

# PREDATION OF ALLIGATOR NESTS IN OKEFENOKEE SWAMP NATIONAL WILDLIFE REFUGE, GEORGIA, U.S.A.

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**ABSTRACT** - Predation of 70 alligator nests in Chesser and Grand Prairies of the Okefenokee Swamp is discussed. In 11 nesting seasons 16% of monitored nests survived predation. Black bears (*Ursus americanus*) and raccoons (*Procyon lotor*) were the major consumers of alligator eggs. Thirty-nine percent of female alligators guarded their nests from human intrusion and 58% of these nests survived predation.

## INTRODUCTION

Across its range the American alligator (*Alligator mississippiensis*) exhibits some degree of nest tending behavior but predators of alligator eggs still manage to significantly affect nesting success. In coastal South Carolina raccoons destroyed 11.1% of 117 clutches late in the incubation period (Wilkinson 1983). On Rockefeller Refuge, Louisiana, Joanen (1969) reported a 16.5% (N = 44) loss of nests to raccoons and found that predation occurred usually at the end of the seventh week of incubation with raccoons making multiple visits to the nest mound until all eggs were consumed. In a North Florida study 43% of 35 nests were preyed upon primarily by raccoons (Deitz and Hines 1980). The highest recorded predation rate was in the Okefenokee Swamp National Wildlife Refuge, Georgia, where predators destroyed 86% of nests (Metzen 1977). Here I report on nest predation and identify predators in the Okefenokee Swamp.

## METHODS

The study area of Chesser and Grand Prairies is an aquatic macrophyte marsh containing thousands of tree islands. A boat trail connects the prairies with several fishing lakes and in normal rainfall years is navigable by motor-boat traffic. Twelve km of this boat trail and its intersecting alligator trails were explored for nests. Searches for nests were conducted on foot or from paddle craft.

To identify predators of eggs, some nests were monitored with set cameras; Kodak Instamatic X-15 cameras with mouse-trap shutter releases were mounted on stakes and connected to the nest mound with thread. Disturbance to the mound tripped the camera and a single photograph recorded each incident. Unless the integrity of the mound was disturbed by predators, eggs and egg chambers were not examined.

When possible, nesting females were identified by atypical scutes. The nest guarding behavior of females was determined by approaching their nests; those hissing or lunging at the intruder were considered to be guarding nests; those present but not displaying defensive behavior toward humans, were considered not to be guarding nests. "Guarding" as defined here does not necessarily mean that females avoiding humans will not guard nests from other predators.

## RESULTS

Eighty-eight percent of nesting starts occurred from 20 June to 30 June. In 11 nesting seasons (1976-1986) 83 nests were located within 200 m of the 12 km trail through Chesser and Grand Prairie; predators destroyed 70 nests (Fig. 1). Fifty-nine percent of all nests and 42% of nests monitored with cameras were preyed upon before 10 July. Because of this early predator activity 45% of nests in Grand Prairie and 39% in Chesser Prairie were first discovered after predation.

Nest sites - Typically, nests were constructed in the interior of small (< 100 sq m) tree islands or at the periphery of large (> 100 sq m) tree islands. On large tree islands, nests were often at the base of a tree. Two or more alligator trails connected nests with holes, ponds or boat trails. Twenty-one nests in Chesser Prairie were located within 3 m of boat trails or ponds more than 1 m in depth and these deep-water nests had a predation rate of 67%.

Guarding Behavior - Nests of alligators not guarding from humans had higher predation rates than nests of guarding alligators. In Grand Prairie only one nest was guarded and predators destroyed all except one nest. In Chesser Prairie 44% of nests were unguarded with a predation rate of 86%; guarded nests had a predation rate of 39%. Although male alligators (> 3 m in total length) were frequently observed near females nesting in deep water, only two were observed in possible guarding postures: one hissed at me near a nest which had been preyed on and the other lunged and hissed at me near a pod of two day old neonates.

Nest repair - After predations some damaged nests still contained viable eggs; often a small excavation exposed the upper eggs with the mound retaining most of its mass and shape. In 17% (N = 12) of nests preyed on before 10 July, females made effective repairs. During this early incubation period all nesting females crawled over their nests and used their feet to scoop more plant material over nest mounds. Thus, the same activity that added mass to undamaged nests also repaired nests damaged by predators. Repeated or major structural damage to nests was not usually repaired but on 6 July, 1978 a female in Grand Prairie scooped a small amount of nest material over two whole eggs after her other eggs had been consumed in repeated predations. During nest repair she used her mouth to remove whole egg shells from the mound; set cameras photographed two other females engaged in similar behavior. Nests which had been emptied of viable eggs by predators usually contained a few scattered egg shells but some apparently intact nest mounds contained whole egg shells in the egg chamber.

Predators of eggs - Set camera photographs identified predators in 16 incidents of nest predation. One nest was destroyed by rice rats (*Oryzomys palustris*), two by raccoons, four by raccoons and bears, and nine by bears.

Early in the nesting season bears, including sows with cubs, were commonly seen wading in shallow water near nests. Although alligators were not observed defending nests from bears, one set camera photographed an egg consuming bear with extensive neck wounds. Bears usually consumed all eggs during a single visit but sometimes they made repeated visits to mounds.

In Grand Prairie a nest damaged in daylight hours by a bear, was repaired by the alligator then further damaged by raccoons and bears on three successive nights until all eggs were consumed. Bears sometimes left whole egg shells at the nest site but usually only small fragments of shell remained. Typically, nest mounds damaged by bear were massively excavated and leveled to the depth of the egg chamber.

Before the beginning of the nesting season, raccoons excavated holes in old nest debris and they preyed on nests throughout the incubation period. Set camera photographs identified raccoons excavating nests and consuming eggs during both night and daylight hours. Typically they excavated holes into the egg chamber and drained eggs by removing one end of the egg. Usually eggs were not consumed in one visit

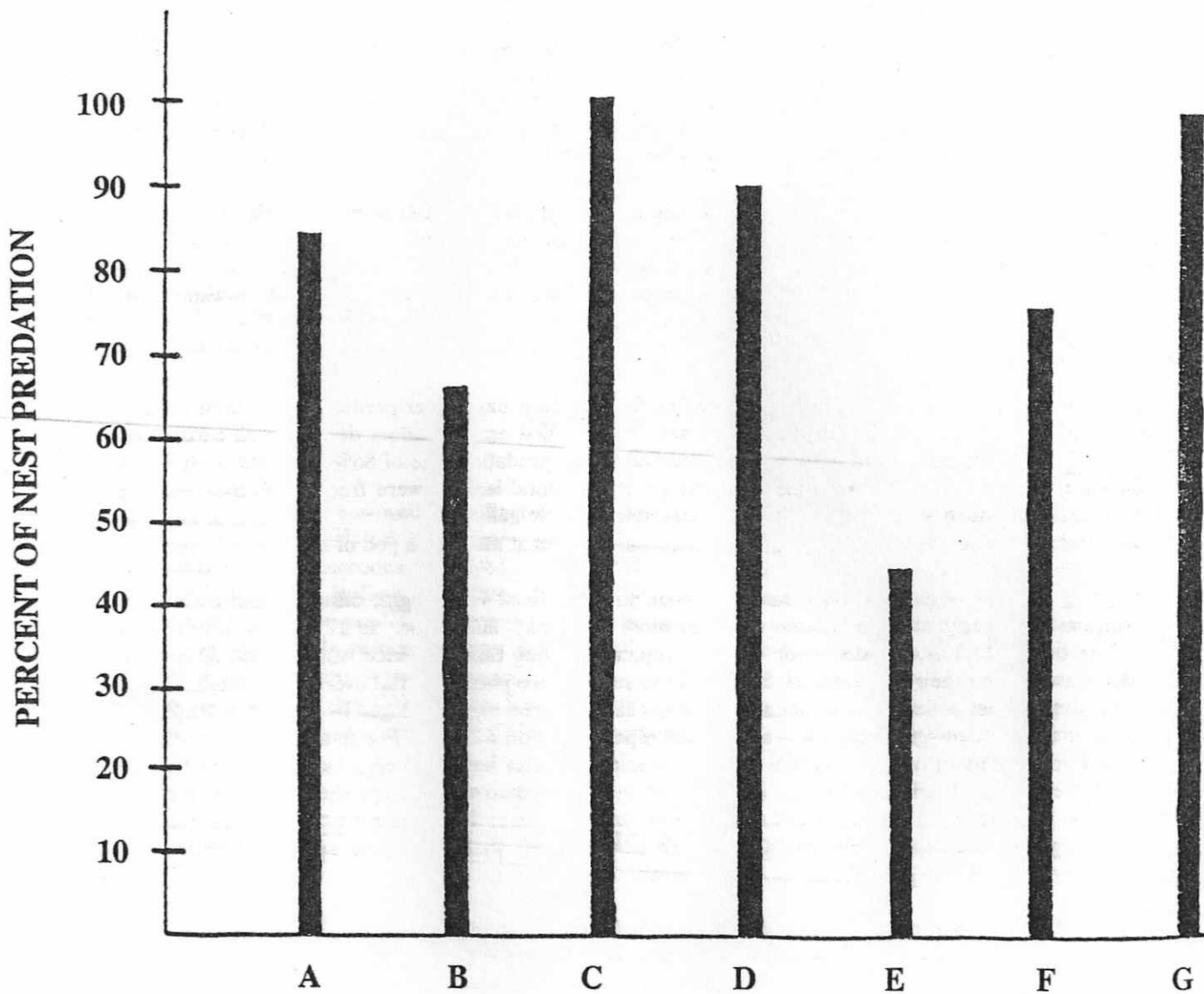


Figure 1. Predation rates of nests in Okefenokee Swamp, Georgia. A = nests with turtle eggs; B = nests near deep water; C = repaired nests; D = unguarded nests; E = guarded nests; F = Chesser Prairie; G = Grand Prairie. Total predation rate of 70 nests = 84%.

and raccoons returned over a period of several days to consume the remainder of the alligator eggs. Raccoons also consumed turtle eggs in the mound.

Turtles often laid eggs in alligator nests and in the process they eroded the mound, cracked alligator eggs and exposed alligator eggs to sunlight and opportunistic predators. Seventeen percent of alligator nests contained one or more clutches of turtle eggs and had a predation rate of 83%. Set camera photographs taken before 10 July identified Florida red-belly turtles (*Chrysemys nelsoni*) on alligator nests during night and daylight hours. One alligator nest was damaged by *C. nelsoni* laying eggs on 26 and 27 June and 3 July, 1986; the turtles deposited eggs inside the egg cavity exposing several alligator eggs and on 4 and 6 July, rice rats bit through the shells of the exposed eggs. By 29 July all alligator and turtle eggs in this nest were destroyed.

Nesting alligators, including those not guarding nests from humans, attacked turtles crawling on their mounds. On one occasion an alligator lunged with open mouth at the gravid turtle; another nesting alligator bit an escaping *C. nelsoni* but did not crush the turtle's shell.

### DISCUSSION

Black bears were responsible for the massive and early nest predation in the Okefenokee Swamp. At the shallow-water nesting sites they could easily evade female alligators defending their nests. Although only two male alligators were observed in defensive postures near nest sites, it is possible that the movement of large territorial males in the vicinity of deep-water nests inhibited bear activity. Deep water might also be an advantage for females defending nests from bears. It has been suggested that alligators see humans as facsimiles of bears (Deitz and Hines 1980) and that an alligator guarding a nest from humans will also guard from bears. Guarding alligators were more successful in hatching nests and presumably more successful in thwarting predators of eggs, but some non-guarding alligators evidently defended nests from bears; because bears usually consumed all eggs in one visit it was assumed that an alligator was defending her nest from bears when the bear made several visits to consume all eggs. A Florida study showed that guarding alligators immediately attacked small predator models but delayed serious attack on large predator models (Kushlan and Kushlan 1980). Humans and bears are the only predators able to seriously threaten the nesting alligator. For a female alligator an adult black bear is a formidable opponent and if her nest defense requires contact with the bear she could be injured. Such aggressive contact could also alter her behavior in successive encounters with bears and perhaps with humans. Guarding alligators that are attacked or stressed by humans learn not to guard (Kushlan and Kushlan 1980) and sometimes a single incident can produce this behavior (Joanen and McNease 1970). Nesting alligators encounters with aggressive bears could have the same effect. It is also possible that the bears which massively prey on nests in Grand Prairie have had such extensive nest raiding experience that few alligators can thwart their egg consuming habit.

In defense of nests from raccoons, alligators seem to differ in behavior. In Louisiana an alligator was present at her nest but did not defend it from a raccoon (Joanen 1969). In Florida an alligator not defending her nest from humans did defend from a raccoon (Deitz and Hines 1980).

Raccoons are not a lethal threat to an adult alligator and can not usually consume all eggs in one visit, but they are successful in preying on nests. In the Okefenokee some raccoons learn to raid nests from their mothers - set cameras identified females with young preying on alligator eggs. Other raccoons probably follow familiar scents to nest mounds. Raccoons inexperienced in locating alligator eggs but experienced in locating turtle eggs by scent could be expected to occasionally cross an alligator mound and find both the familiar turtle eggs and the unfamiliar alligator eggs.

Turtles laying eggs in nest mounds can affect predation of alligator eggs. In Florida, turtles have damaged alligator nests, excavating the mound, crushing eggs and depositing a powerful scent package for predators to locate (Deitz and Jackson 1979, Kushlan and Kushlan 1980). Certainly, exposure of alligator eggs by turtles makes the eggs vulnerable to opportunistic predation. In a South Carolina study, 4.2% of alligator nests were used by rodents with no impact on eggs (Wilkinson 1983). In my study, however, after *C. nelsoni* damaged one nest the exposed eggs were destroyed by rice rats.

Turtles crawling on a nest mound might be easily thwarted by the guarding alligator. Dietz and Jackson (1979) reported two gravid, dead *C. nelsoni* near nest mounds but the heavy shell of *C. nelsoni* in Okefenokee has an excellent chance of withstanding the pressure of a female alligator's jaws and turtles can employ other escape strategies, such as burrowing into the mound or assuming a stationary posture when confronted by the guarding alligator.

Nests with minor damage were effectively repaired by some Okefenokee alligators; mounds were restored and exposed eggs were reburied. Repair behavior should be an advantage to alligators nesting in areas of intense predator activity but because nests can be targeted again by the same predator and because other predators can be attracted to the scent of broken eggs these nests remain extremely vulnerable to predation. In this study, predators eventually destroyed all repaired nests.

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