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## INCREASED INCIDENCE OF RED IMPORTED FIRE ANT (HYMENOPTERA: FORMICIDAE) PRESENCE IN LOGGERHEAD SEA TURTLE (TESTUDINES: CHELONIIDAE) NESTS AND OBSERVATIONS OF HATCHLING MORTALITY

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Red imported fire ants, *Solenopsis invicta* Buren, were introduced to North America in the 1930s (Buren 1972). Since their introduction, fire ant distribution and abundance has continued to increase dramatically. Fire ants have infested more than one hundred million hectares and expanded their range throughout most of the southeastern United States (Callcott & Collins 1996).

Fire ants are an omnivorous and opportunistic species, and are often aggressive predators and competitors of native species. Fire ants have the potential to negatively affect vertebrates (Allen et al. 1994). Oviparous species may be especially vulnerable to fire ant predation, particularly ground nesting birds and reptiles (Allen et al. 1994, Allen et al. 1997, Tuberville et al. 2000, Wojcik et al. 2001). Observations of fire ant predation on amphibian and reptilian eggs and hatchlings have been reported for numerous species (Landers et al. 1980, Mount et al. 1981, Freed & Neitman 1988, Montgomery 1996, Allen et al. 1997, Buhlmann & Coffman 2001).

The occurrence of red imported fire ants in green sea turtle, *Chelonia mydas*, and loggerhead sea turtle, *Caretta caretta*, nests have been documented (Wilmers et al. 1996, Moulis 1997), however few researchers have been able to document observations of hatchling mortality due to fire ants. Hatching sea turtles may be particularly vulnerable to fire ant predation. Sea turtles are oviparous, subterranean nesting species. Prior to hatchling emergence from the nest, newly hatched turtles remain in the ground for up to seven days (Lohmann et al. 1997), during which they may be susceptible to injury from fire ants. In addition, fire ants primarily feed on high protein resources during brood production in late spring, which coincides with the start of sea turtle nesting season. In this paper, we provide observations of predation by fire ants on loggerhead sea turtle hatchlings on Cape San Blas, Florida.

Cape San Blas, a coastal barrier island along the Northern Gulf of Mexico, supports the largest density of nesting loggerhead turtles in north-west Florida (Fig. 1). Encalada et al. (1998) identified this group of nesting loggerhead sea turtles as genetically distinct from other nesting populations in southeastern United States. Surveys for

nesting sea turtles have been conducted every year since 1994 along Eglin Air Force Base property on Cape San Blas by foot and on ATV. Two surveyors conducted daily monitoring surveys of the 5-km area from 6:00 am to 10:00 am every morning from May 15 to August 15. From August 15 to October 31, nests were observed daily for signs of hatchling emergence or depredation. Nest inventories were conducted 72 h after first emergence or after 85 days of incubation, and number of hatched, unhatched, and depredated eggs was recorded.

Red imported fire ant presence was not recorded in sea turtle nests on Cape San Blas before 1995 (Table 1). In 1995, fire ants were observed on one of 60 loggerhead sea turtle nests; however, fire ant induced hatchling mortality was not documented. In 1996, fire ant presence was not recorded on any of the 25 loggerhead sea turtle nests. Fire ants were observed again in 1997 on 14 of 54 loggerhead nests (25.9%). Hatchling mortality was witnessed at two of the 54 nests (3.7%). Upon excavation of one nest, fire ants were observed consuming one sea turtle hatchling that had cracked (pipped) the egg shell, entering and stinging a live turtle within a second pipped egg, and stinging a third hatchling. In the second nest, fire ants were observed consuming an undetermined number of pipped eggs, and skeletonizing five hatchlings before emergence from the nest. In 1998, fire ants were observed on 10 of 57 nests (17.5%). Fire ant depredation resulted in mortality of 23 hatchlings, combined in three of the 57 nests (5.3%). Hatchling mortality was not recorded in the remaining seven fire ant infested nests. In 1998, surveyors observed one hatchling being consumed by fire ants near the nest surface. Upon excavation of the nest, an additional twenty dead hatchlings and one live hatchling were observed covered with fire ants. Fifteen live hatchlings were removed from the infested nest and released. Injuries observed on numerous live hatchlings included blinding due to removal of eyes and wounds on head and flippers due to necrotizing fire ant stings. All fire ant induced hatchling mortalities were observed in nests left to incubate in-situ along the North beach, not in the nests relocated to East beach.

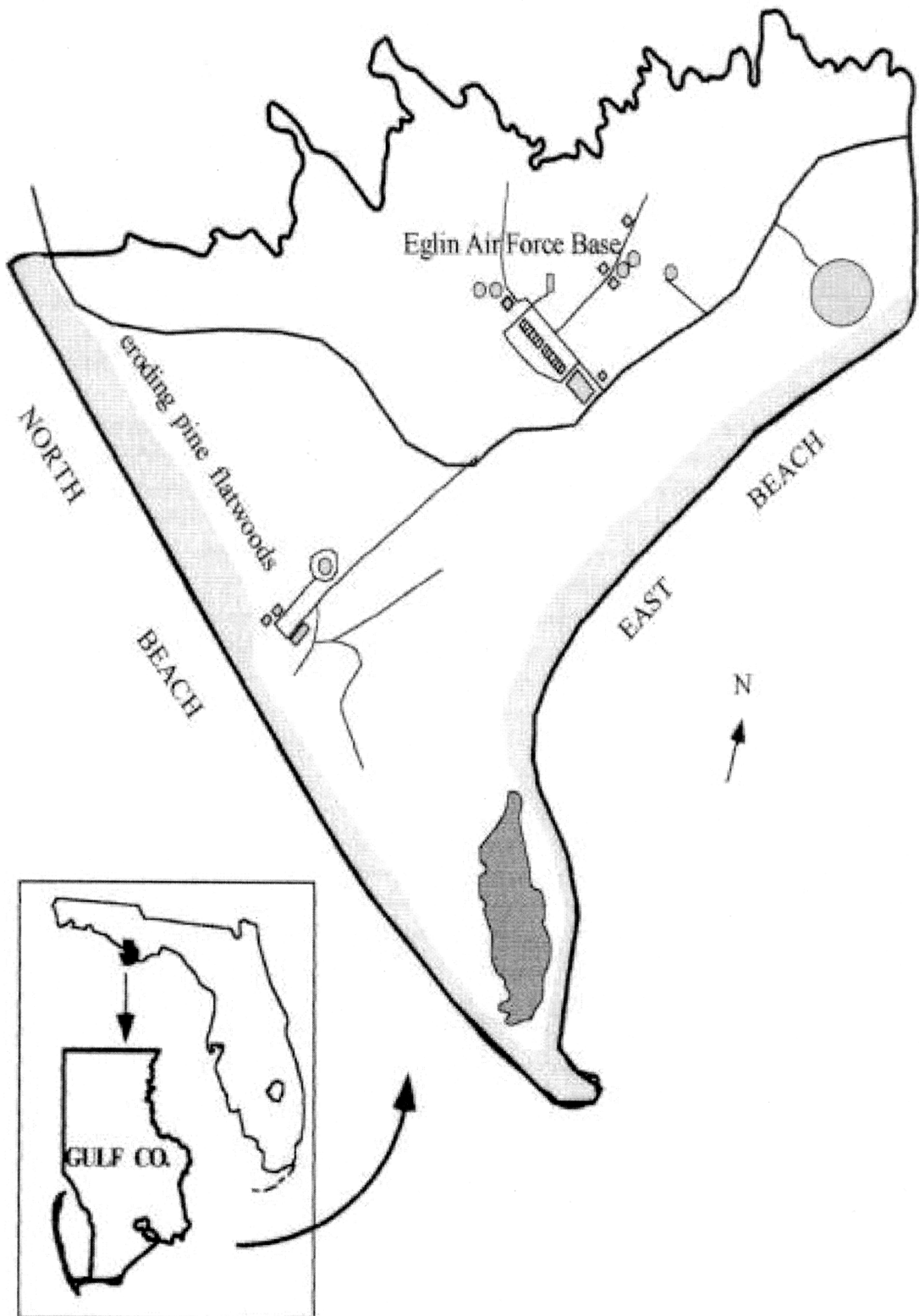


Fig. 1. Eglin Air Force Base on Cape San Blas, Florida, showing North beach, East beach and eroding pine flatwoods. [Inset showing Florida and Gulf of Mexico.]

TABLE 1. SUMMARY OF FIRE ANT-INDUCED LOGGERHEAD SEA TURTLE HATCHLING MORTALITY AND INCIDENCE OF FIRE ANT INFESTATION IN SEA TURTLE NESTS ON CAPE SAN BLAS, FLORIDA FROM 1995-1998.

Year	Total no. of sea turtle nests	Total nests with fire ants present	Total nests with fire ant-induced hatchling mortality	Total no. of hatchlings depredated by fire ants	Average clutch size (no. eggs/nest)
1995	60	1	0	0	89.1
1996	25	0	0	0	96.2
1997	54	14	2	Und*	112.4
1998	57	10	3	23	90.1

\*Undetermined no. of hatchlings depredated.

During 1995 to 1998, fire ant presence was observed on loggerhead nests at several stages of egg incubation; however, the precise time that fire ants located and infested the nest chambers is unknown. In 1995, fire ants were observed in one nest chamber within 12h of oviposition. In 1997, fire ant infestation of a nest was not detected until 72 h after the first hatchling emerged from the nest. In 1998, fire ants were observed throughout the 60-d egg incubation period at the surface of one nest. Few researchers have been able to document direct mortality of sea turtle hatchlings by fire ants. Allen et al. (2001) used red-bellied sliders, *Pseudemys nelsoni*, as a surrogate species to investigate the potential effects of fire ants on sea turtles and found a 71% mortality rate for hatching turtles exposed to imported fire ants. Buhlmann and Coffman (2001) monitored yellow-bellied slider, *Trachemys scripta*, eggs and hatchlings in nests with an infrared camera. They reported a 45% fire ant induced hatchling mortality, and confirmed that fire ants established underground trails to the nests and monitored the eggs until hatching. Fire ants depredated eggs, and upon completed sea turtle egg incubation, fire ants depredated pipped eggs and newly hatched young.

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SUMMARY

Hatching sea turtles may be at risk to fire ant predation during egg incubation, and especially at risk once pipped from the egg, prior to hatchling emergence from the nest. In addition to direct mortality, fire ants have the potential to inflict debilitating injuries that may directly affect survival of the young. The increased incidence of

red imported fire ant induced mortality and envenomization of loggerhead sea turtle hatchlings on Cape San Blas suggests this invasive ant species may pose a serious threat to the future of this genetically distinct population.

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