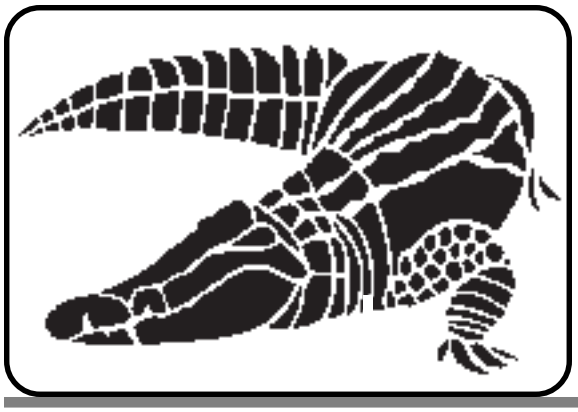

APPENDIX A

LISTED SPECIES

AMERICAN ALLIGATOR *(Alligator mississippiensis)*

HABITAT: The Alligator is generally distributed in the various wetland types throughout the state, including the edges of large lakes and ponds, rivers, and the interiors of swamps and fresh water marshes. The reptile apparently is very adaptive and may be equally at home in ponds and lakes in urban areas or in the middle of the Everglades. Although not generally associated with salt water, it may occasionally enter brackish or even salt water habitats.

AMERICAN OYSTERCATCHER *(Haematopus palliatus)*

HABITAT REQUIREMENTS AND HABITAT TREND: The American Oystercatcher needs extensive beach, sandbar, mudflat, and mollusk beds for feeding and roosting. Oystercatchers feed on almost any nonvegetative life that can be gleaned from wet substrates by walking and wading. Listed among their foods are bivales, gastropods, marine worms, crustaceans, small fish, and many insects (Bent 1929; Murphy 1936). Oystercatchers prefer large, sparsely vegetated sand areas for nesting, but will use wrack and marsh grass (Lauro, 1989).

ATLANTIC STURGEON *(Acipenser oxyrhynchus)*

HABITAT: Acipenser oxyrinchus is an anadromous species, spending most of its adult life in salt or brackish water and during certain years moving into fresh water to spawn. It frequently enters the ocean, where it may make extensive coastal migrations, and has been found in water as deep as 46m (Bigelow and Schroeder 1953). It is less closely restricted to fresh water than *A. brevirostrum*, and in the St. Johns River estuary (New Brunswick) large juveniles of the two species were found to be ecologically separated on the basis of salinity. *A. oxyrinchus* predominating in water of .3 ppt and *A. brevirostrum* predominating in water of <3 ppt (Apply and Dadswell 1978; Dadswell 1979). As a result of its movements in the ocean and into fresh water, the Atlantic sturgeon encounters a broad range of substrates (ranging from soft mud to hard rock) and may occur in water of

widely varying clarity. The species usually is found in areas devoid of submergent aquatic vegetation. Little or no current is usually present, except when the species enters rivers and moves upstream to spawn. Spawning occurs in areas with strong water movement, and the early life stages are spent under these conditions.

BALD EAGLE *(Hialaeetus leucocephalus)*

HABITAT REQUIREMENTS AND HABITAT TREND: Although Bald Eagles occur in a wide variety of habitats throughout their range, proximity to water is important. Preferred habitat includes a high amount of water-to-land edge where prey is concentrated (Palmer 1988). Bald Eagles feed primarily on fish, but birds, smaller mammals, and carrion are also utilized. In north-central Florida freshwater catfish (*Ictalurus* spp.) and American Coot (*Fulica americana*) make up the bulk of the Bald Eagle's diet (McEwan and Hirth 1980), whereas in Florida Bay sea catfish (*Arius Felis*), mullet (Mugil spp.), and assorted wading birds up to the size of Great White Heron (*Ardea herodias*) are taken (Curnutt, unpubl. data). A notable exception in Florida is found on the small keys of Florida Bay where the virtual absence of both mammalian predators and tall emergent trees has led to nesting within the crowns of mangroves, on nest platforms built by Great White Herons, and nesting on the ground (Shea and Robertson 1979).

Under natural conditions habitat suitability of an area remains relatively constant so long as prey density is not diminished. The structural dynamics of undisturbed forests may lead to a decrease in the availability of emergent trees (i.e., the Gulf Coast mangrove forest of Everglades National Park), in which case eagles will occupy emergents along the inland edge of the forest if available. Much suitable Bald Eagle habitat in Florida has been developed for urban and recreational use. Recreational use of coastal areas and feeding areas, while not affecting the structural integrity of suitable habitat, may have adverse effects on eagles during the breeding season by disrupting incubation and feeding of offspring and the ability to procure prey.

BARTRAM'S IXIA *(Sphenostigma coelistina)*

HABITAT: This is a plant of the wet, level grassy flatwoods, almost always under scattered slash or longleaf pines. It is associated with *Aletris obovata, Asclepias michauxii, Cleistes divaricata, Ctenium floridanum, Polygala ramosa, Psorlea virgata, Tephrosia hispidula*, and other Coastal Plan species of limited distribution. The dominant vegetation is usually Wiregrass, *Aristida stricta*. In the prolonged absence of fires this association becomes densely covered with grasses and other herbs, and the Ixia ceases to flower and seems almost to disappear. In the spring after a fire has removed the herbaceous cover, the Ixia produces a showy display of hundreds of plants where none was seen before. Then, with successive fireless years, the number of blooms dwindles annually, until again few or none are to be seen.

BLACK SKIMMER *(Rynchops niger)*

HABITAT REQUIREMENTS AND HABITAT TREND: Black Skimmers depend on healthy estuaries for feeding and on undisturbed coastlines for breeding and loafing. In Florida, colonies are located on dredge-material islands, natural sandbars, small coastal islands, and beaches with little vegetation usually within sight of open water (Schreiber and Schreiber 1978; Kale 1979; Clapp et al. 1983). In some parts of their range, but not yet in Florida, Black Skimmers nest on

wrack in salt marshes (see literature review in Spendelow and Patton 1988; Burger and Gochheld 1990). This behavior is apparently or recent origin and is believed to be related to increasing human use of beaches. Skimmers require an adequate prey base of small fish near their nesting colonies. Skimmers are opportunistic feeders, taking any small fish of suitable size. They rely heavily on silversides (*Menidia* spp.), killifishes (*Fundulus* spp.), anchovies (*Anchoa* spp.), and mullet (*Mugil* spp.) (Erwin 1977; Loftin 1982; King 1989). Most prey items are less than 100 mm long (Loftin 1982; King 1989). Prey may range in weight from about 0.5 to 14.5 g (Loftin 1982; King 1989). Shrimp also are taken "coincidentally" (Barbour 1978).

BROWN PELICAN *(Pelecanus occidentalis)*

HABITAT REQUIREMENTS AND HABITAT TREND: Nesting sites used by Brown Pelicans in Florida have consistently been small to medium-sized islands (most <5 ha, some to 10 ha), and most have been located along the Intracoastal Watersay. Only 4 of 49 sites used for nesting were not originally vegetated with mangrove (*Avicennia germinans* and *Rhizophora mangle*). Nesting occurs from 0.5-10.7 m above the high tide line (Schreiber and Schreiber 1982). In addition to nesting sites, Brown Pelicans require loafing and roosting habitats. Sand bars are "an important, non-nesting habitat used for roosting and loafing" (Schreiber and Schreiber 1982). Loafing and roosting mangrove islands often evolve into nesting sites after a period of increasing use (Schreiber and Schreiber 1982). Feeding habitat is not well understood and should be better researched since access to prey in adequate abundance is essential for successful reproduction (Anderson et al. 1982).

Many (>75%) of the Florida nesting sites are on state or federal land (Williams et al. 1980). There is no security or protection for non-nesting habitats and undoubtedly many important sites have been lost to direct or indirect degradation through disturbance (Schreiber and Schreibe1982) or pollution.

BURROWING OWL *(Speotyto cunicularia)*

HABITAT REQUIREMENTS AND HABITAT TREND: Florida Burrowing Owls typically occur in open, well-drained treeless areas where herbaceous ground cover is short. These requirements were met historically in Florida on the dry prairies of the central peninsula in the vicinity of burns and along the margins of depressional marshes during dry periods (Howell 1932; Bent 1938). Land clearing and wetland drainage have greatly expanded the amount of suitable Burrowing Owl habitat in Florida, and these activities probably played a major role in the range expansion of this species since the 1940s. Currently, Burrowing Owls still occur in dry prairies in central Florida, although they are most often associated with such unnatural elevated features as canal banks and road berms. In addition, they occur in tame-grass pastures, on airports, golf courses, athletic fields, and in partially developed residential and industrial areas where expanses of mowed lawn and ruderal grassland are maintained. The latter areas probably support the largest concentrations of Burrowing Owls in Florida at the present time. In Cape Coral, Burrowing Owls appear to prefer areas where developed lots occupy between 25% and 75% of the landscape (Wesemann and Rowe 1987). Burrowing Owl nesting density decreases under more or less intensive development (Wesemann and Rowe 1987). Although far from conclusive, these observations suggest that Burrowing Owl populations may actually thrive in some developing areas, but then decrease or collapse when the amount of developed land exceeds some critical, but unknown and probably variable, threshold. R. Ashton (pers. comm.) found Burrowing

Owls in Sumter, Land and Marion counties most likely to nest in pastures that had been cleared for at least 4 years and that were heavily grazed.

EASTERN INDIGO SNAKE *(Drymarchon corais couperi)*

HABITAT: In peninsular Florida, the Indigo Snake may be found in habitats ranging from mangrove swamps and wet prairies to xeric pinelands and scrub. In the northern parts of its range, it typically winters in Gopher Tortoise (Gopherus polyphemus) burrows on the higher sand ridges, although it may forage in more hydric habitats during the warmer months.

FLORIDA BLACK BEAR *(Ursus americanus floridanus)*

HABITAT REQUIREMENTS AND HABITAT TREND: Black bears use a wide variety of forested landscapes, from temperate plant communities in northwestern Florida to subtropical communities in southern Florida. Some of the more important forest types include pine flatwoods, hardwood swamp, cypress swamp, cabbage palm forest, sand pine scrub, and mixed hardwood hammock. A combination of several major forest types is typical of occupied bear range. As with black bears in other parts of their range, seasonal changes in habitat use occur in response to food availability (Pelton 1982). In the Osceola National Forest, black bears use forested wetlands in greater proportion than available, and flatwoods in lower proportion than available. Mykytka and Pelton (1989) found that swamps larger than 150 ha were important components of bear habitat in Osceola National Forest. In the Ocala National Forest, bears prefer flatwoods and avoid longleaf pine forests (Wooding and Hardisky 1988).

Cover, especially for the female's denning requirements, also is an essential habitat component. Beds usually are located in remote swamps or thickets. Nests measure 45-75 cm across and 5-17 cm deep and often occur in a nearly impenetrable tangle of vines and stems characterized by *Lyonia lucida, Lyonia ferruginea, Clethra alnifoli, Serenoa repens, Ilex glabra*, and *Smilax* spp. Shrub cover at denning sites is usually dense, with midstory and overstory sparse (J.B. Wooding, unpubl. data). Bears in Florida also may use hollow trees for denning.

The diet of black bears in Florida varies both temporally and geographically (Maehr and Brady 1982a, 1984a, 1984b) and includes a great variety of plants and animals (Maehr and DeFazio 1985). As with black bears in other parts of their range, Florida bears follow a chronology of food availability from herbaceous matter in early spring, to soft fruits in summer, to hard mast during fall (Pelton 1982:508). Major food items are the fruits and hearts of saw palmetto (*Serenoa repens*) and cabbage palm (*Sabal palmetto*) and the fruits of swamp tupelo (*Nyssa biflora*), oaks (*Quercus* spp.), blueberry (*Vaccinium* spp.), and gallberry (*Ilex glabra*). These species are found throughout the state and probably account for nearly 80 percent of the diet. Insects are the most important animal food, with the introduced honey bee (*Apis mellifera*) occurring most frequently. Other important insects include yellow jackets (*Vespula* spp.), carpenter ants (*Campanotus abdominalis floridanus*), bessie bugs (*Odontotaenius disjunctus*) and walking stocks (*Anisomorpha bupresetoides*). For some plants requiring acid scarification of seeds, the black bear may act as an important agent of dispersal and germination (Maehr 1984b).

CURTISS' MILKWEED *(Asclepius curtissii)*

No information is provided on this species in Rare and Endangered Biota of Florida.

FLORIDA MOUSE *(Podomys floridanus)*

HABITAT REQUIREMENTS AND HABITAT TREND: The Florida mouse is narrowly restricted to fire-maintained, xeric, upland vegetation occurring on deep, well-drained sandy soils. Specific plant communities in which the species has been recorded include sand pine scrub, coastal scrub, scrubby flatwoods, longleaf pine-turkey oak (sandhill), south Florida slash pine-turkey oak (southern ridge sandhill), upland hammock, live oak (xeric) hammock, and drier pine flatwoods (Bangs 1898; Layne 1963, 1978; Stout 1979). Occasional occurrences in such atypical habitats as mesic hammock, seasonal pond margin, freshwater marsh, and old fields probably represent transients (Layne 1990). The two major habitats of the Florida mouse are scrub, including sand pine scrub and scrubby flatwoods, and sandhill. Scrub is the primary habitat and probably more closely similar to the ancestral habitat, while sandhill vegetation is a secondary habitat that may not have been generally occupied until historic times when the original state of the habitat – a pine savanna – was converted as a result of human disturbance (logging of pines and fire suppression) to a drier, more open condition more suitable for Florida mice (Layne 1990). A major difference in the two vegetation types is in the number of species and density of oaks. Scrub has a well-developed shrub layer usually dominated by three or four species of oaks, whereas sandhill characteristically has one major species, turkey oak, usually occurring in a relatively open stand. In addition to their greater abundance, scrub oak species also tend to have higher and more consistent acorn production than turkey oak (Layne 1990). The difference in acorn production between scrub and sandhill association is reflected in numerous demographic and behavioral differences between Florida mouse populations in these habitats.

The combination of more widespread xeric vegetation and greatly expanded peninsular Florida landmass during the Late Wisconsinan glacial state (Watts 1980) suggests that *Podomys* may have had a larger and more continuous distribution during that period than by the end of the Holocene, when the sea had risen to its present level, accompanied by large-scale replacement of xeric habitats by more mesic or hydric associations. During historic times, there has been a continuing loss of xeric upland habitats to real estate development and agricultural use. Much of the sand pine scrub association along the Atlantic coast has been destroyed, with resultant loss of *Podomys* populations. The same is true of the more disjunct scrubs along the Gulf coast of the peninsula. Vast areas of the original sandhill vegetation along the Lake Wales Ridge have been converted to citrus groves, and only few small remnants continue to support *Podomys* populations. An example of the magnitude of Florida mouse habitat loss in some areas is provided by data compiled for Highlands County by Peroni (1983). During the period from 1940-44 to 1981, approximately 64 percent of the xeric upland habitat suitable for *Podomys* was destroyed and an additional 10 percent was disturbed. Since 1981, the rate of clearing of the remaining scrub and sandhill habitats for development and citrus has escalated sharply. In the northern portion of the range, many former sandhill and scrub sites have been converted to pine plantations. In addition, suppression of fire and the resultant successional changes have resulted in further reduction of elimination of Podomys populations in many remaining sandhill and scrub habitats.

FLORIDA PINE SNAKE *(Pitophis melanoleucus mugitus)*

HABITAT: The Florida Pine Snake occupies xeric sites, including Longleaf Pine-xerophytic oak woodlands, Sand Pine scrub, pine flatwoods on well drained soils, and old fields on former sandhill sites. Radio-telemetry studies in sandhill habitats in northern

Florida indicate that this species prefers High Pine (Longlear Pine-Turkey Oak association) and old fields over Sand Live Oak hammocks and other forest types with heavy canopies. Under drought conditions, Pine Snakes seek open habitats surrounding wetlands. Two radio-tracked females exhibited home ranges of 11 and 12 ha (27.5 and 30 ac) each, while 3 males used areas 2-8 times larger in size. The Florida Pine Snake is extremely fossorial, particularly seeking out the tunnel systems of pocket gophers and, to a lesser extent, the burrows of Gopher Tortoises. Radio-tracked snakes were observed to dig open pocket gopher mounds using methods described by Carpenter (1982) for the closely related Bullsnake (*Pituophis melanoleucus sayi*). Radio-tracked snakes were active between March and October but showed their greatest activity in May, June, July, and October. During these months, they made the greatest numbers of moves and traveled the greatest distances.

FLORIDA SANDHILL CRANE *(Crus canadensis pratensis)*

HABITAT REQUIREMENTS AND HABITAT TREND: Mean annual home-range size for 31 Florida Sandhill Cranes was 936 ha. Home range averaged 447 ha for 20 adult pairs and 2,132 ha for 9 subadults (Nesbitt and Williams 1990). The two most frequently used habitats were pastures/prairies and emergent palustrine wetlands dominated by pickerelweed (*Pontedaria cordata*) and Maidencane (*Panicum hemitomon*). Cranes also showed a preference for transition zones between wetlands and pastures/prairies and between pastures/prairies and forested habitats. During summer, to avoid the heat of the day, cranes will either stand motionless in full shade or in a marsh area. Recently, the reduction in suitable wetland habitat, pointed out by Williams (1978), may have slowed somewhat due to concern for wetland protection. However, the loss of open, upland habitat, also critical to the subspecies, continues (Bishop 1988; Nesbitt and Williams 1990).

FLORIDA SCRUB-JAY *(Aphelocoma coerulescens)*

HABITAT REQUIREMENTS AND HABITAT TRENDS: The oak scrub to which Florida Scrub-Jays are restricted is a peculiar vegetation formation found only on extremely well-drained sandy soils formed by old coastal dunes or paleodunes (Laessle 1958, 1968). Davis (1967) mapped the scrubs of Florida.

The indigenous plants are adapted to nutrient-poor soils, periodic drought, high seasonal rainfall, and frequent fires. The most characteristic and, for the jays, essential plants are four stunted, low-growing oaks, which occur in varying percentages in scrubs around the peninsula: *Quercus Geminata, Q. chapmanii, Q. myrtifolia and Q. inopina* (the last is endemic to the Florida interior, mainly on the Lake Wales Ridge). In optimal habitat most of the oaks and other shrubs are between 1 and 4 m tall, and interspersed with numerous, small patches of bare sand. Trees are few and scattered, with canopy cover rarely exceeding 15% in occupied habitat. Herbaceous vegetation is sparse. The dominant trees are slash pines (*Pinus elliottis*) and sand pines (*P. clausa*). Slash pines tend to occur in lower areas, sand pines and Florida rosemary (*Ceratiola ericoides*) on the highest dune tops. Along with the oaks, two palmettos (Serenoa repens and Sabal etonia (interior only), and several woody shrubs (especially of genera *Lyronia, Vaccinium, Carya, Befaria*, and *Osmanthus*) comprise most of the remaining dominant plants.

Fire is a frequent natural event in scrub habitats. From May to September, ground strikes by lightning are common in peninsular Florida. Lightning fires probably occurred at intervals of 8-20 years in most types of scrub during presettlement times (Myers 1990; Ostertag and Menges 1994).

Natural fires usually leave many patches of scrub unburned. As a result entire Florida Scrub-Jay territories (average 10 ha or 25 ac) rarely are completely burned.

Elimination of scrub habitat through human activities has occurred throughout the Florida Scrub-Jay's native range. Conversion of scrub habitat to citrus groves and dwellings proceeded throughout the 20th century, with rapid acceleration in the 1950s and 1960s. Continued loss of habitat to rural residential development, mobile-home parks, industrial construction, shopping malls, golf courses and other recreational uses closely tracked the rapid growth of the human population in Florida throughout the 1970s and 1980s. Conversion of scrub to citrus groves no doubt eliminated scrub and jays from hundreds of xeric-soil patches as early as the 1920s. Major killing freezes caused rapid southward expansion of the citrus industry in the 1970s and 1980s, especially in the interior peninsula, which resulted in the elimination of much additional scrub. Scrub land vacated by citrus growers is not restored to its natural condition and rarely reverts to a habitat suitable for Florida Scrub-Jays.

Fire suppression by humans has caused many of the remaining patches of scrub to become tall (>3 m) and dense, with a canopy of oaks and pines and a thick leaf litter. Under these conditions, death rates for breeding adults exceeds recruitment (Fitzpatrick and Woolfenden 1986). This demographic scenario inevitably causes the jays to die out. Entire local populations of Florida Scrub-Jays have disappeared as a result, despite the persistence of native xeric vegetation.

FLORIDA WILLOW *(Salix floridana)*

HABITAT: Salix floridana grows only in very wet soils, usually in dense, swampy woods. It often favors the edges of cool, clear spring runs, as along the Ichetucknee River and in swamps south of Interlachen, Putnam County.

GOPHER (CRAWFISH) FROG *(Rana capito)*

HABITAT: Most records of the species in Florida are from native, xeric, upland habitats, particularly longleaf pine-Turkey Oak sandhill associations which, not coincidentally, often support the densest populations of Gopher Tortoises. They also are known from pine flatwoods, sand pine scrub, xeric hammocks, and ruderal successional stages of these plant communities. Preferred breeding habitats include seasonally flooded, grassy ponds and cypress heads that lack fish populations. Populations of Gopher Frogs are known only from sites that support Gopher Tortoises. Even prime sandhill habitat, if more than a mile from suitable breeding sites, rarely supports Gopher Frogs.

GOPHER TORTOISE *(Gopherus polyphemus)*

HABITAT: Three environmental conditions are especially important: well-drained loose soil in which to burrow, adequate low-growing herbs for food, and open sunlit sites for nesting. The Gopher Tortoise is primarily associated with Longleaf Pine-Xerophytic Oak Woodlands (sandhills), but it is also found in Sand Pine scrub, coastal strands, Live Oak hammocks, dry prairies, pine flatwoods, and mixed hardwood-pine communities. Disturbed habitats, such as roadsides, fence rows, clearings, and old fields, often support relatively high densities.

LEAST TERN *(Sterna antillarum)*

HABITAT REQUIREMENTS AND HABITAT TREND: Nesting habitat of the Least Tern has been characterized in detail by several authors (Jernigan et al 1978; Thompson and Slack 1982; Gochfeld 1983; Kotliar and Burger 1986); and Gochfeld (1983) and Carreker (1985) prepared models to evaluate potential nesting habitat. Least Terns routinely select a nesting site with a substrate of sand or gravel. Substrate composition varies among sites, but light colored sands with less than 20% shell fragments are typical. Shell fragments make the eggs more difficult to see and may keep sand from blowing onto the nest. Clays or other fine materials are unsuitable for nesting substrate because they do not drain well and may stick to the eggs (Thompson and Slack 1982).

Most nesting sites are nearly bare and few have vegetation covering more than 20% of the area; but, as with the substrate, the amount of vegetation that will be tolerated is variable. Colonies that have been successful at a given site in past years are likely to tolerate more vegetation (Burger 1984; Kotliar and Burger 1986). Vegetation at nesting sites is usually short, thus providing cover for chicks but not for large predators.

The Least Tern historically nested along the coast on broad, sparsely vegetated sandy beaches (Bent 1921; Gochfeld 1983). Unfortunately, as the human population has increased, many of the traditional Least Tern nesting sites have been usurped by human activities and buildings. The loss of nesting habitat apparently began earlier in the northeast (Nisbet 1973) than in the mid-Atlantic or southeast (Downing 1973; Gochfeld 1983). The loss of traditional nesting areas has been offset somewhat by the creation of new nesting habitat. Least Terns now nest in a variety of artificial open habitats such as dredged-material deposits (Downing 1973; Jernigan, et al. 1978), gravel-covered roofs (Fisk 1975), and ground cleared by mining, construction, and other activities (Lohrer and Lohrer 1973; Loftin 1973; Maehr 1982; Gore 1991).

LIMPKIN *(Aramus guarauna)*

HABITAT REQUIREMENTS AND HABITAT TRENDS: The apple snail appears to be the most important habitat requirements of Limpkins, as their distributions are almost identical (Harper 1936). Limpkins are found along the wide and well-vegetated shallows of rivers and streams statewide, as well as around lakes in peninsular Florida and in the marshes, broad swales, strand swamps, sloughs, and impoundments in south Florida. Much natural riparian habitat has been reduced or degraded by human activities, including agricultural conversion, river channelization, wetland drainage, aquifer and surface water depletion, and the introduction of exotic aquatic plants. While the steady trend of habitat loss has certainly slowed considerably, piecemeal conversion and the spread of exotic plants continue. Nests are built in an impressively wide variety of situations. Theses include on piles of slowly sinking aquatic vegetation, among tall marsh grasses, especially bulrush (*Scirpus spp*.), between the knees of bald cypress (*Taxodium distichum*), in vine-covered shrubs, in the tops of sabal palms (*Sabal palmetto*), and on high cypress branches. An abandoned Osprey nest also was recorded to have been used and a cypress tree cavity 30 feet high was used by one individual for several years (Bryan 1992). In all these sites any usable material is pulled from nearby or, rarely, carried to construct the piled or crudely woven nest.

LITTLE BLUE HERON *(Egretta caerulea)*

HABITAT REQUIREMENTS AND HABITAT TREND: As with other ardeids, the Little Blue Heron requires relatively shallow freshwater, brackish, and saltwater foraging habitats that provide access to adequate prey. The Little Blue's diet is quite diverse and includes fishes, amphibians, and invertebrates (Meanley 1955; Jenni 1969; Domby and McFarlane 1978; Telfair 1981; Rodgers 1982). Little Blue Herons nesting in marine-estuarine regions often will fly inland to forage at freshwater sites (Rodgers 1982), possibly as a consequence of nestlings being intolerant of a high salt content of prey.

Breeding habitat requirements for Little Blue Herons are similar to other ardeids (Rogers 1980b). Little Blue Herons nest in a variety of woody vegetation including cypress (*Taxodium distichum*), southern willow (*Salix caroliniana*), red maple (*Acer rubrum*), buttonbush (*Cephalanthus occidentalis*), red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), cabbage palm (*Sabel palmetto*), and Brazilian pepperbush (*Schinus terebenthifolius*). Little Blue Herons usually breed in mixed-species colonies located in flooded vegetation or on islands.

In Florida, much alteration of freshwater and marine-estuarine foraging habitat has had an adverse effect on the Little Blue Heron and probably has contributed to a decrease in its population. Further degradation of the foraging habitat of all ardeids probably will occur in the future.

OSPREY *(Pandion haliaetus)*

HABITAT REQUIREMENTS AND HABITAT TREND: Except during migration, Ospreys spend most of their lives around bodies of open water. Nests are constructed in the tops of large living or dead trees, including cypress (*Taxodium sp.*), mangrove (*Avicennia germinans, Rhizophora mangle*), pine (*Pinus sp.*), and swamp hardwoods. Nest trees are often located in extensive stands of swamp forest, in riparian woodlands, or in belts of cypress bordering lakes or streams. Nests in Florida Bay and other coastal bays or offshore islands may be in low mangrove trees or shrubs or even on the ground (Ogden 1977). Ospreys also readily construct nests on a wide variety of man-made structures, including utility poles, radio towers, and channel markers, where human activity may be relatively high but where direct disturbance to nests is unlikely (Schreiber and Schreiber 1977). Ospreys also require open, relatively clear water in order to successfully locate and capture fish. There seems to be no overall assessment of Osprey habitat trends in Florida. Locally, and perhaps regionally, Ospreys numbers appear to be limited by a lack of adequate nesting trees or other structures, if one can judge by the success of supplemental nest platform programs (Westall 1983). Construction of large numbers of lakefront homes has undoubtedly displaced Ospreys from nesting sites in shoreline trees. Logging, especially for larger trees or in limited stands of cypress and swamp hardwoods, may be eliminating nesting sites.

PIPING PLOVER *(Charadrius melodus)*

HABITAT REQUIREMENTS AND HABITAT TREND: The Piping Plover nests on sandy beaches along the Atlantic Coast and Great Lakes, and on river sandbars and shallow alkali wetlands throughout the Great Plains region (USFWS 1985). Piping Plovers are primarily associated with barrier beach systems during the wintering period. Haig and Oring (1985) found plovers on sandy beaches adjacent to inlets on their winter survey of the Gulf of Mexico. Similarly, Nicholls and Baldassarre (1990b) observed plovers on accreting ends of barrier islands and

spits, at coastal inlets, and on low-lying barrier islands with overwash intertidal flats. In this study, comparisons along 36 Atlantic Coast and 75 Gulf Coast wintering sites indicated that foraging activity was most associated with sandflats (27%), mudflats (25%), sandy-mudflats (32%), and occasionally lower beach or foreshore (10%), and dredge spoil (6%). Roosting birds were primarily observed along the upper beach or berm area adjacent to intertidal feeding areas. However, more roosting sites need to be located and characterized to determine specific features because few roosting birds were found (Nicholls and Baldassarre 1990b). Nicholls and Baldassare (1990b) noted that sites with the highest concentrations of plovers such as Honeymoon Island State Recreation Area and Fort Desoto County Park (Pinellas County) consist of complex systems with expansive sand/mudlfats in close proximity. These diverse coastal systems may concentrate plovers because of the juxtaposition of foraging and roosting areas. Winter habitat loss is difficult to document, but historical data suggests that degradation has occurred along portions of the Atlantic and Gulf coasts (Baldassarre 1986; Dyer et al, 1988; USFWS 1988, 1994, 1995). For example, on the Atlantic Coast of Florida, plovers were considered abundant from July to August (Bent 1929; Stevenson 1960), but now only number from 20-30 birds, excluding the Keys (Nichols 1989).

PONDSPICE *(Litsea aestivalis)*

No information is provided on this species in Rare and Endangered Biota of Florida.

RED-COCKADED WOODPECKER *(Picoides borealis)*

HABITAT REQUIREMENTS AND HABITAT TREND: This distribution of the Red-cockaded Woodpecker is related closely to the occurrence of fire. Throughout Florida and the northern Gulf coast states, weather patterns associated with the Gulf of Mexico result in a frequency of electrical storms matched nowhere else in North America (Jackson et al. 1986). Average annual thunderstorm frequency ranges from 90 days in central Florida to 60 days in the more northern portions of the southeastern United States. Prior to human intervention, lightning-caused fires occurred annually in peninsular Florida and at 3-5 year intervals elsewhere in the coastal plain (Komarek 1974). This fire-dominated community was the primary selective force in the formation of the southern pin ecosystem with which the Red-cockaded Woodpecker is so intricately associated. Under this fire regime, the southern pines evolved adaptations for fire resistance — their bark and needles form insulating layers that protect the growing tissues from fire (Jackson 1987). In turn, the Red-cockaded Woodpecker adapted to this fire-climax ecosystem by excavating cavities in fire-tolerant living pines.

Red-cockaded Woodpeckers require old-growth, living pines for nesting and roosting. Although longleaf pine (*Pinus palustris)* is preferred when available (Hopkins and Lynn 1971; Lennartz et al. 1983a; Hovis and Labisky 1985), cavities also are constructed in loblolly (*P. taeda)*, shortleaf (*P. echinata)*, pond (*P. serotina)*, slash (*P. elliottii),* pitch *(rigada)*, and Virginia (*P. virginiana*) pines. Regardless of species, Red-cockaded Woodpeckers preferentially select old-age pines for cavity excavation (Hovis and Labisky 1985; Conner and O'Halloran 1987; DeLotelle and Epting 1988; Rudolph and Conner 1991). Average cavity-tree ages range between 63 and 130 years for longleaf pine and between 62 and 149 years for all other pine species (Hopkins and Lynn 1971; Jackson et al, 1979b; Wood 1983; Rudolph and Conner 1991). Cavity trees have thinner sapwood and greater heartwood diameter than other mature pines (Conner et al. 1994) and typically are infected with *Phellinus pini*, a fungus that decays the heartwood and facilitates cavity excavation (Jackson 1977b; Conner and Locke 1982;

Conner and O'Halloran 1987; Hooper 1988; Conner et al. 1994). Cavity excavation usually requires from one to several years, but once a cavity is completed it often is used for many years (Jackson et al 1979b). Red-cockaded Woodpeckers always construct their cavities in live pines; however, after a cavity tree dies the birds may continue to use it for several years (Hooper 1982). The number of cavities per tree typically ranges between one and two (Hopkins and Lynn 1971; Shapiro 1983; Hovis and Labisky 1985).

Most active clusters occur in open, mature pine stands with sparse midstory vegetation. Rangewide, overstory basal areas and stem densities within active clusters are consistently <18 m2/ha and <300 stems/ha, respectively (Thompson and Baker 1971; Locke et al. 1983; Shapiro 1983; Hovis and Labisky 1985). Midstory basal area and stem density are typically <5.0 m2/has and <400 stems/ha respectively (Van Balen and Doerr 1978; Locke et al. 1983; Hovis and Labisky 1985). Although most biologists agree that Red-cockaded Woodpeckers cannot tolerate a well-developed hardwood midstory, Conner and Rudolph (1989) were the first to statistically correlate hardwood encroachment with cluster abandonment.

Red-cockaded Woodpeckers feed primarily on arthropods (Bear 1911; Ligon 1970; Baker 1971), which they locate by scaling the bark from trees. Fruits and mast also may be eaten but comprise a minor portion of the diet. Throughout their range, Red-cockaded Woodpeckers prefer to forage in pine-dominated habitats, and within these habitats, large (>20 cm dbh) living pines are the preferred foraging substrate (Ramey 1980; Hooper and Lennartz 1981; DeLotelle et al. 1983; Porter and Labisky 1986). However, home range size is variable and apparently is related to the amount and quality of available habitat. In general, home ranges tend to be larger in habitats with poorly stocked pine stands and a paucity of larger trees. In center and southern Florida, where the habitat is considered to be relatively poor (<7m2/ha pine basal area), home range size averages about 150 ha (Nesbitt et al. 1983b; DeLotelle et al. 1987). In coastal South Carolina, where the habitat is better (pine basal area averages 11.8 m2/ha), home range size averages 86.9 ha (Hooper et al. 1982). Habitat in northern Florida appears to be intermediate between the two extremes. Porter and Labisky (1986) reported a mean home range size of 129 ha for a population on the Apalachicola National Forest and the birds preferred to forage in pine stands with a mean basal area of 16.1 m2/ha.

Red-cockaded Woodpecker habitat, particularly nesting and roosting habitat, has declined throughout the species' range. Lennartz et al. (1983b) estimated that only 2.5% of the commercial pine acreage in the southeastern United States was suitable as nesting and roosting habitat. Between 1953 and 1977, the amount of old-growth pine in the sourtheastern United States declined by 13%; the loss was most severe in the longleaf and slash pine forest type where a 25% decline occurred over the 25-year period. In Florida, the acreage of longleaf pine declined by 83% in the 30 years between 1950 and 1980 (Bechtold and Knight 1982). However, the reduction in old-growth pine forests has been most rapid on private lands where there are no legal requirements or incentives to perpetuate the habitat for this endangered species (Lennartz 1988).

SEASIDE SPARROWS *(Ammodramus maritimus spp.)*

HABITAT REQUIREMENTS AND HABITAT TRENDS: Habitat for the Seaside Sparrow consists of saltmarshes along the Atlantic and Gulf coasts. Optimal habitat on the Atlantic coast is the extensive tidal marshes that occur behind barrier islands and vegetated chiefly by saltmarsh cord grass (*Spartina alterniflora*) and (in Duval County) patches of black needlerush (*Juncus roemerianus*). On the Gulf coast optimal habitat is the mixture of dense stands of Juncus and Spartina, and

scattered stands of salt grass (*Distichlis spicata*) that front on the Gulf of Mexico from Port Richey north to Apalachee Bay, and in the bays behind the barrier islands westward to Escambia Bay. Seaside Sparrows can tolerate early invasion of their grassy habitat by Red (*Rhizophora mangle*) and Black (*Avicennia germinans*) mangroves, but the sparrows abandon the site when these woody plants cover a major portion of the habitat. Nicholson (1946, 1950) documented the disappearance of Seaside Sparrows from the marshes near New Smyrna as mangroves moved northward. In the past, dredging and filling of coastal marshlands impacted Seaside Sparrow habitat, but current governmental policy against wetland destruction now protects the habitat. The impact of rising sea level on marsh stability over the next 50-100 years may be of some concern in the future.

SHERMAN'S FOX SQUIRREL *(Sciurus niger shermani)*

HABITAT REQUIREMENTS AND HABITAT TREND: The mature, fire-maintained longleaf pine-turkey oak sandhills and flatwoods are the optimal habitat for Sherman's fox squirrels. Only 10-20% of the original habitat is still intact, however, having been greatly altered through extensive logging; conversion to pasture, single-stand short-rotation forestry, and agricultural, commerical, and residential development; and by lack of fire (Bechtold and Knight 1982). Man's intense and widespread modification of the mature pine-oak communities of the sandhills has fragmented fox squirrel populations and reduced the quality of most remaining habitat. As habitat quality decreases, the area required to support viable squirrel populations increases. To accommodate the squirrel's large home range and varied food resources, suitable habitat must be fairly extensive and, in addition to the drier hilltops (upland), it should include the more productive lower slopes of the sandhills where the predominant longleaf pines and turkey oaks are interspersed with san post oak (*Quercus stelata var. margaretta*), live oak (*Q. virginiana*), laurel oak (*Q. hemisphaerica*) and bluejack oak (*Q. incana*). Kantola and Humphrey (1990) suggested that the highest-quality habitat might be along the edge of longleaf pine savanna and live oak forest, because live oak acorns appear to be a major food source when turkey oak acorn crops fail.

Moore (1957) considered longleaf pine seeds and turkey oak acorns to be the primary foods of Sherman's fox squirrel. Kantola and Humphrey (1995), however, found production of these two seed crops to be extremely patchy, varying considerably from year to year and site to site. During mast failures to turkey oak, squirrels moved downslope to include live oak forest in their home ranges during the mast season. Consequently acorns of live oak appear to be a major component of the diet. Pine cones are cut from the trees from late May through October, beginning while they are still green. Acorns are harvested from both the trees and ground beginning in late September, and some are cached for later use. Other acorns and nuts, fungi, bulbs, vegetative buds, insects, and staminate pine cones also are eaten. Squirrel reproduction, and thus densities, may be expected to vary with resource abundance (Weigle et al. 1989).

Tree cavities occasionally are used for nesting, but they apparently are not as important for Sherman's fox squirrel as they are for more northern squirrels. Instead, leaf nests are used extensively. These usually are located in large oaks and often contain Spanish moss (*Tillandsia usneoids*), which provides insulation. Turkey oaks in the low slopes of the sandhills typically are larger, have more Spanish moss, and produce more acorns than those in the upland, making the lower slopes a more important component of fox squirrel habitat.

SHORT-TAILED SNAKE *(Stiloma extenuatum)*

HABITAT: *Stilosoma extenuatum* is restricted chiefly to Longleaf Pine - Turkey Oak plant associations. It occasionally is found in upland hammock and Sand Pine scrub, but is usually closely adjacent to Longleaf Pine - Turkey Oak stands. Two specimens were dug from sphagnum bog adjacent to a stand of the typical habitat (Carr 1940 and personal communication).

The ecological factors, other than preferred habitat distribution, which limit the distribution of this species are not known. Preliminary data indicate that the species selects Norfolk, Blanton fine, and St. Lucie soils over a variety of other types for burrowing when placed in choice situations. The extensive stands of Longleaf Pine - Turkey Oak habitat (now chiefly Turkey Oak) in Marion and Lake counties still maintain populations, and stands of apparently acceptable habitat still exist scattered elsewhere throught its original range.

SNOWY EGRET *(Egretta thula)*

HABITAT REQUIREMENTS AND HABITAT TRENDS: The Snowy Egret in Florida nests in both coastal and inland wetlands, often in mangroves (*Rhizophora mangle, Avicennia germinans, Laguncularia racemosa)* or in willows (*Salix caroliniana)* (Bent 1926; Palmer 1962). Nesting also occurs in many other species of woody shrubs and small tress, including Australian pine (*Casuarina sp.)*, cypress (*Taxodium sp.*), pond apple (*Annona glabra)*, Brazilian pepper (*Schinus terebinthifolius)*, buttonbush (*Cephalanthus occidentalis)*, and elderberry (*Sambucus canadensis)* (Nesbitt et al. 1982). Almost all nesting occurs over shallow water or on islands separated from the mainland by relatively broad expanses of open water. Snowy Egrets feed in a wide variety of permanently and seasonally flooded marshes, swamps, lake and stream shorelines, and water impoundments, or even in very temporarily flooded ditches and agricultural fields, usually where the water is relatively shallow and calm (Palmer 1962; Sykes and Hunter 1978; Bancroft et al 1990; Edelson and Collopy 1990). The Snowy Egret also feeds in upland grasslands and at the edge of the surf along beaches (Palmer 1962; Ogden, unpubl. data).

Although difficult to document, the overall impression is that significant losses of feeding habitat have been occurring for several decades in Florida, and that it is these losses rather than destruction of colony sites that has been primarily responsible for the population declines (W. Robertson and P. Frederick, pers. comm.). The pattern of population recovery prior to the 1950s, followed by several recent decades of decline, has been explained as an artificially depressed population (plume hunting) building to its regional carrying capacity, then declining as that carrying capacity diminished as wetlands were lost (Robertson and Kushlan 1974).

SOUTHEASTERN AMERICAN KESTREL *(Falco sparverius paulus)*

HABITAT REQUIREMENTS AND HABITAT TREND: American Kestrels are secondary cavity-nesters, depending on cavity excavators (e.g. woodpeckers) and natural processes to produce nesting sites. In a study of 95 nest sites in north-central Florida (Hoffman 1983; Hoffman and Collopy 1987), kestrels were found to nest predominately in longleaf pine (*Pinus palustris*) snags (53%); of the remaining nests, 32% occurred in sand pines (*P. clausa*), 12% in turkey oaks (*Quercus laevis*), 3% in live oaks (*Q. Virginiana*), and<1% in post oaks (*Q. stellata*). In an area with a wide size range of potential nesting trees (8-40+cmdbh), kestrels preferred snags that were 32-40 cm dbh

(Hoffman 1983). In a comparison study area that had a smaller size range of snags available (8-32 cm dbh), 93% of the kestrels nested in the largest size class available (24-32 cm dbh).

In a longleaf pine-turkey oak sandhill study site in north-central Florida, kestrel cavities (n=29) were most frequently old Pileated Woodpecker (*Dryocopus pileatus)* excavations (45%) or enlarged cavities of *Melanerpes or Colaptes* woodpeckers (38%) (Hoffman 1983). Kestrel nest cavities (n=31) in the sand pine clearcuts of the Ocala National Forest were predominately (61%) old Northern Flicker (*C. auratus*) holes. In addition to the presence of snags and woodpeckers to excavate cavities, kestrels require open fields to forage for food. In a roadside survey conducted in north-central Florida, *paulus* kestrels generally preferred open areas (e.g. pastures, fields, and open woodlands), and avoided hardwood stands and slash pines, pine plantations (Bohall-Wood and Collopy 1986). Smallwood (1987) showed that the percent coverage of a kestrel's winter territory by woody canopy was negatively correlated with the foraging quality of that habitat; nearly all hunting attempts occurred in grasses and weedy forb <25 cm in height. Nesting and foraging habitats preferred by kestrels have and are continuing to decline rapidly throughout Florida.

TRICOLORED HERON *(Egretta tricolor)*

HABITAT REQUIREMENTS AND HABITAT TREND: Nesting colonies of the Tricolored Heron in Florida are most often located on mangrove (*Rhizophora mangle, Avicennia germinans, Laguncularia racemosa*) islands along the coast, or in willow (*Salix caroliniana*) thickets in freshwater wetlands (Bent 1926; Palmer 1962). Nesing also may occur in other woody thickets, including Australian pine (*Casuarina sp.*), cypress (*Taxodium sp.*), pond apple (*Annona glabra*), Brazilian pepper (*Schinus teretbinthifolius*), saltbush (*Baccharis sp.*), and wax myrtle (*Myrica cerifera*) (Inesbitt et al. 1982). Almost all colony sites are located on islands or in woody vegetation over standing water. Tricolored Herons feed in a wide variety of permanently and seasonally flooded marshes, mangrove swamps, tidal streams, roadside ditches, and shallow edges to ponds and lakes (Bancroft et al. 1990). The long history in Florida of wetland degradation by drainage, creation of impoundments, and changes in water quality are thought to be the major cause for the population decline of Tricolored Herons. It appears that losses of wetlands essential as feeding habitats for Tricolored Hersons during the nesting season may be having the greatest adverse impact on these birds. For example, water management practices in the Everglades region have altered the timing, location, and frequency of natural hydrological patterns (Johnson and Ogden 1990, Johnson et al, 1992). These hydrological changes have caused nesting wading birds to abandon traditional colony sites and to have reduced levels of nesting success (Frederick and Collopy 1989; Bancroft 1989; Ogden 1994).

WEST INDIAN MANATEE *(Trichechus manatus)*

HABITAT REQUIREMENTS AND HABITAT TREND: Florida manatees occupy coastal, estuarine, and some riverine habitats. Primary habitat requisites are access to vascular aquatic plants, freshwater sources, proximity to channels 1-2m deep, and access to natural springs or man-made warm-water refugia during winter (Hartman 1978). Sheltered bays, coves, and canals are important for resting, feeding, and reproductive activity (Bengtson 1981; Powell and Rathbun 1984). Florida manatees forage on a wide variety of aquatic plants including seagrasses, bank grasses, overhanging mangrove, and submerged, rooted, or floating species (Hartman 1979; Best 1981). In sum-

mer individuals may range widely, and seasonal migrations of 850km to wintering areas have been documented (U.S. fish and Wildlife Service, unpubl. data). These wide-ranging movements require access to travel corridors that are unobstructed by dams, shallows, or congested boat traffic.

Manatee habitat in Florida has been and continues to be greately altered by residential and commercial development of coastal land (Packard and Wetterqvist 1986). Dredge-and-fill activities may destroy areas of aquatic vegetation, whereas new channels and inlets may allow access to additional habitat. Tampa Bay, for example, has experienced an 81% decrease in seagrass acreage in the last century due to adjacent urbanization (Lewis et al. 1985). Water pollution poses a threat to aquatic plants as a food base. Manatees are not known to accumulate significant residues of most persistent environmental contaminants, because of their low position in the food chain. Exposure to copper-containing aquatic herbicides, however, has potential harmful effects (O'Shea et a. 1984). The number of boats using manatee habitat has increased rapidly (O'Shea 1988) creating substantial disturbance as well as greater potential for injury and death. An increase in artifical warm-water sources in the 1950s and 1960s and a proliferation of exotic aquatic vegetation have proven of short-term benefit to manatee populations (Powell and Rathbun 1984; Shane 1984), but some industrial sources of warm water will soon reach the end of their designed operating life.

WHITE IBIS *(Eudocimus albus)*

HABITAT REQUIREMENTS AND HABITAT TREND: White Ibises show very broad habitat tolerances for both foraging and nesting. The species nests and feeds commonly in freshwater, brackish, and saline environments, and adults appear to prefer foraging in freshwater areas when feeding young. Though adults are capable of excreting salt through a nasal salt gland, young will not grow when fed salty diets or denied access to fresh water (Johnston and Bildstein 1990). The success of breeding is therefore dependent on access to freshwater feeding areas, especially when nesting on marine islands. This limitation was probably the cause of the collapse of breeding by Scarlet Ibises in Trinidad's Caroni Swamp (Bildstein 1990), where an estuarine swamp became salinized through canalization of a major river. White Ibises prefer relatively shallow water depths when feeding (5-15cm), though often they have been noted feeding on lawns and pastures. Foraging habitats include bottomland hardwood and cypress swamps, river banks, salt marsh meadows, wet prairies, floating vegetated mats, mudflats, mangrove swamps, sawgrass strand edges, hydric hamocks, canal edges, beach flats, and landfills. Ibises feed primarily on aquatic arthropods, especially crayfishes and insects, although small amphibians and reptiles also are commonly taken. Ibises will eat fish when available, but the fish must usually be extremely abundant or vulnerable for ibises to capture them. Although receding water levels in south Florida seem to be critical to the stimulation and success of nesting, this is not necessarily true of breeding in other parts of the range. In coastal South Carolina, White Ibises foraging in riparian bottomlands may nest in larger numbers during years of higher rainfall (Bildstein et al. 1990). Ibises are tactile feeders and forage effectively in turbid waters and in waters with dense vegetation.

Nesting colonies are usually surrounded by water, as this species is quite vulnerable to predation by terrestrial mammals. Ibises tend to nest in shrubby vegetation with moderate shade, although their preferences often include ground nesting on clumps of grasses and in trees to 15 m. White Ibises can travel long distances from colonies in feeding areas; regular trips to sites 30 km away have been associated with successful breading in several loations. Foraging and breeding

habitat has declined considerably in the last 25 years, both due to the drainage or degradation of wetlands through human encroachment and through manipulation of intact wetlands. While drainage and physical destruction of habitat has been largely discontinued in the state, habitat degradation, encroachment of human development, and water management remain important sources of further habitat degradation.

WOOD STORK *(Mycteria americana)*

HABITAT REQUIREMENTS AND HABITAT TRENDS: Wood Storks nest in colonies located in woody vegetation over standing water or on islands surrounded by relatively broad expanses of open water (Newsbitt et al. 1982). Most natural colony sites in Florida have been in cypress (*Taxodium sp.)* or mangrove (often *Rhizophora mangle*), although colonies also have been located in southern willow (*Salix caroliniana)*, pond apple (*Anna glabra)*, and in mixed associations of swamp hardwoods (e.g. *Magnolia Nyssa)* (Rodgers et al. 1988; Ogden 1991). Primarily since the 1970s, storks also have nested at sites where water has been artificially impounded by roads or levees or where islands have been created by dredge activities (Ogden 1991). Nests in these altered or artifically created colony sites may be in the same species of trees as in the natural sites, but also have been in dead or dying upland trees (e.g. *Pinsus. Quercus*), in exotic species such as Australian pine (*Casuarina sp.)* and Brazilian pepper *(Schinus terebinthefolius)*, or even in low thickets of cactus (*Opuntia sp.)* on islands. The use of altered or artifical colony sites suggests that, in some regions or in years of low rainfall, storks have been unable to locate natural nesting habitat that adequately floods during the nesting season. Use of altered or artificial habitats as stork nesting habitat in central and north Florida has increased from approximately 10% of all nesting pairs in 1959-1960 to 50-82% between 1976 and 1986.

Storks feed primarily in water between 5 and 40 cm (2-15 in.) deep, where the water is relatively calm and uncluttered by aquatic vegetation (Kahl 1964; Coulter 1987). Almost any shallow wetland depression where fish tend to become concentrated, either through local reproduction by fishes or as a consequence of area drying, may be good feeding habitat. These sites include drying marshes, shallow roadside or agricultural ditches, narrow tidal creeks and pools and depressions in cypress heads or swamp sloughs. However, all such sites must have sufficiently long annual hydroperiods of adequately strong hydrological connections with more permanent water to produce or make available necessary densities of fishes as prey for storks.

Differences among years in patterns and amounts of rainfall result in differences among years in where and when storks feed. Colony sites that are successful over time will be those that have a large number of potential feeding sites, including relatively shallow and deep sites that may only be suitable in years of rainfall extremes (Courter 1987).

The increase in both number and percentage of the population nesting in central and northern Florida since the 1970s has been characterized by a regional increase in the number of colonies active each year, rather than by an increase in size of existing colonies (Ogden et al. 1987). Presumably limitations in the total area of wetland foraging habitat within flight range of each site may limit colony size in this region. By contrast, the south Florida region, where much more expansive wetlands once occurred, was formerly characterized by a relatively small number of much larger colonies being active each year.