Pacific Science (1997), vol. 51, no. 1: 48–53

Notes on Juvenile Hawksbill and Green Turtles in American Samoa[1]

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ABSTRACT: Both hawksbill [*Eretmochelys imbricata* (L.)] and green turtles [*Chelonia mydas* (L.)] occur in American Samoa. Three distinct size classes were encountered in the region in both species: hatchlings <5 cm in length, juveniles 30–70 cm long, and adult females ≥77.5 cm long. Recaptures of flipper-tagged juvenile hawksbill turtles demonstrated short-distance homing movements and high growth rates (4.5 cm/yr CCL [curve of the carapace length]).

HAWKSBILL (*Eretmochelys imbricata*) and green (*Chelonia mydas*) turtle populations have declined precipitously in American Samoa (14° S, 170° W; Figure 1), and only about 120 nesting females (species combined) per year occur within the territory (Tuato'o-Bartley et al. 1993). Despite an extensive education program, some turtles and eggs are still harvested, illegally, in American Samoa.

In this paper we report on the relative abundance of different size classes, tag recoveries of juvenile turtles documenting localized movements and some short-range homing observations, and growth rates for immature turtles in American Samoa.

MATERIALS AND METHODS

We and our colleagues have tagged the flippers of 36 hawksbill and 52 green turtles in American Samoa with Inconel alloy 625 (size 681, National Band & Tag Co., Newport, Kentucky) since 1971. Flippers of 42 nesting female green turtles and one juvenile hawksbill turtle were tagged on Rose Atoll during periodic trips by personnel of the U.S. Fish and Wildlife Service, Department of Marine and Wildlife Resources (DMWR) of the American Samoa government, and the National Marine Fisheries Service (NMFS). Rose Atoll is a National Wildlife Refuge managed jointly by the U.S. Fish and Wildlife Service and the American Samoa government.

On Tutuila, juvenile turtles were captured by both spear fishermen and hook and line fishermen, and adult nesting turtles were frequently detained by locals on the beach. Some villagers illegally collected turtle eggs and adults for consumption (Tuato'o-Bartley et al. 1993), and some children kept hatchlings as pets. Some of these were voluntarily turned over to DMWR for tagging and release. Others were confiscated by the conservation staff of DMWR. In addition, DMWR provided financial incentives to reef fishermen between 1990 and 1994 who turned over turtles captured incidental to their fishing operations. Data presented here were extracted from DMWR files and G.H.B. (unpubl. ms.).

Juvenile and adult turtles were measured using a flexible tape over the curve of the carapace (CCL) from the nuchal notch to the posteriormost tip of the postcentral scute. To convert between CCL and SCL (straight carapace length) measurements we used the equations of R. van Dam and C. E. Diez (unpubl. ms.). Hatchlings and eggs were measured with dial calipers and weighed with a Pesola scale. We frequently released juvenile turtles in locations distant from the capture site to avoid encouraging fishermen to seek out a tagged turtle released at the capture point.

RESULTS

Hawksbill Turtles

Fifty-two hatchling, 37 juvenile, and eight adult hawksbill turtles were measured in Tutuila,

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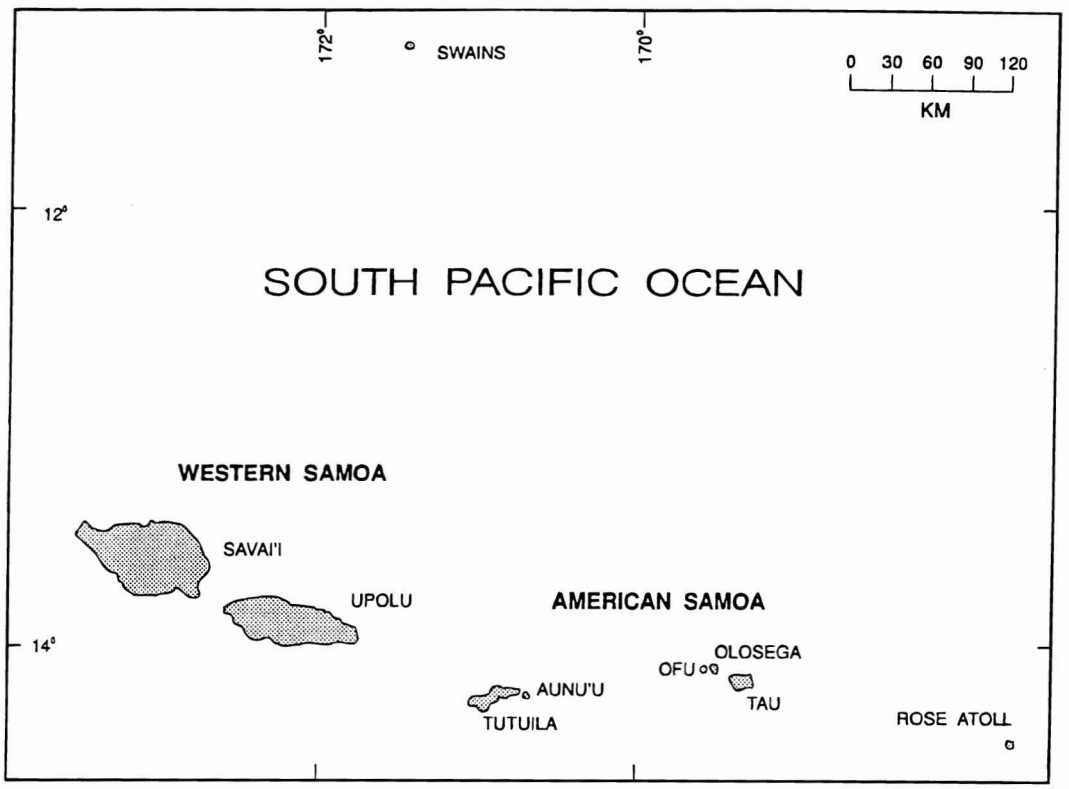

FIGURE 1. Map showing location of islands within American Samoa and its proximity to Western Samoa.

American Samoa (Figure 2). In addition, one juvenile was captured by hand by scuba divers in the lagoon of Rose Atoll. Nine (three adults, six juveniles) of these were found dead (three with obvious spear wounds). The mean length of 52 hatchlings was 3.89 ± 0.10 cm (range, 3.51–4.08), and their mean mass was 15.4 ± 0.8 g (range, 14.0–17.0). Juvenile hawksbills ranged in size from 35.5 to 57.2 cm, and eight adults averaged 86.4 ± 6.0 cm (range, 77.5–92.3 cm). We have no observations on hawksbills between 4.1 and 35.5 cm and none between about 57.2 and 77.5 cm. Very small juveniles might escape detection by Samoan spear fishermen, but it is likely that subadults would be encountered and captured if they were present.

Ten hawksbill eggs from a nest unearthed by high tides were weighed and measured on 14 January 1994 in the village of Onenoa, Tutuila Island. The mean mass was 25.7 ± 1.9 g (range, 24.0–30.0), and the mean diameter was 36.1 ± 0.8 mm (range, 35.1–37.6). In total, 84 eggs were recovered from this nest and carefully reburied on the beach above the tide zone.

Thirty-six hawksbill turtles have been tagged to date (all but one were tagged on Tutuila). We recaptured five tagged hawksbill turtles on six occasions, all on Tutuila Island (Table 1). Three of these (N-208, N-231, N-235) clearly demonstrated homing or returning to the initial capture site. The duration between tagging and recapture for two of the juvenile hawksbill turtles from American Samoa was sufficient to calculate growth rates. One turtle (39.0 cm CCL initially) grew 3.6 cm (CCL) in 7.3 months (5.9 cm/yr), and the second individual (40.0 cm CCL initially) grew 3.2 cm in 13 months (3.0 cm/yr). This averages out to 4.5 cm per year. The former weighed 3.6 kg when initially captured and 6.4 kg when recaptured 7.3 months later (4.6 kg/yr). It gained 2.8 kg while increasing in length 3.6 cm.

Two freshly dead hawksbill turtles were autopsied. An adult (92.0 cm CCL, 86.5 cm

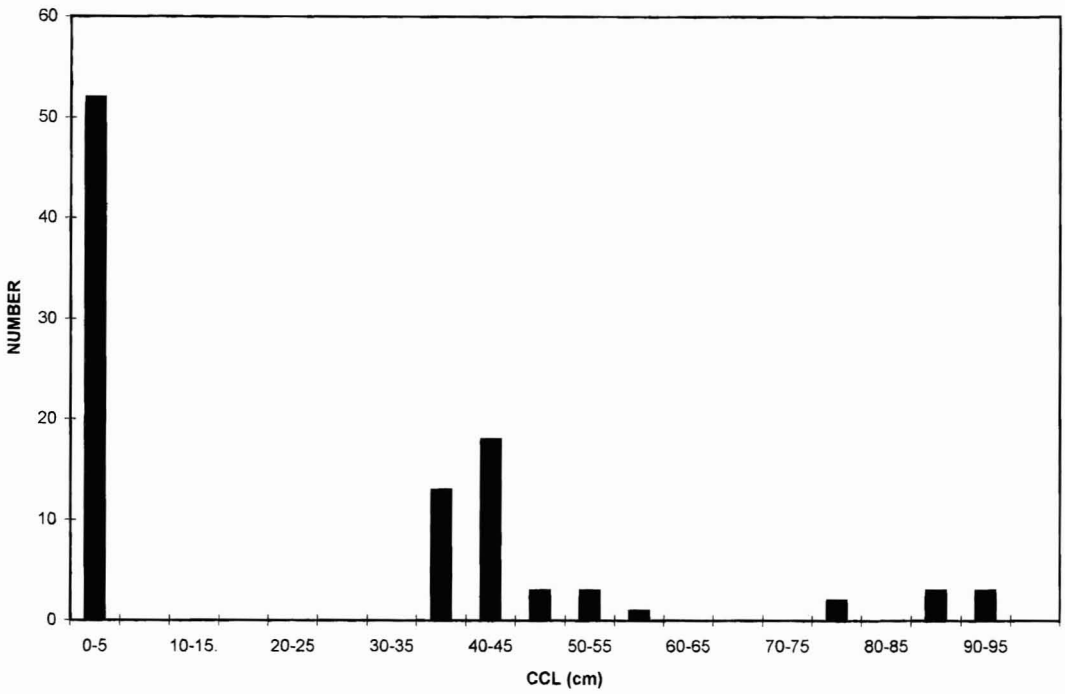

FIGURE 2. Size distribution of hawksbill turtles in American Samoa.

SCL) female was found near death on 17 November 1992 in Pala Lagoon, Tutuila Island, and it died shortly thereafter. No obvious external or internal injuries were evident. We counted 1182 ova (ranging in diameter from 11 to 20 mm) within her reproductive system. None of the ova was surrounded by albumen or shells. A dead juvenile (53.5 cm CCL) female was confiscated from a fisherman in Pago Pago harbor on 1 December 1992. A small quantity of blood was oozing from her cloaca, and the liver was saturated with blood. Sectioning of the liver resulted in copious blood flow. The ova within the ovaries were small (<1 mm in diameter).

Green Turtles

The size distribution of green turtles encountered in American Samoan waters was similar (Figure 3). Four hatchlings from Rose Atoll, seven juveniles from Tutuila in the 30- to 70-cm size range, three juveniles (50–56 cm) from

TABLE 1

TAGGING AND RECAPTURE LOCATIONS OF HAWKSBILL TURTLES ON TUTUILA, AMERICAN SAMOA

TAG NO.	TAGGING		RELEASE	RECAPTURE		DISTANCE (km)[a]
	LOCATION	DATE	LOCATION	LOCATION	DATE	
N-122	Fagaalu	2 July 1991	Alega	Amouli	12 July 1991	6.5
N-202	Fagatogo	13 Mar. 1992	?	Fagatogo	22 Oct. 1992	?
N-208	Alofau	11 Nov. 1992	Auasi	Alofau	13 Dec. 1992	5
N-208	Alofau	13 Dec. 1992	Alega	Fagaitua	9 Dec. 1993	3.5
N-231	Alofau	11 Aug. 1993	Auasi	Alofau	13 Oct. 1993	5
N-235	Satala	3 Nov. 1993	Nuuuli	Satala	11 Nov. 1993	7.2

[a] Minimum distance between sites.

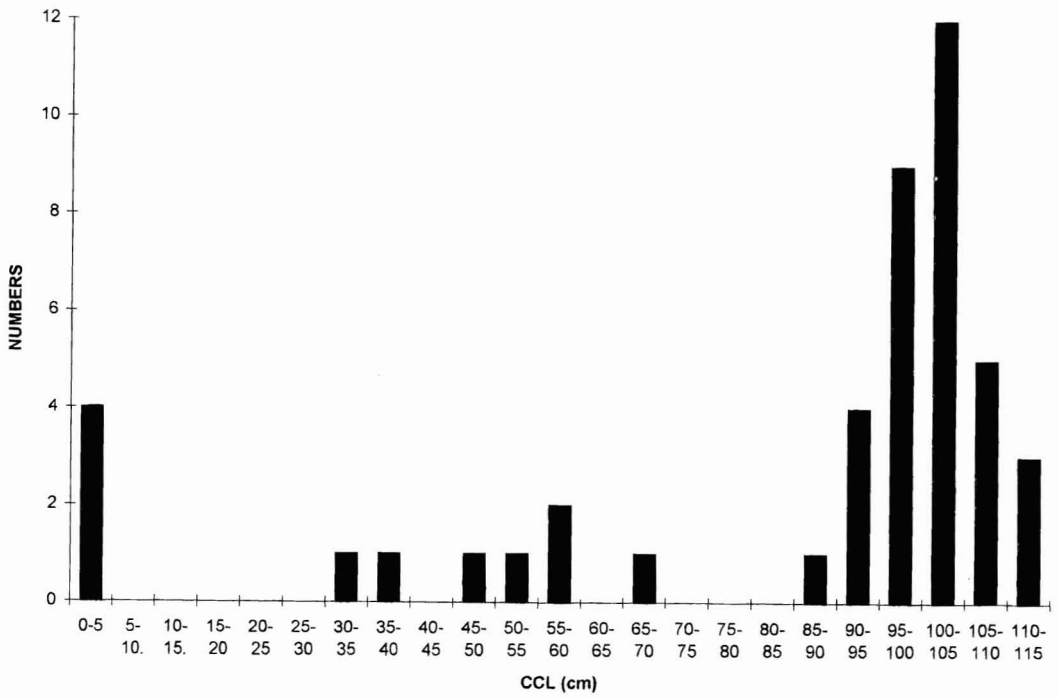

FIGURE 3. Size distribution of green turtles in American Samoa.

Rose Atoll (G. H. B., unpubl. ms.), 39 nesting adults (mean = 101.5 ± 6.0 cm; range, 86.5–113) from Rose Atoll, and three nesting adults from Tutuila have been measured. Substantial size class gaps between hatchlings and juveniles and juveniles and adults suggest a pattern similar to that observed in hawksbills in American Samoa.

The only recaptured juvenile green turtle tagged in American Samoa was recovered 5 days later, so we do not have any growth rate data on juveniles of this species. Growth rate for an adult (103.0 cm) green turtle nesting on Rose was 0.7 cm/yr (8.9 yr between tagging and recovery).

DISCUSSION

Hawksbill Turtles

We hypothesize that the hatchling turtles disperse to other areas, probably the open sea. They may return to Samoan reefs when they reach about 35 cm in length. Alternatively, they may remain elsewhere until maturity and the juvenile size class encountered in Samoan waters may represent a stock from elsewhere that departs from Samoan waters before attaining adult size. If we assume that some of the juvenile hawksbills forage in American Samoan waters while they grow from 35 to 60 cm (Figure 2) and assume that the average growth rate during this interval is 4.5 cm/yr, then it follows that some of these turtles may remain in local waters for up to 5.6 yr. Most juveniles encountered were in the 35- to 45-cm size class, with relatively few found longer than 45 cm. This suggests that some may depart after only 2 yr, or alternately, this decline may be caused by human predation. The longer a given juvenile remains in Samoan waters, the more likely it will be captured and killed by fishermen. The local movement data and the frequency (67% of all live captures) of initial capture in three areas favored by turtles (Pala Lagoon, Fagaitua Bay, Pago Pago Harbor) and heavily fished by humans (hook and line, spear fishing) and the fact that nine of these turtles were found dead (three with obvious spear wounds) suggest that continued human

harvest occurs. R. van Dam and C. E. Diez (unpubl. ms.) also encountered two distinct size classes (juvenile and adult) of hawksbills in Puerto Rico.

The purpose and regularity of movements/migrations of juvenile hawksbill turtles need further study (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1993). Evidence from the literature suggests that some hawksbill turtles may be somewhat sedentary, but other populations or age classes may migrate considerable distances (reviewed by Witzell 1983). Only three nesting female hawksbills have been tagged in American Samoa to date, and none have been recaptured. There have been no recaptures of nesting female hawksbills tagged on Western Samoa either (Witzell and Banner 1980). Witzell and Banner (1980) frequently observed juvenile hawksbills foraging among the Western Samoan reefs. Of 1720 distinctly notched headstart hatchlings, seven were recaptured locally within 12 months.

Witzell (1980) presented growth rate data and equations from captive-reared hawksbill turtles. Few data exist on wild juvenile turtles. Six hawksbill turtles (40–50 cm CCL) averaged a growth of 1.4 cm/yr, and 10 hawksbills 50–60 cm CCL averaged 2.2 cm/yr in Australia (Limpus 1992). Larger hawksbills from Australia grew at slower rates: one (67 cm CCL) grew 1.8 cm/yr, and another (81 cm CCL) grew 1.6 cm/yr (Limpus 1979). Juvenile hawksbills in Puerto Rico grew at an average of 2.2 cm/yr ($n = 15$) in a study by R. van Dam and C. E. Diez (unpubl. ms.). Growth rates of eight juvenile hawksbills in the 30- to 50-cm size range averaged 3.3–4.8 cm/yr in the Virgin Islands (Boulon 1994), and two hawksbills grew 5.9–15.7 cm/yr in the Bahamas (Bjorndal and Bolten 1988). Growth rate of two juvenile hawksbills from American Samoa was similar to that found in Virgin Island hawksbills.

Green Turtles

Witzell (1982) also encountered two distinct size classes of green turtles from Western Samoa: adults 86.5–109 cm (SCL) and juveniles 30.5–44 cm (SCL), with a substantial gap between juveniles and adults.

No juvenile green turtles tagged in American Samoa have been recovered elsewhere. However, two green turtles with tagged flippers and three that were telemetered by satellite nesting at Rose Atoll were recovered subsequently in Fiji (Balazs et al. 1994). In addition, a green turtle with tagged flippers at Rose Atoll in November 1993 was found dead in Vanuatu in April 1994 (G. H. B., unpubl. ms.).

ACKNOWLEDGMENTS

Special thanks to the many DMWR personnel that tagged turtles over the years, including B. Ponwith, P. W. Trail, K. Sooto, N. Tuato'o-Bartley, T. Morrell, A. Tualaulelei, and others. This paper benefitted from a review by P. W. Trail.

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