

RADIO-TRACKING INVESTIGATIONS OF HABITAT USAGE
AND INTERESTING BEHAVIOR OF GREEN TURTLES AT FRENCH FRIGATE SHOALS

A plan to conduct research in the Hawaiian Islands National Wildlife Refuge under the auspices of the Tripartite Cooperative Agreement and Threatened Species Permit No. PRT 2-3593, as amended.

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BACKGROUND AND JUSTIFICATION

One of the main research objectives in the Tripartite Cooperative Agreement relating to the Hawaiian green turtle (*Chelonia mydas*) involves the determination of marine and terrestrial habitat usage in the Northwestern Hawaiian Islands. The Refuge unit of French Frigate Shoals (Figure 1) is known to host over 90% of all breeding activity by green turtles in the Hawaiian Archipelago. This area consequently contains some of the most important and possibly the most vulnerable habitat for the population.

The breeding colony at French Frigate Shoals is comprised of individuals that periodically travel long distances from resident algal foraging pastures located in both the southeastern and northwestern segments of the archipelago (Figure 2). Females undertake these reproductive migrations in cycles of two

or more years, while many of the males migrate and breed on an annual basis. Courtship and copulation take place within the shallow waters of French Frigate Shoals between mid-April and early June. Nesting commences during the middle of May, reaches a peak during late June, and declines to a low level by early August. Egg clutches are deposited over the entire land area of the islets of East, Whale-Skate, Trig, Gin and Little Gin, and along the south shore of Tern. Approximately 55% of the females nest on East and 35% nest on Whale-Skate. East Island has therefore been the principal site of long-term tagging and other research activities conducted by one of us (GHB) during each breeding season since 1973. The results of this work, as well as other aspects of the life history and ecology of the Hawaiian green turtle, are presented in Balazs (1976, 1979a, 1979b, 1980 & in press) and Whittow and Balazs (1979 & in press).

Females nesting at French Frigate Shoals have been found to lay as many as six egg clutches within a season, however the mean number is only two. The length of time between these clutches ranges from 11 to 18 days, with the mean being 13 days. During this internesting interval, many of the turtles identified with temporary numbers painted on their carapace have been regularly seen both basking diurnally on the same island where nesting takes place and swimming in the adjacent waters. However, other females are not observed during the internesting interval, and their whereabouts and activities are presently unknown. A similar absence of information exists for movements and behavior which occur nocturnally during the internesting period. The habitat usage and diel activities of males during the breeding season at French Frigate Shoals are also inadequately known at the present time.

Tracking studies conducted during the interesting interval at other green turtle breeding sites consist of work by Carr *et al.* (1974) at Ascension Island, and Carr (1967, 1972) and Meylan (1978) at Tortuguero in Costa Rica. The basic tracking method successfully used at these locations consisted of direct observations of a float attached to a turtle with a long (18 m) line. Radiotelemetry studies conducted by Baldwin (1972) which attempted to monitor the velocity and magnetic heading of green turtles in the interesting habitat at Tortuguero were unsuccessful in providing information on actual positions and movements. However, the recent radio tracking of a Kemp's ridley (*Lepidochelys kempi*) during the 1979 breeding season at Rancho Nuevo in Mexico has provided worthwhile results. Additional tracking in this interesting habitat is planned for the 1980 season (A. Kemmerer and A. McGehee, personal communications).

It is important at this point to make a clear distinction between the relatively short-range tracking of turtles in their interesting habitat, and long-range tracking of the high-seas migrations between foraging pastures and breeding grounds. As described, the former research activity has been successfully accomplished at a few locations, while the latter has not been achieved to date. Furthermore, it should be noted that only females have thus far been involved in tracking studies due to the inaccessibility of males at the locations where the work was conducted.

OBJECTIVES

Principal

1. To obtain information on the movements of adult female and male green turtles during the period spent in the breeding habitat of French Frigate Shoals.

2. To obtain information on the behavioral ecology of these turtles, including aspects of their daily foraging, basking and underwater resting, speeds of travel, duration and depth of dives, social interaction, orientation, and natural mortality from shark predation.

3. To obtain information on the initial segment of the high-seas migration back to the resident foraging pastures, including aspects of the departure routes taken from French Frigate Shoals, speeds of travel, group movements, and mechanisms used for orientation and navigations.

Supplemental

1. To obtain information on the actual routes traveled during the high-seas migration back to the resident foraging pastures. The accomplishment of this supplemental objective is conditional upon detecting and locating by aircraft one or more of the transmitter-equipped turtles during the course of regular support flights between Honolulu and French Frigate Shoals.

2. To obtain information on the locations of resident foraging pastures in the main Hawaiian Islands that are utilized by turtles that breed at French Frigate Shoals. The accomplishment of this supplemental objective is conditional upon detecting one or more of the transmitter-equipped turtles during aircraft overflights planned for coastal areas of the main Hawaiian Islands.

METHODS

Research methods for tracking will employ the use of small radio-beacon transmitters attached to a maximum of six female and four male turtles at Whale-Skate Island. The position and movements of these turtles will be

monitored by triangulation for up to 20 days using two receivers consisting of a base station on Tern Island and a portable station on East Island. The two other possible methods for tracking turtles, direct observations of tethered floats and ultrasonic transmissions, are both unsuited for French Frigate Shoals due to obstructions presented by the reefs and islands.

All radio equipment for the investigation is being obtained from the Telonics Company of Mesa, Arizona. The transmitters measure 2.5 by 2.5 by 8.5 cm, weigh 200 g, and have a flexible 40 cm antenna. The method of attachment will be by four surgical stainless steel screws that self-thread into the carapace but do not enter the body cavity. This is similar to the procedure used for attaching transmitters to Kemp's ridleys in the Rancho Nuevo tracking project. In addition, the attachment method has been successfully tested by us using a green turtle in captivity at Sea Life Park on Oahu.

The transmitters will be attached to unrestrained females by two of us (GHB & AED) during the latter phase of the nesting process when the turtle is less susceptible to disturbance. Since 1973, self-piercing metal identification tags have been successfully applied to unrestrained turtles at French Frigate Shoals during this same phase of nesting. The attachment of transmitters to the males will take place during the course of terrestrial basking and may require three of us (GHB, AED & HAJ) to restrain the turtle in a normal prone position. A maximum of 10 minutes will be necessary to attach each transmitter. The transmitter battery can last for up to four months, thereby providing us with the unique opportunity to detect the turtles in resident areas of the main Hawaiian Islands following the conclusion of the breeding season at French Frigate Shoals. The transmitters that are not recovered before the cessation of battery life will eventually be dislodged during the course of normal activity in the resident habitat.

The portable receiver station established at the northwestern end of East Island will be operated by two of us (GHB & GCW). This temporary facility will consist of a small tent (2 by 4 m) which will essentially be the same accommodations that have been established on East Island during each breeding season since 1973 for the purpose of censusing and tagging nesting turtles. A 3.7 m antenna will be used as part of this receiver station. The base receiver station established on Tern Island will be located in the existing Fish and Wildlife Service caretaker facility, as mutually agreed during our planning visit of 5-6 March 1980. A 3.7 m antenna will be temporarily affixed to the top of this building. This base station will require continuous and intensive monitoring, ideally involving a minimum of four of us working in short rotating shifts.

The disturbance of monk seals will be avoided during all phases of the project.

SCHEDULE

- 10 June 1980 - Investigators arrive at French Frigate Shoals by chartered aircraft
- 1 July 1980 - Investigators depart from French Frigate Shoals by chartered aircraft

The option is provided for one investigator (GHB) to remain at French Frigate Shoals until 15 July should this be necessary to accomplish the required censusing and tagging work for the 1980 season.

RESPONSIBILITIES

The National Marine Fisheries Service, Southeast Fisheries Center Honolulu Laboratory, is responsible for the financial support of this project. The investigators will make all arrangements for transporting sufficient

quantities of food, gasoline and other necessary supplies to Tern Island. Copies of reports and publications that result from this radio-tracking investigation will be forwarded to the Fish and Wildlife Service in a timely manner.

The periodic use of the Fish and Wildlife Service's Boston Whaler at Tern Island is requested for the duration of the project.

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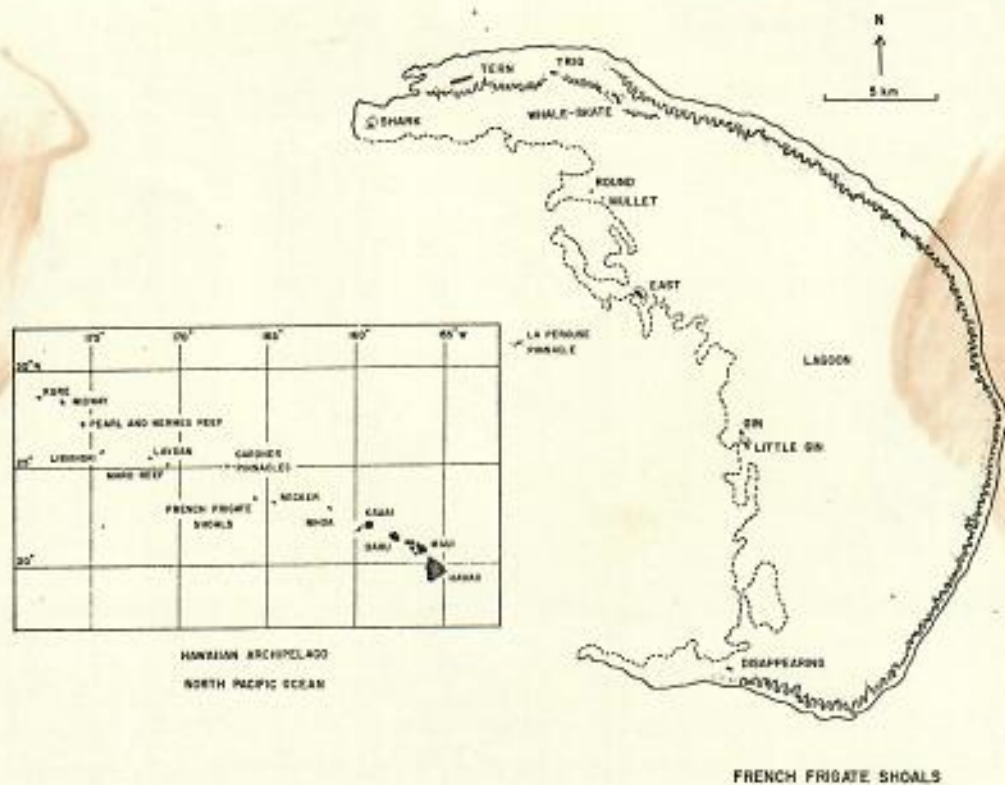


Figure 1.

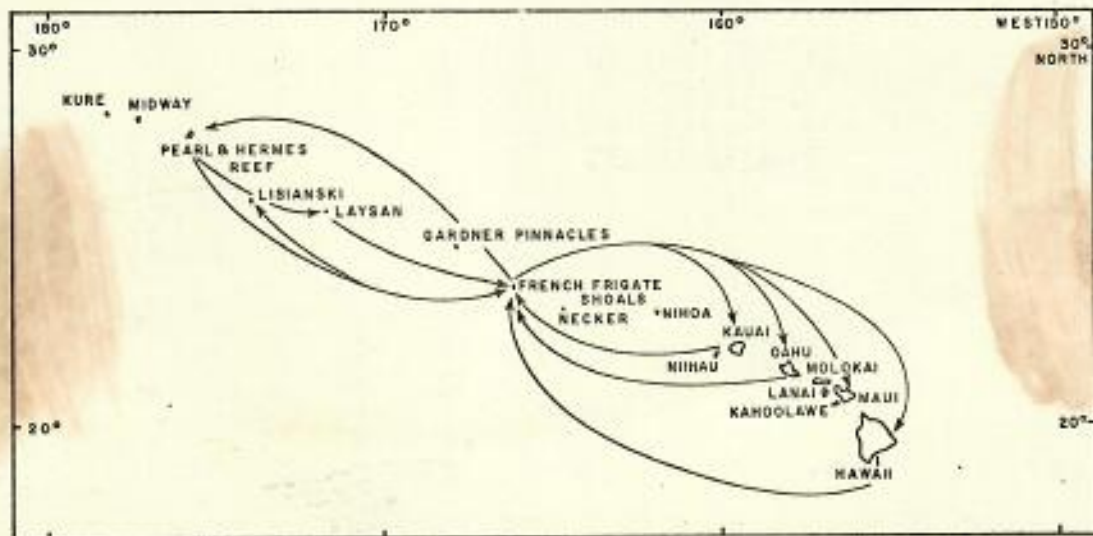


Figure 2. Migrations of adult green turtles in the Hawaiian Archipelago documented by tag recoveries. The actual routes traveled are unknown.