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The First Successful Nesting of Wood Storks on Arthur R Marshall Loxahatchee National Wildlife Refuge

Mark D. Maffei

Howard L. Jelks

This case illustrates the behavioral plasticity of Sandhill Cranes and supports the concept of developing nesting buffer zones derived from the disturbance tolerances of a given nesting pair. However, the protracted incubation period described herein provides evidence that even seemingly habituated Sandhill Cranes can be adversely affected through subtly stressful encounters with humans.

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The First Successful Nesting of Wood Storks on Arthur R. Marshall Loxahatchee National Wildlife Refuge

MARK D. MAFFEI[1] AND HOWARD L. JELKS[2]
[1]Arthur R. Marshall Loxahatchee National Wildlife Refuge,
Rt. 1, Box 278, Boynton Beach, Florida 33437, and
[2]Florida Cooperative Fish and Wildlife Research Unit, University of Florida,
117 Newins-Ziegler Hall, Gainesville, Florida 32611

Located in central Palm Beach County, the Arthur R. Marshall Loxahatchee National Wildlife Refuge totals 57,906 ha. The habitat is characterized as northern Everglades habitat consisting primarily of a matrix of wet prairie and slough communities in which thousands of tree islands are located. The tree islands, ranging in size from 0.1 to 50 ha provide suitable substrate for wading bird nesting. In typical water years (i.e., years where water levels are not impacted by drought) as many as 200 islands are used as rookery locations in the Refuge, supporting 15,000 nesting pairs of wading birds. Colonial wading birds which nest on the Refuge include White Ibis (*Eudocimus albus*), Little Blue Herons (*Egretta caerulea*), Great Blue Herons (*Ardae herodias*), Snowy Egrets (*E. thula*), Great Egrets (*Casmerodius albus*), Cattle Egrets (*Bubulcus ibis*), and Tricolored Herons (*E. tricolor*). White Ibis often are the most common of the nesting wading birds, with as many as 12,000 pairs nesting on the Refuge.

In order to monitor wading bird nesting on the Refuge, surveys of colonies are conducted each year by the Refuge staff. Surveys are conducted on the ground using airboats, and aerial surveys are conducted using both fixed- and rotary-winged aircraft. Surveys are conducted beginning in late January, and continue through early July. Typically, Great Blue Herons are the first to nest, with many initiating nesting in January. By mid-March, most species have begun nesting, and White Ibis have been found incubating eggs as late as July. Despite the fact that typically up to 1,000 Wood Storks (*Mycteria americana*) forage within the Refuge from mid-December through early June (Hoffman et al. 1987, 1988, 1989) there are no records of Wood Storks successfully nesting on the Refuge (Kushlan and Frohring 1986). In 1981, about 100 Wood Stork nest platforms were found

on the Refuge (Takekawa 1982). All of these nests were abandoned and no hatchlings were found in any of these nests.

On 13 March 1990, during an aerial wading bird rookery survey, 20 Wood Storks were observed in a colony of about 2,000 pair of White Ibis. We visited this site, located at 26° 25′ 25″ N, 80° 22′ 15″ W, on 26 April 1990, in order to conduct research activities. While at the rookery, which by this time had grown to about 4,500 White Ibis nests, with lesser numbers of Snowy Egrets, Great Egrets, and Tricolored Herons, 8 Wood Stork nests were found and inspected. The rookery island was vegetated primarily with sawgrass (*Cladium jamaicensis*), and the majority of ibis nests were ground nests. A small willow (*Salix caroliniana*) clump on the western side of the island was the site of several hundred Tricolored Heron, Snowy Egret and Great Egret nests.

The Wood Stork nests, all of which were located in a single strangler fig tree (*Ficus aurea*) embedded with the largest willow clump, were examined using a mirror on an extendable pole. Four of the nests inspected were being tended by adult Wood Storks and had fresh vegetation in them, but contained no eggs; two of the nests contained 2 eggs, one nest contained 3 eggs, and one nest contained 2 hatchlings, about 5 days old. The colony was revisited on 22 June 1990. Fifteen Wood Stork young were observed in or near 7 nests. One nest that Wood Storks initially constructed contained two nestling Anhingas (*Anhinga anhinga*). Young Wood Storks were seen flying up to 15 m from their nests. A final visit was made to the colony on 9 July 1990. Eight immature Wood Storks remained in the colony at this time, with up to 13 adult Wood Storks present. All but one of the immature birds were observed flying more than 50 m from the colony. These represent the first confirmed successful nesting of Wood Storks on Arthur R. Marshall Loxahatchee National Wildlife Refuge since its establishment in 1951. Like the nests constructed in 1981, those reported in this note were initiated in March, located in the southern portion of the Refuge, and the nesting attempts occurred during a period of drought. During periods of drought, nesting areas typically used by Wood Storks in the Everglades lack sufficient water to support colony establishment. During these times, areas such as the south end of the Refuge, where water is impounded, become extremely important as nesting areas for all species of wading birds which nest in the Everglades.

In the southern Everglades, Wood Storks which initiate nesting after January generally fail to fledge young (Ogden 1989). Wood Storks require 15 to 21 weeks following colony formation to fledge young (Kahl 1964). Because successful fledging of young requires a great deal of food, young Wood Storks must be on their own prior to the onset of the rainy season in early June. Once the summer rains begin, prey populations, which had become concentrated due to falling water levels and reduced areas of inundation, disperse into newly flooded marshes. The resulting prey densities fall below that which is necessary for adult Wood Storks to provide adequate food resources to nestlings. This results in abandonment of nests and nest failure (Ogden 1989). The Wood Stork nests found within ARM Loxahatchee NWR were initiated after mid-March. Typically, nests initiated that late in the season are expected to fail. Of the 8 nests on the Refuge, however, only one failed while the others fledged an average of 2.1 young. These were the first Wood Storks known to be produced on the Refuge since its establishment.

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Multiple Clutches and Nesting Behavior in the Gulf Coast Box Turtle

DALE R. JACKSON
Florida Natural Areas Inventory, The Nature Conservancy,
1018 Thomasville Rd., Suite 200-C, Tallahassee, Florida 32303

Although many North American emydid turtles typically lay more than one clutch of eggs per year, this does not appear to be generally true of the eastern box turtle (*Terrapene carolina*), whose range encompasses much of the eastern United States. However, Dickson (1953) recorded annual production of as many as four clutches by captive female Florida box turtles (*T. c. baurii*) in southern Florida, and Legler (1958) noted the presence of two sets of corpora lutea in some females taken from peninsular Florida and southern Mississippi. Based on gonadal examinations, Tucker et al. (1978) postulated the routine occurrence of multiple clutches in a Florida panhandle population of the largest extant subspecies, the Gulf Coast box turtle (*T. c. major*). However, because follicular atresia as well as ovulation may produce corpora lutea, and because there is no assurance that enlarged and preovulatory follicles will be ovulated, direct observations of multiple nestings are needed to verify this phenomenon. In this paper I confirm the hypothesis of Tucker et al. (1979) via repeated observations of nesting by a single female Gulf Coast box turtle during a five-year period.,

On 18 February 1986 I acquired a pair (male and female) of adult Gulf Coast box turtles that had been collected two days earlier in floodwaters of the Ochlockonee River (T2N, R1W, sec 18), Leon/Gadsden County Line, Florida. Respective maximum carapacial/plastral lengths (mm, CL/PL) of the male and female were 178/171 and 160/160. The female showed no linear growth throughout the study; her non-gravid mass was about 730 g. Along with several other resident Gulf Coast and eastern (*T. c. carolina*) box turtles, both were allowed to roam freely in my fenced, 570 m^2 back yard, which consists predominantly of a mixed, mesophytic hardwood hammock in northern Leon County. In the southeast corner is a 30 m^2 barren to grassy area that slopes up to the hammock (maximum elevational difference = 40 cm). During heavy rains, the lower area is prone to brief flooding, with the soil remaining saturated for several days. A small artificial "pond" (33 cm diameter, 8 cm maximum depth) provides water. Bananas, tomatoes, and earthworms were offered occasionally to supplement naturally obtained food, which included mushrooms, invertebrates, and other organic matter.