

GREEN TURTLE FORAGING AND RESTING HABITATS AT MIDWAY ATOLL: SIGNIFICANT FINDINGS OVER 25 YEARS, 1975-2000

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A PINNACLE IN PELAGIC SEAS - In 1975 a unique research partnership was formed with the Koral Kings Dive Club at the Midway Naval Air Station. The goal of this union was to learn more about the sea turtles commonly seen at this tiny remote Pacific atoll (28°N, 177°W) at the northwestern end of the Hawaiian Archipelago (Apple and Swedberg, 1979; Rauzon, 2001). No nesting or terrestrial basking occurred at Midway in the 1970's, and all turtles encountered were green turtles (*Chelonia mydas*), nearly all of which were juveniles (Balazs, 1982a). During periodic visits by Balazs, Koral Kings' members were shown how to safely hand-capture turtles to measure, flipper tag and release them during recreational snorkeling and scuba diving. Important turtle resting habitats were found within the sheltered man-made Inner Harbor and underneath the large Cargo and Fuel Piers at Sand Island (Fig. 1 & 2). At nearby Eastern Island turtles frequented the shallow southern reef flat, but elsewhere within the atoll sightings were not common.

By 1979, as reported that year at the World Conference on Sea Turtle Conservation (Balazs, 1982b), eight juvenile turtles tagged and recaptured at Midway after 0.5-3.0 years were found to exhibit the astonishingly slow growth rate of 1.1 cm/year in straight

carapace length (SCL). The high level of predation on juvenile turtles by tiger sharks at Midway caused one to wonder if year-class survival was sufficient, given such slow growth, for any turtles to reach adulthood. By the early 1980's the Navy's personnel and presence had diminished significantly at the historic World War II battle site of Midway. Clean-up activities were initiated to mitigate decades of military use. In 1988, National Wildlife Refuge status was achieved with the Navy's transfer of the atoll to the U.S. Fish and Wildlife Service. In collaboration with Midway Phoenix Corporation, limited ecotourism presently allows public viewing of the atoll's magnificent nesting seabird colonies and other special resources.

During the 1990's new partnerships were formed to resume sea turtle research at Midway, as shown by the authorship affiliations of this paper. Important and exciting discoveries have resulted from this renewed effort founded upon the pioneering work of the 1970's. The conservation status of the turtles at Midway has markedly improved, as demonstrated by the current size-class composition of 40% subadults/adults, in contrast to only 3% in the 1970's (Fig. 3). Resident adult females have been recorded migrating to, and returning from, the Hawaiian green turtle nesting colony at French

Frigate Shoals (see Balazs, 1980; Bowen et al., 1992). The slow growth rates of juveniles at Midway have now been confirmed by additional data that include a 22-year Inconel flipper tag recovery (0.5 cm/year SCL, Fig. 4). However, in contrast, a large subadult recently recovered after a 21-month interval displayed a growth spurt of 5.3 cm SCL (2.8 cm/year). Also of considerable significance is the finding that the Inner Harbor, piers, iron seawalls and related artificial elements at Midway continue to be preferred foraging and resting habitats for turtles (see Rice and Balazs, 2000). Other significant findings of recent work at Midway are briefly presented as follows:

- Basking ashore by juvenile, subadult and adult turtles is now a common occurrence.
- Juvenile turtles regularly feed on algae such as *Spyridia filamentosa* and *Centroceras clavulatum* growing on the iron seawalls. The turtles also feed on wind-driven pelagic invertebrates that accumulate along the seawalls, including gooseneck barnacles attached to synthetic floating debris.
- A small seagrass foraging pasture of *Halophila hawaiiiana* occurs inside the atoll adjacent to the Cargo Pier and principal basking beach. Foraging on *Codium cuneatum* by subadults and adults takes place outside the atoll along the southern side.
- A time-depth recorder and sonic tag placed on an adult male revealed long periods of resting at depths of 20-25 ft., probably under the Fuel and Cargo Piers. Average dives lasted 67 min (range 17-120 min) representing 82% of each day. Seawater temperature during 1998-99 ranged from 19-27°C.
- Fibropapilloma tumors have been observed on several turtles during the 1990's, but none were seen during the 1970's.
- Turtles routinely travel between the Inner Harbor and foraging, basking and underwater resting habitats less than a mile away on the north side of Sand Island (Fig. 1). The turtles swim close to the seawalls and shoreline during this short transit, making them highly visible to tourists and readily available for observational research.

Figure 1. Sand Island showing, from left to right, the locations of: deep-water foraging zone of *Codium cuniatum* used mainly by adult/subadult turtles; Inner Harbor with seawall foraging and underwater resting habitats; Cargo and Fuel Pier underwater resting habitats, adjacent *Halophila* foraging area and "Turtle Beach" used for basking; and the southern reef flat of Eastern Island.



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Figure 2. North side of Sand Island showing Midway's lagoon and, from left to right: the Fuel and Cargo Piers where turtles sleep underwater; the *Halophila hawaiiiana* seagrass pasture; the concrete seawall where drifting pelagic invertebrates collect and are eaten by turtles; and "Turtle Beach" where basking takes place.



Figure 3. Comparison of size-class composition of green turtles at Midway, 1970's and 1990's.

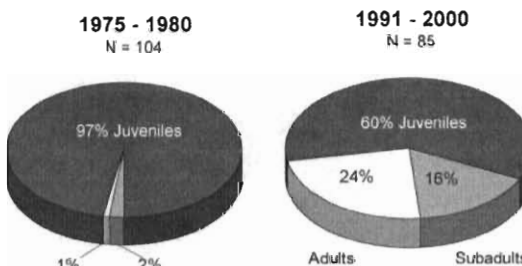
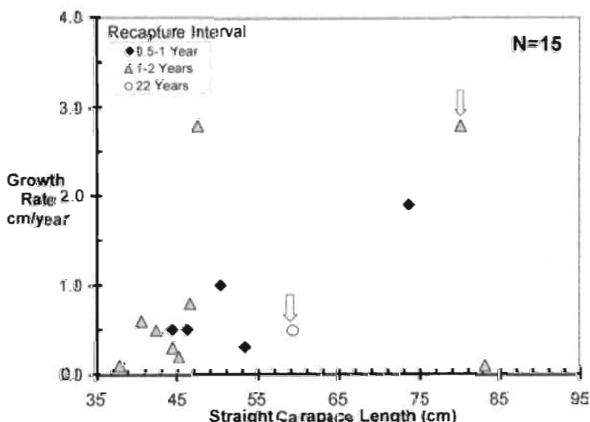


Figure 4. Growth rates of green turtles at Midway determined during the 1990's. Arrows point to the 22-year tag recovery and the large subadult with the growth spurt of 2.8 cm/year.



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*Coming
of Age*



24 to 28 February 2001
Philadelphia, Pennsylvania, USA

Compiled by:
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