In our evaluation of a habitat's suitability, the field distinction between an exotic coverage of

90 percent and 100 percent in many situations is not definable, therefore unless otherwise noted in the field reports and in our analysis; we consider a suitability value of 3 percent to represent both densities.

Hydroperiod: The hydroperiod of a wetland can affect the prey densities in a wetland. For instance, research on Everglades fish populations using a variety of quantitative sampling techniques (pull traps, throw traps, block nets) have shown that the density of small forage fish increases with hydroperiod. Marshes inundated for less than120 days of the year average ± 4 fish/m^2; whereas, those flooded for more than 340 days of the year average ± 25 fish/m^2 (Loftus and Eklund 1994, Trexler et al. 2002).

The Service (1999) described a short hydroperiod wetland as wetlands with between 0 and 180-day inundation, and long hydroperiod wetlands as those with greater than 180-day inundation. However, Trexler et al. (2002) defined short hydroperiod wetlands as systems with less than 300 days per year inundation. In our discussion of hydroperiods, we are considering short hydroperiod wetlands to be those that have an inundation of 180 days or fewer.

The most current information on hydroperiods in south Florida was developed by the SFWMD for evaluation of various restoration projects throughout the Everglades Protection Area. In their modeling efforts, they identified the following seven hydroperiods:

Table 4. SFWMD Hydroperiod Classes – Everglades Protection Area

Hydroperiod Class	Days Inundated
Class 1	0-60
Class 2	60-120
Class 3	120-180
Class 4	180-240
Class 5	240-300
Class 6	300-330
Class 7	330-365

Fish Density per Hydroperiod: In the Service's assessment of project related impacts to wood storks, the importance of fish data specific to individual hydroperiods is the principle basis of our assessment. In order to determine the fish density per individual hydroperiod, the Service relied on the number of fish per hydroperiod developed from throw-trap data in Trexler et al.'s (2002) study and did not use the electrofishing data also presented in Trexler et al.'s study that defined fish densities in catch per unit effort, which is not hydroperiod specific. Although the throw-trap sampling generally only samples fish 8 cm or less, the Service believes the data can be used as a surrogate representation of all fish, including those larger than 8 cm, which are typically sampled by either electrofishing or block net sampling.

We base this evaluation on the following assessment. Trexler et al.'s (2002) study included electrofishing data targeting fish greater than 8 cm, the data is recorded in catch per unit effort and in general is not hydroperiod specific. However, Trexler et al. (2002) notes in their assessment of the electrofishing data that in general there is a correlation with the number of fish per unit effort per changes in water depth. In literature reviews of electrofishing data by Chick et

al. (1999 and 2004), they note that electrofishing data provides a useful index of the abundance of larger fish in shallow, vegetated habitat, but length, frequency, and species compositional data should be interpreted with caution. Chick et al. (2004) also noted that electrofishing data for large fish (> 8cm) provided a positive correlation of the number of fish per unit effort (abundance) per changes in hydropeiod. The data in general show that as the hydroperiod decreases, the abundance of larger fishes also decreases.

Studies by Turner et al. (1999), Turner and Trexler (1997), and Carlson and Duever (1979) also noted this abundance trend for fish species sampled. We also noted in our assessment of prey consumption by wood storks in the Ogden et al. (1976) study (Figure 4) (discussed below), that the wood stork's general preference is for fish measuring 1.5 cm to 9 cm, although we also acknowledged that wood storks consume fish larger than the limits discussed in the Ogden et al. (1976) study. A similar assessment is reference by Trexler and Goss (2009) noting a diversity of size ranges of prey available for wading birds to consume, with fish ranging from 6 to 8 cm being the preferred prey for larger species of wading birds, particularly wood storks (Kushlan et al. 1975).

Therefore, since data were not available to quantify densities (biomass) of fish larger than 8 cm to a specific hydroperiod, and Ogden et al.'s (1976) study notes that the wood stork's general preference is for fish measuring 1.5 cm to 9 cm, and that empirical data on fish densities per unit effort correlated positively with changes in water depth, we believe that the Trexler et al. (2002) throw-trap data represents a surrogate assessment tool to predict the changes in total fish density and the corresponding biomass per hydroperiod for our wood stork assessment.

In consideration of this assessment, the Service used the data presented in Trexler et al.'s (2002) study on the number of fish per square-meter per hydroperiod for fish 8 cm or less to be applicable for estimating the total biomass per square-meter per hydroperiod for all fish. In determining the biomass of fish per square-meter per hydroperiod, the Service relied on the summary data provided by Turner et al. (1999), which provides an estimated fish biomass of 6.5 g/m^2 for a Class 7 hydroperiod for all fish and used the number of fish per square-meter per hydroperiod from Trexler et al.'s data to extrapolate biomass values per individual hydroperiods.

Trexler et al.'s (2002) studies in the Everglades provided densities, calculated as the square-root of the number of fish per square meter, for only six hydroperiods; although these cover the same range of hydroperiods developed by the SFWMD. Based on the throw-trap data and Trexler et al.'s (2002) hydroperiods, the square-root fish densities are:

Table 5. Fish Densities per Hydroperiod from Trexler et al. (2002)

Hydroperiod Class	Days Inundated	Fish Density
Class 1	0-120	2.0
Class 2	120-180	3.0
Class 3	180-240	4.0
Class 4	240-300	4.5
Class 5	300-330	4.8
Class 6	330-365	5.0

Trexler et al.'s (2002) fish densities are provided as the square root of the number of fish per square meter. For our assessment, we squared these numbers to provide fish per square meter, a simpler calculation when other prey density factors are included in our evaluation of adverse effects to listed species from the proposed action. We also extrapolated the densities over seven hydroperiods, which is the same number of hydroperiods characterized by the SFWMD. For example, Trexler et al.'s (2002) square-root density of a Class 2 wetland with three fish would equate to a SFWMD Model Class 3 wetland with nine fish. Based on the above discussion, the following mean annual fish densities were extrapolated to the seven SFWMD Model hydroperiods:

Table 6. Extrapolated Fish Densities for SFWMD Hydroperiods

Hydroperiod Class	Days Inundated	Extrapolated Fish Density
Class 1	0-60	2 fish/m^2
Class 2	60-120	4 fish/m^2
Class 3	120-180	9 fish/m^2
Class 4	180-240	16 fish/m^2
Class 5	240-300	20 fish/m^2
Class 6	300-330	23 fish/m^2
Class 7	330-365	25 fish/m^2

Fish Biomass per Hydroperiod: A more important parameter than fish per square-meter in defining fish densities is the biomass these fish provide. In the ENP and WCA-3, based on studies by Turner et al. (1999), Turner and Trexler (1997), and Carlson and Duever (1979), the standing stock (biomass) of large and small fishes combined in unenriched Class 5 and 6 hydroperiod wetlands averaged between 5.5 to 6.5 grams-wet-mass/m^2. In these studies, the data was provided in g/m^2 dry-weight and was converted to g/m^2 wet-weight following the procedures referenced in Kushlan et al. (1986) and also referenced in Turner et al. (1999). The fish density data provided in Turner et al. (1999) included both data from samples representing fish 8 cm or smaller and fish larger than 8 cm and included summaries of Turner and Trexler (1997) data, Carlson and Duever (1979) data, and Loftus and Eklund (1994) data. These data sets also reflected a 0.6 g/m^2 dry-weight correction estimate for fish greater than 8 cm based on Turner et al.'s (1999) block-net rotenone samples.

Relating this information to the hydroperiod classes developed by the SFWMD, we estimated the mean annual biomass densities per hydroperiod. For our assessment, we considered Class 7 hydroperiod wetlands based on Turner et al. (1999) and Trexler et al. (2002) studies to have a mean annual biomass of 6.5 grams-wet-mass/m^2 and to be composed of 25 fish/m^2. The remaining biomass weights per hydroperiod were determined as a direct proportion of the number of fish per total weight of fish for a Class 7 hydroperiod (6.5 grams divided by 25 fish equals 0.26 grams per fish).

For example, given that a Class 3 hydroperiod has a mean annual fish density of 9 fish/m^2, with an average weight of 0.26 grams per fish, the biomass of a Class 3 hydroperiod would be 2.3 grams/m^2 (9*0.26 = 2.3). Based on the above discussion, the biomass per hydroperiod class is:

Table 7. Extrapolated Mean Annual Fish Biomass for SFWMD Hydroperiods

Hydroperiod Class	Days Inundated	Extrapolated Fish Biomass
Class 1	0-60	0.5 gram/m^2
Class 2	60-120	1.0 gram/m^2
Class 3	120-180	2.3 grams/m^2
Class 4	180-240	4.2 grams/m^2
Class 5	240-300	5.2 grams/m^2
Class 6	300-330	6.0 grams/m^2
Class 7	330-365	6.5 grams/m^2

Wood stork suitable prey size: Wood storks are highly selective in their feeding habits and in studies on fish consumed by wood storks, five species of fish comprised over 85 percent of the number and 84 percent of the biomass of over 3,000 prey items collected from adult and nestling wood storks (Ogden et al. 1976). Table 8 lists the fish species consumed by wood storks in Ogden et al. (1976).

Table 8. Primary Fish Species consumed by Wood Storks from Ogden et al. (1976)

Common name	Scientific name	Percent Individuals	Percent Biomass
Sunfishes	*Centrarchidae*	14	44
Yellow bullhead	*Italurus natalis*	2	12
Marsh killifish	*Fundulus confluentus*	18	11
Flagfish	*Jordenella floridae*	32	7
Sailfin molly	*Poecilia latipinna*	20	11

These species were also observed to be consumed in much greater proportions than they occur at feeding sites, and abundant smaller species [*e.g.*, mosquitofish (*Gambusia affinis*), least killifish (*Heterandria formosa*), bluefin killifish (*Lucania goodei*)] are under-represented, which the researchers believed was probably because their small size did not elicit a bill-snapping reflex in these tactile feeders (Coulter et al. 1999). Their studies also showed that, in addition to selecting larger species of fish, wood storks consumed individuals that are significantly larger (>3.5 cm) than the mean size available (2.5 cm), and many were greater than 1-year old (Ogden et al. 1976, Coulter et al. 1999). However, Ogden et al. (1976) also found that wood storks most likely consumed fish that were between 1.5 and 9.0 cm in length (Figure 4 in Ogden et al. 1976).

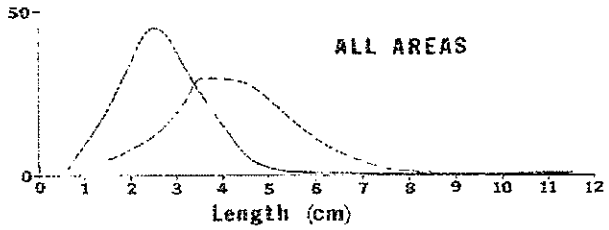


FIGURE 4. Length frequency distribution of fish available to and consumed by Wood Storks in different habitats.

In Ogden et al.'s (1976) Figure 4, the dotted line is the distribution of fish consumed and the solid line is the available fish. Straight interpretation of the area under the dotted line curve

represents the size classes of fish most likely consumed by wood storks and is the basis of our determination of the amount of biomass that is within the size range of fish most likely consumed by wood storks, which in this example is a range size of 1.5 to 9.0 cm in length.

Wood stork suitable prey base (biomass per hydroperiod): To estimate that fraction of the available fish biomass that might be consumed by wood storks, the following analysis was conducted. Trexler et al.'s (2002) 2-year throw trap data of absolute and relative fish abundance per hydroperiod distributed across 20 study sites in the ENP and the WCAs was considered to be representative of the Everglades fish assemblage available to wood storks (n = 37,718 specimens of 33 species). Although Trexler et al.'s (2002) data was based on throw-trap data and representative of fish 8 cm or smaller, the Service believes the data set can be used to predict the biomass/m^2 for total fish (those both smaller and larger than 8 cm). This approach is also supported, based on our assessment of prey consumption by wood storks in Ogden et al.'s (1976) study (Figure 4), that the wood storks general preference is for fish measuring 1.5 cm to 9 cm and is generally inclusive of Trexler et al.'s (2002) throw-trap data of fish 8 cm or smaller.

To estimate the fraction of the fish biomass that might be consumed by wood storks, the Service, using Trexler et al.'s (2002) throw-trap data set, determined the mean biomass of each fish species that fell within the wood stork prey size limits of 1.5 to 9.0 cm. The mean biomass of each fish species was estimated from the length and wet mass relationships for Everglades' icthyofauna developed by Kushlan et al. (1986). The proportion of each species that was outside of this prey length and biomass range was estimated using the species mean and variance provided in Table 1 in Kushlan et al. (1986). These biomass estimates assumed the length and mass distributions of each species was normally distributed and the fish biomass could be estimated by eliminating that portion of each species outside of this size range. These biomass estimates of available fish prey were then standardized to a sum of 6.5 g/m^2 for Class 7 hydroperiod wetlands (Service 2009).

For example, Kushlan et al. (1986) lists the warmouth (*Lepomis gulosus*) with a mean average biomass of 36.76 g. In fish samples collected by Trexler et al. (2002), this species accounted for 0.048 percent (18/37,715=0.000477) of the Everglades freshwater ichthyofauna. Based on an average biomass of 36.76 g (Kushlan et al. 1986), the 0.048 percent representation from Trexler et al. (2002) is equivalent to an average biomass of 1.75 g (36.76*0.048) or 6.57 percent (1.75/26.715) of the estimated average biomass (26.715 g) of Trexler et al.'s (2002) samples (Service 2009).

Standardizing these data to a sample size of 6.5 g/m^2, the warmouth biomass for long hydroperiod wetlands would be about 0.427 g (Service 2009). However, the size frequency distribution (assumed normal) for warmouth (Kushlan et al. 1986) indicate 48 percent are too large for wood storks and 0.6 percent are too small (outside the 1.5 cm to 9 cm size range most likely consumed), so the warmouth biomass within the wood stork's most likely consumed size range is only 0.208 g (0.427*(0.48+0.006)=0.2075) in a 6.5 g/m^2 sample. Using this approach summed over all species in long hydroperiod wetlands, only 3.685 g/m^2 of the 6.5 g/m^2 sample consists of fish within the size range likely consumed by wood storks or about 57 percent (3.685/6.5*100=56.7) of the total biomass available.

An alternative approach to estimate the available biomass is based on Ogden et al. (1976). In their study (Table 8), the sunfishes and four other species that accounted for 84 percent of the biomass eaten by wood storks totaled 2.522 g of the 6.5 g/m^2 sample (Service 2009). Adding the remaining 16 percent from other species in the sample, the total biomass would suggest that 2.97 g of a 6.5 g/m^2 sample are most likely to be consumed by wood storks or about 45.7 percent (2.97/6.5=0.4569)

The mean of these two estimates is 3.33g/m^2 for long hydroperiod wetlands (3.685 + 2.97 = 6.655/ 2 = 3.33). This proportion of available fish prey of a suitable size (3.33 g/m^2 / 6.5 g/m^2 = 0.51 or 51 percent) was then multiplied by the total fish biomass in each hydroperiod class to provide an estimate of the total biomass of a hydroperiod that is the appropriate size and species composition most likely consumed by wood storks.

As an example, a Class 3 SFWMD model hydroperiod wetland with a biomass of 2.3 grams/m^2, adjusted by 51 percent for appropriate size and species composition, provides an available biomass of 1.196 grams/m^2. Following this approach, the biomass per hydroperiod potentially available to predation by wood storks based on size and species composition is:

Table 9. Wood Stork Suitable Prey Base (fish biomass per hydroperiod)

Hydroperiod Class	Days Inundated	Fish Biomass
Class 1	0-60	0.26 gram/m^2
Class 2	60-120	0.52 gram/m^2
Class 3	120-180	1.196 grams/m^2
Class 4	180-240	2.184 grams/m^2
Class 5	240-300	2.704 grams/m^2
Class 6	300-330	3.12 grams/m^2
Class 7	330-365	3.38 grams/m^2

Wood Stork-Wading Bird Prey Consumption Competition: In 2006, (Service 2006), the Service developed an assessment approach that provided a foraging efficiency estimate that 55 percent of the available biomass was actually consumed by wood storks. Since the implementation of this assessment approach, the Service has received comments from various sources concerning the Service's understanding of Fleming et al.'s (1994) assessment of prey base consumed by wood storks versus prey base assumed available to wood stork and the factors included in the 90 percent prey reduction value.

In our original assessment, we noted that, "*Fleming et al. (1994) provided an estimate of 10 percent of the total biomass in their studies of wood stork foraging as the amount that is actually consumed by the storks. However, the Fleming et al. (1994) estimate also includes a second factor, the suitability of the foraging site for wood storks, a factor that we have calculated separately. In their assessment, these two factors accounted for a 90 percent reduction in the biomass actually consumed by the storks. We consider these two factors as equally important and are treated as equal components in the 90 percent reduction; therefore, we consider each factor to represent 45 percent of the reduction. In consideration of this approach, Fleming et al.'s (1994) estimate that 10 percent of the biomass would actually be consumed by the storks would be added to the 45 percent value for an estimate that 55 percent (10 percent plus the remaining 45 percent) of the available biomass would actually be consumed by the storks and is the factor we believe represents the amount of the prey base that is actually consumed by the stork.*"

In a follow-up review of Fleming et al.'s (1994) report, we noted that the 10 percent reference is to prey available to wood storks, not prey consumed by wood storks. We also noted the 90 percent reduction also includes an assessment of prey size, an assessment of prey available by water level (hydroperiod), an assessment of suitability of habitat for foraging (openness), and an assessment for competition with other species, not just the two factors considered originally by the Service (suitability and competition). Therefore, in re-evaluating of our approach, we identified four factors in the 90 percent biomass reduction and not two as we previously considered. We believe these four factors are represented as equal proportions of the 90 percent reduction, which corresponds to an equal split of 22.5 percent for each factor. Since we have accounted previously for three of these factors in our approach (prey size, habitat suitability, and hydroperiod) and they are treated separately in our assessment, we consider a more appropriate foraging efficiency to represent the original 10 percent and the remaining 22.5 percent from the 90 percent reduction discussed above. Following this revised assessment, our competition factor would be 32.5 percent, not the initial estimate of 55 percent.

Other comments reference the methodology's lack of sensitivity to limiting factors, i.e., is there sufficient habitat available across all hydroperiods during critical life stages of wood stork nesting and does this approach over emphasize the foraging biomass of long hydroperiod wetlands with a corresponding under valuation of short hydroperid wetlands. The Service is aware of these questions and is examining alternative ways to assess these concerns. However, until futher research is generated to refine our approach, we continue to support the assessment tool as outlined.

Following this approach, Table 10 has been adjusted to reflect the competition factor and represents the amount of biomass consumed by wood storks and is the basis of our effects assessments (Class 1 hydroperiod with a biomass 0.26 g, multiplied by 0.325, results in a value of 0.08 g [0.25*.325=0.08]) (Table 10).

Table 10 Actual Biomass Consumed by Wood Storks

Hydroperiod Class	Days Inundated	Fish Biomass
Class 1	0-60	0.08 gram/m^2
Class 2	60-120	0.17 gram/m^2
Class 3	120-180	0.39 grams/m^2
Class 4	180-240	0.71 grams/m^2
Class 5	240-300	0.88 grams/m^2
Class 6	300-330	1.01 grams/m^2
Class 7	330-365	1.10 grams/m^2

Sample Project of Biomass Calculations and Corresponding Concurrence Determination

Example 1:

An applicant is proposing to construct a residential development with unavoidable impacts to 5 acres of wetlands and is proposing to restore and preserve 3 acres of wetlands onsite. Data on the onsite wetlands classified these systems as exotic impacted wetlands with greater than 50

percent but less than 75 percent exotics (Table 3) with an average hydroperiod of 120-180 days of inundation.

The equation to calculate the biomass lost is: The number of acres, converted to square-meters, times the amount of actual biomass consumed by the wood stork (Table 10), times the exotic foraging suitability index (Table 3), equals the amount of grams lost, which is converted to kg.

Biomass lost (5*4,047*0.39 (Table 10)*0.37 (Table 3)=2,919.9 grams or 2.92 kg)

In the example provided, the 5 acres of wetlands, converted to square-meters (1 acre= 4,047 m^2) would provide 2.9 kg of biomass (5*4,047*0.39 (Table 10)*0.37 (Table 3)= 2,919.9 grams or 2.9 kg), which would be lost from development.

The equation to calculate the biomass from the preserve is the same, except two calculations are needed, one for the existing biomass available and one for the biomass available after restoration.

Biomass Pre: (3*4,047*0.39(Table 10)*0.37 (Table 3)=1,751.95grams or 1.75 kg)

Biomass Post: (3*4,047*0.39 (Table 10)*1(Table 3)=4,734.99 grams or 4.74 kg)

Net increase: 4.74 kg-1.75 kg = 2.98 kg Compensation Site

Project Site Balance 2.98 kg- 2.92 kg = 0.07kg

The compensation proposed is 3 acres, which is within the same hydroperiod and has the same level of exotics. Following the calculations for the 5 acres, the 3 acres in its current habitat state, provides 1.75 kg (3*4,047*0.39 (Table 10)*0.37 (Table 3)=1,751.95grams or 1.75 kg) and following restoration provides 4.74 kg (3*4,047*0.39 (Table 10)*1(Table 3)=4,734.99 grams or 4.74 kg), a net increase in biomass of 2.98 kg (4.74-1.75=2.98).

Example 1: 5 acre wetland loss, 3 acre wetland enhanced – same hydroperiod - NLAA

Hydroperiod	Existing Footprint		On-site Preserve Area				Net Change*	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1 - 0 to 60 Days								
Class 2 - 60 to 120 Days								
Class 3 - 120 to 180 Days	5	2.92	3	1.75	3	4.74	(5)	0.07
Class 4 - 180 to 240 Days								
Class 5 - 240 to 300 Days								
Class 6 - 300 to 330 Days								
Class 7 - 330 to 365 days								
TOTAL	**5**	**2.92**	**3**	**1.75**	**3**	**4.74**	**(5)**	**0.07**

*Since the net increase in biomass from the restoration provides 2.98 kg and the loss is 2.92 kg, there is a positive outcome (4.74-1.75-2.92=0.07) in the same hydroperiod and Service concurrence with a NLAA is appropriate.

Example 2:

In the above example, if the onsite preserve wetlands were a class 4 hydroperiod, which has a value of 0.71. grams/m^2 instead of a class 3 hydroperiod with a 0.39 grams/m^2 [Table 10]), there would be a loss of 2.92 kg of short hydroperiod wetlands (as above) and a net gain of 8.62 kg of long-hydroperiod wetlands.

Biomass lost: (5*4,047*0.39 (Table 10)*0.37 (Table 3)=2,919.9 grams or 2.92 kg)

The current habitat state of the preserve provides 3.19 kg (3*4,047*0.71 (Table 10)*0.37 (Table 3)=3,189.44 grams or 3.19 kg) and following restoration the preserve provides 8.62 kg (3*4,047*0.71 (Table 10)*1(Table 3)= 8,620.11 grams or 8.62 kg, thus providing a net increase in class 4 hydroperiod biomass of 5.43 kg (8.62-3.19=5.43).

Biomass Pre: (3*4,047*0.71(Table 10)*0.37 (Table 3) = 3,189.44 grams or 3.19 kg)

Biomass Post: (3*4,047*0.71 (Table 10)*1(Table 3)=8,620.11 grams or 8.62 kg)

Net increase: 8.62 kg-3.19 kg = 5.43 kg

Project Site Balance 5.43 kg- 2.92 kg = 2.51 kg

Example 2: 5 acre wetland loss, 3 acre wetland enhanced – different hydroperiod – May Affect

Hydroperiod	Existing Footprint		On-site Preserve Area				Net Change*	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1 - 0 to 60 Days								
Class 2 - 60 to 120 Days								
Class 3 - 120 to 180 Days	5	2.92					(5)	-2.92
Class 4 - 180 to 240 Days			3	3.19	3	8.62	0	5.43
Class 5 - 240 to 300 Days								
Class 6 - 300 to 330 Days								
Class 7 - 330 to 365 days								
TOTAL	**5**	**2.92**	**3**	**3.19**	**3**	**8.62**	**(5)**	**2.51**

In this second example, even though there is an overall increase in biomass, the biomass loss is a different hydroperiod than the biomass gain from restoration, therefore, the Service could not concur with a NLAA and further coordination with the Service is appropriate.

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