

HOMeward BOUND: SATELLITE TRACKING OF HAWAIIAN GREEN TURTLES FROM NESTING BEACHES TO FORAGING PASTURES

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Telonics ST-3 satellite transmitters linked to the Argos system were deployed on three green turtles, *Chelonia mydas*, nesting at East Island, French Frigate Shoals (FFS) during August 1992. The objectives of this study were to determine 1) migratory pathways to the foraging areas; 2) degree of fixation on a foraging area; 3) diving behaviors during the migrations; and 4) differences in migratory abilities between healthy turtles and ones moderately afflicted with fibropapillomas.

The intensive flipper tagging of nesting females and basking males has been underway in the Hawaiian Islands since 1973. Results show that reproductive migrations are carried out between FFS and numerous distant foraging areas throughout the 2400-km span of the archipelago (Balazs 1976, 1983). Isolated Johnston Atoll, situated 830 km to the south, also constitutes one of the foraging areas (Balazs 1985).

METHODS

A safe and secure method of attaching the transmitters was pretested on captive green turtles at Sea Life Park Hawaii. Silicone Elasetomer, a two-part compound, was first used to firmly position the transmitter against the contour of the carapace along the second central scute. This product cures within five minutes and produces no heat. Final attachment was then achieved by applying two layers of fiberglass cloth and resin, similar to what has been used by Beavers et al. (1992) and Renaud (1990). A sturdy plywood container was devised to place around the turtle to safely hold her in a prone position during the attachment process.

Two of the three turtles selected for satellite telemetry were already identified with flipper tags that had been applied at Johnston Atoll (U306) and Kaneohe Bay, Oahu (U260). The third turtle (U236) had not been tagged and was moderately afflicted with fibropapillomas. This tumorous disease is of major concern for green turtle populations in Hawaii, Florida, and elsewhere worldwide (Balazs and Pooley 1991). However, severe cases of the disease are seldom seen in the breeding assemblage at FFS. This is presumably due to the inability of heavily diseased individuals to achieve reproductive readiness and accomplish the required migration. The duty cycle of the transmitters used on U260 and U236 was 6 hours on, 6 hours off. The duty cycle of U306 was 10 hours on, 50 hours off.

The study was initiated during the latter part of the nesting season to increase the chances of the turtles leaving on their homeward voyage shortly after transmitter attachment. Short-range radio telemetry of green turtles within FFS had already been conducted in 1980 early in the nesting season to determine habitat utilization during interesting intervals (Dizon and Balazs 1982).

RESULTS AND DISCUSSION

All three turtles were successfully tracked by satellite during their homeward migrations. Two of the turtles, (U260 and U236) departed within four days of one another and swam in excess of 1100 km against prevailing winds and currents to Kaneohe Bay (Fig. 1). Instead of using the islands and shoals of the archipelago as navigational guideposts, as might be expected, both turtles followed similar paths to the

south of the chain, beyond sight of land over water thousands of meters deep. The third turtle (U306) also traveled across open ocean, but directly south to Johnston Atoll (Fig. 2). The navigational system used on these voyages remains unknown. However, olfactory reception of chemical cues carried by currents from the islands is a plausible component to the piloting process (Carr 1972).

Both of the previously tagged turtles migrated to the same foraging area where they had been encountered earlier. The turtle with tumors took a less direct path, traveling 130 km farther than the healthy turtle, to arrive at the same foraging area of Kaneohe Bay. Short diving times for all three turtles indicated that they were mainly swimming close to the surface during their migration. However, mean submergence intervals regularly recorded by the transmitter over 12-hour periods revealed they were only at the surface 4-5% of the time.

This is the first reported study where green turtles have been successfully tracked on their high-seas migrations from a nesting beach to nearshore foraging areas (see Byles and Keinath 1990).

TURTLE U260 SUMMARY--This healthy 87 cm turtle covered a distance of 1130 km averaging 2.0 km/hr during her 23-day migration from FFS to Kaneohe Bay. During this transit the average dive times ranged from 2.3-5.1 min. Five individual dives were registered lasting 11-34 min. Ambient temperatures during the migration, as recorded by a sensor in the transmitter unit, ranged from 26-27° C. Transmissions from U260 continued for 3.5 months after the migration was completed, during which time the turtle remained within Kaneohe Bay.

The tagging history of U260 showed that she had been first encountered nesting on East Island during the 1989 season. In March 1992 she was hand-captured by the author in Kaneohe Bay while resting under a coral ledge at a depth of 5 m. In June 1992 she was seen back at East Island where four nestings occurred prior to transmitter attachment in August 1992. These data demonstrate two lengthy return trips to the same nearshore area of Kaneohe Bay, thereby suggesting a strong affinity for this particular foraging location.

TURTLE U236 SUMMARY--This 85 cm previously untagged turtle had 12 tumors ranging from 1-6 cm in diameter on her front flippers, neck, and eyes. Three nestings took place on East Island in 1992 prior to transmitter attachment. In addition, the turtle was seen ashore attempting to nest on 7 other nights. U236 traveled 1260 km averaging 2.0 km/hr during the 26 days it took to reach Kaneohe Bay. During this voyage average dive times ranged from 2.2-3.3 min. Four individual dives were registered lasting 26-29 min. Ambient temperatures ranged from 24-27° C.

Since her arrival, U236 has made at least one round trip excursion outside of Kaneohe Bay along Oahu's coastline to a reef area 11 km away. Transmissions were still being received from this turtle in April 1993, 8 months after deployment.

TURTLE U306 SUMMARY--This healthy 91 cm turtle had been originally captured by net and tagged nearly 9 years earlier at Johnston Atoll when she measured 87 cm (Balazs 1985). The principal foraging area for green turtles at Johnston Atoll is adjacent to a chemical munitions disposal facility operated by the U.S. Army.

Unlike the other two turtles tracked in this study, U306 nested at least once on East Island after the transmitter was attached. She was also seen nesting on three earlier occasions during the 1992 season. She departed FFS in mid-September 1992, about one month after transmitter attachment. The 830 km trip directly to Johnston Atoll took about 22 days at an average speed of 1.6 km/hr. However, during the last 70 km of the voyage the swimming speed was only 0.5 km/hr. The average dive times ranged from 2.3-3.3 min and were very similar to those exhibited by turtle U236. Two individual dives of 28 and 29 min were registered during the migration. Ambient temperatures ranged from 26-29° C. Transmissions from U306 at Johnston Atoll ceased during late February 1993, 6 months after deployment.

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This research and similar tracking planned for the future is dedicated to the memory of Dr. Archie Carr. Many years ago Dr. Carr was the first to recognize that satellites would eventually be used to unlock the mysteries of green turtle migrations. Much remains to be accomplished to fulfill this goal, but the technology is now at our disposal in a simplified form at relatively low cost.

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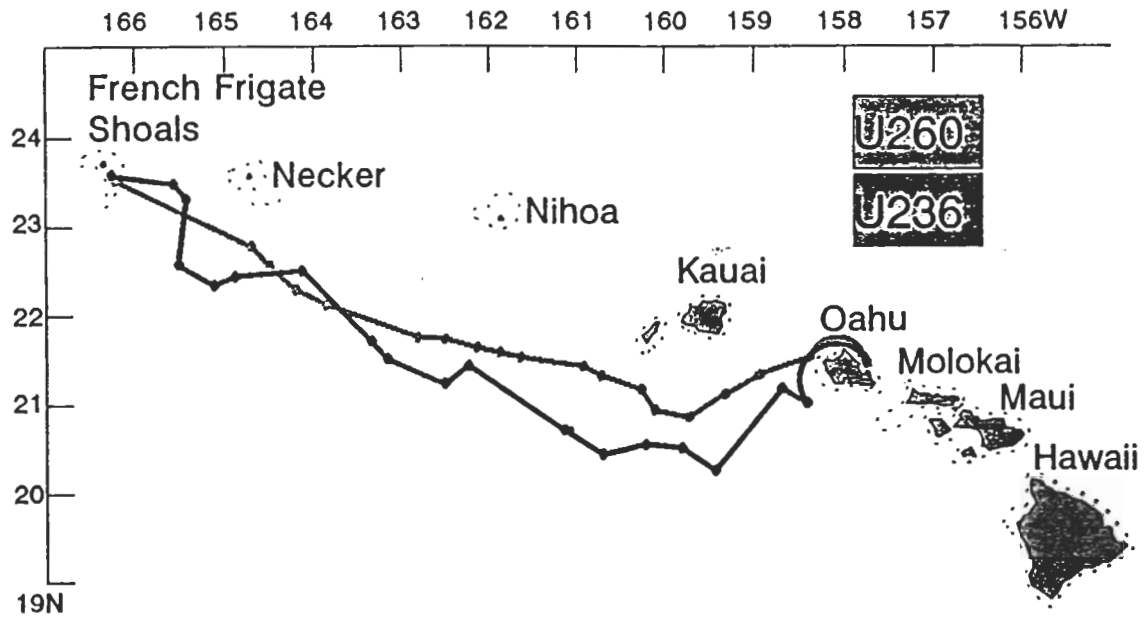


Figure 1. Migratory pathways taken by healthy turtle U260 and tumored turtle U236.

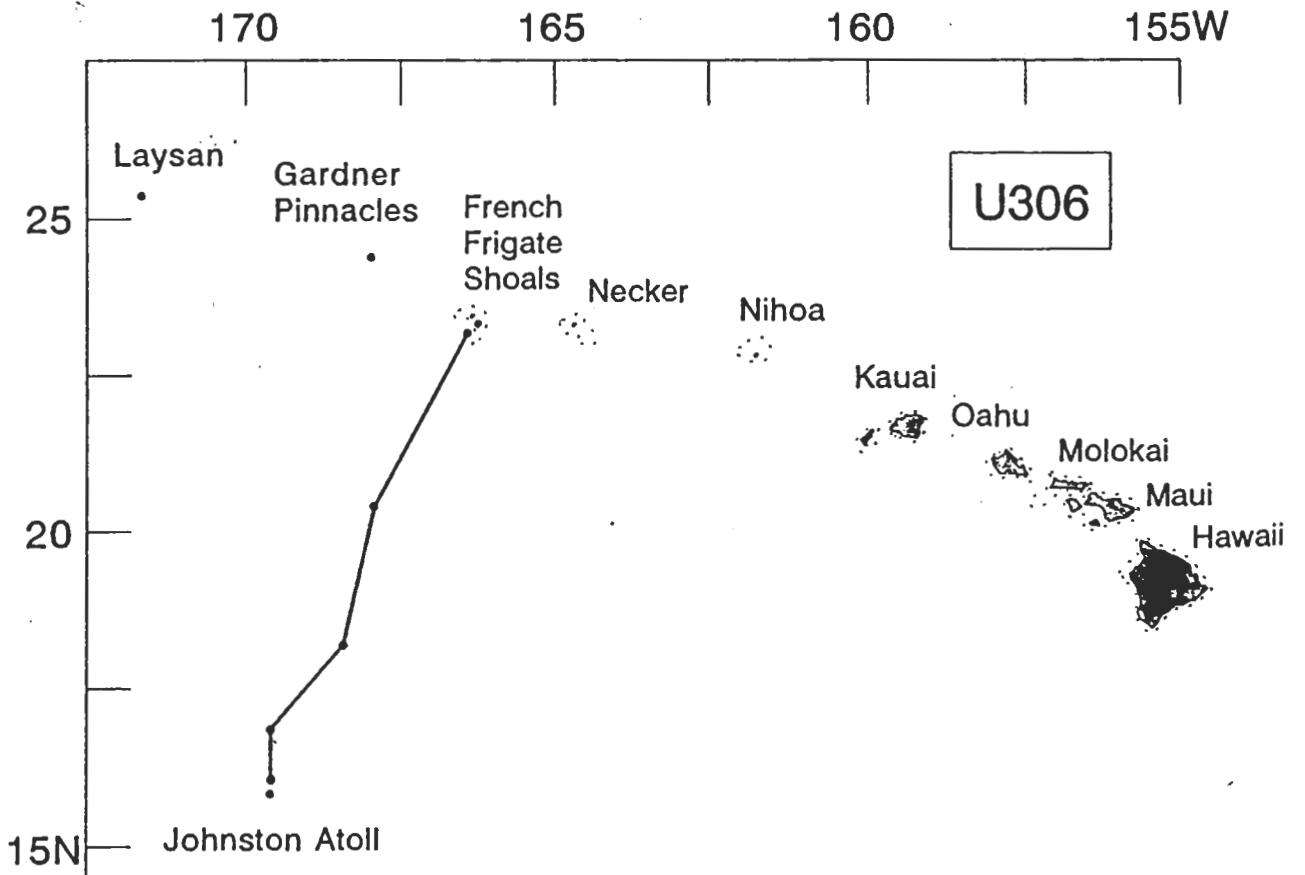


Figure 2. Migratory pathway taken by healthy turtle U306.



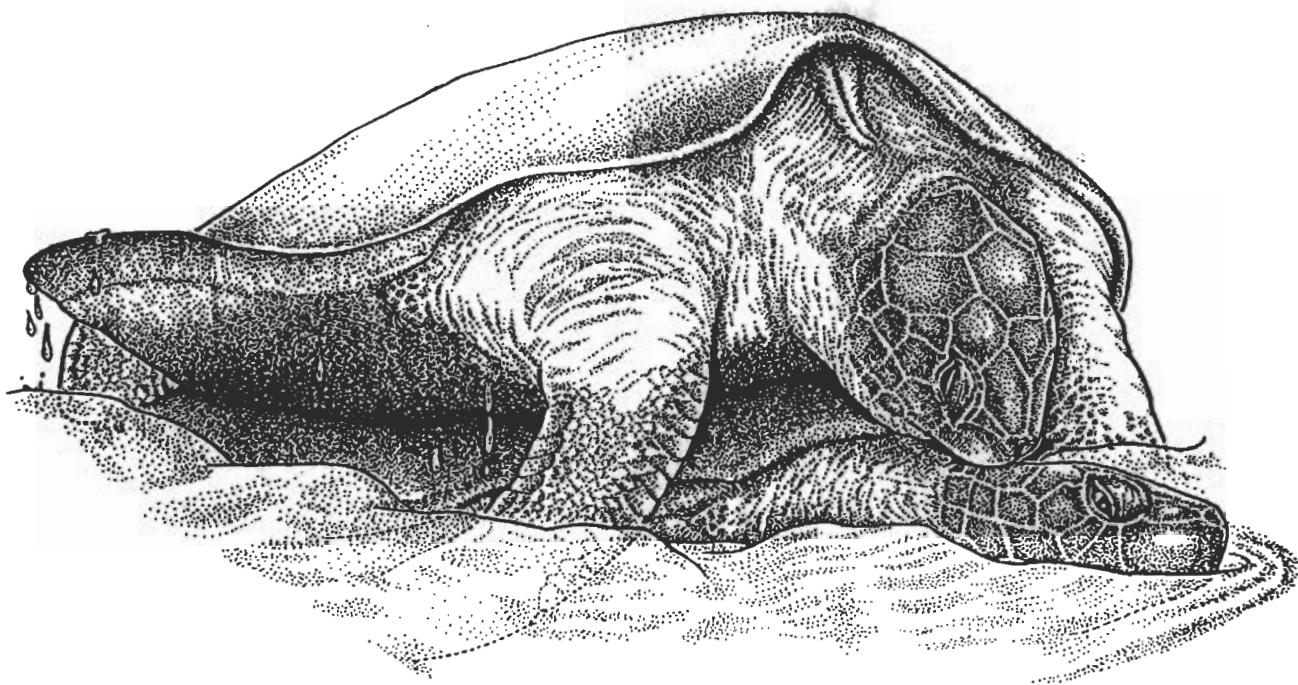
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