

SCHWARTZ, F. J. 1976. Status of sea turtles, Cheloniidae and Dermochelidae, in North Carolina. *J. Elisha Mitchell Sci. Soc.* 92:76-77.

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OBSERVATIONS ON THE GREEN SEA TURTLE (*CHELONIA MYDAS*) IN WESTERN SAMOA.—The Western Samoa Fisheries Division conducted a marine turtle research program from October 1970 to May 1973. The biology and ecology of the endangered hawksbill turtle, *Eretmochelys imbricata*, has previously been described (Witzell and Banner, 1980), and although the hawksbill was the only species of marine turtle found nesting in Western Samoa, the green turtle, *Chelonia mydas*, is well known by the Samoan fishermen.

Published information on the ecology and natural history of marine turtles in the central South Pacific islands is severely limited, generally consisting of short notes (Sachet, 1954; Bustard, 1970; Raj, 1976; Balazs, 1978; Witzell, 1981). In addition, H. Hirth and J. Hendrickson reported on the marine turtle resources of the South Pacific islands in unpublished reports, 1971 and 1972 respectively, prepared for the Regional Fisheries Development Agency Project, Food and Agriculture Organization of the United Nations.

Materials and methods.—Observations on the Western Samoa green turtle were made incidentally while studying the nesting hawksbill turtle on three islets off the eastern coast of Upolu Island. These observations were made from small outboard powered boats, outrigger canoes and by diving in and around reefs and reef passages. Monthly low level flights in a small single engine airplane were made around the country and market surveys were conducted in the capital city of Apia. Also, specimens captured by local village fishermen were examined. Coloration and morphometric mea-

TABLE 1. MORPHOMETRIC MEASUREMENTS OF WESTERN SAMOA GREEN TURTLES. (Maximum straight line measurements in centimeters.)

	Carapace length	Carapace width	Plastron length	Head width	N
Adult females					
Mean	96.9	76.8	80.1	11.5	9
Range	91.5-109	70-84.5	72.5-92	11-12	
Adult males					
Mean	92.2	71.2	73.1	11.4	5
Range	86.5-102	68-79.5	70-78	11-12	
Juveniles					
Mean	38.2	33.6	31.9	—	16
Range	30.5-44	26.5-39	25.5-36	—	

surements were recorded whenever possible in order to determine if the Western Samoa green turtles belonged to any identifiable subspecies or nesting population. Although there were many sightings of green turtles, an observation here is defined as an encounter of sufficient duration, whether in the ocean or on land, in which to note and record size, coloration, sex and behavior.

Coloration and morphology.—The majority of green turtles closely observed (Table 1) generally fell into two size categories (straight carapace length measurements): 1) juvenile turtles 30-45 cm, and 2) adult turtles 80+ cm.

A total of 63 juvenile turtles were observed, of which 16 were measured and 5 tagged. There were 36 observations of adult females, with 9 measured and 3 tagged, and 14 observations of adult males, 5 measured and 1 tagged (Table 1).

The coloration of the juvenile green turtles observed, especially the smaller specimens, was found to be fairly uniform: the carapace and top of head light brown; the side of the head and dorsal surface of the flippers dark brown; the beak brown; the plastron, throat and ventral surface of the flippers entirely creamish-white, except for a few light brown scales distally located on the flippers. The larger juvenile turtles occasionally had yellow or black streaks radiating peripherally on the carapace shields, the general color pattern of the entire dorsal surface becoming darker. All interscutes areas on the carapace and interscale areas on the head and flippers are well defined and creamish-white.

Adult green turtle coloration, in contrast to that of the juveniles, shows considerable variation: the background coloration of the carapace and top of head ranges from dark brown to light green, generously infused with combinations of yellow, brown and black; beak brown; plastron, throat and ventral surface of the flippers creamish, except for scattered dark centered scales on the flippers. There appears to be no easily recognizable difference in coloration between sexes, as described by Hirth and Carr (1970) and Frazier (1971) for Indian Ocean green turtles, although the sample size (Table 1) of closely observed turtles of both sexes is too small to state definitively. Also, there is no evidence that the Western Samoa green turtles belong to any particular subspecies based on coloration as described in Hirth (1971).

Morphometrically, no recognizable differences are readily apparent between these Western Samoa green turtles (Table 1) and other populations of this species as described in Hirth (1971). However, there were not enough turtles measured of all sizes to conduct proper morphometric analysis for population comparisons as attempted by Hughes (1974) and described by Witzell (1980) for other cheloniids.

Ecology.—Juvenile green turtles were seen year-round on the reefs around Western Samoa, and tended to congregate around reef passages. These turtles were shy and difficult to observe closely for extended periods before swimming away, except at night when they were seen sleeping under coral ledges 5–15 m underwater. The carapaces of these juveniles were clean; sessile organisms such as barnacles, bryozoans and algae were not attached. However, damaged rear flippers, presumably healed shark bites, were occasionally seen. Underwater observational evidence, supported by statements from fishermen, suggests that these juveniles may not move far from their foraging territories.

Adult green turtles were seen infrequently year-round near Samoan reefs except between December and February, when they congregated in substantial numbers near the reef passages which connect with large lagoons located at the eastern and western ends of Upolu Island. These adults were seen feeding on the marine angiosperm, *Syringodium isoetifolium*, which grows in the lagoon shallows, breaks off and drifts out to sea with each tide to form distinct debris lines. Adult female turtles out-

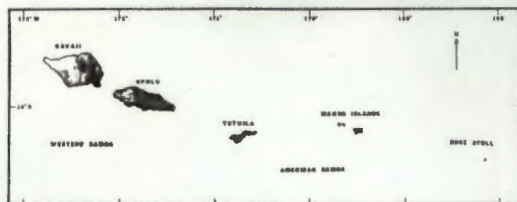


Fig. 1. The Samoa Archipelago.

numbered males along these debris lines approximately 2:1, but neither courtship or mating behavior was seen. These large turtles, like the juveniles, were seen sleeping under coral ledges at night near reef passages. They were also free of attached organisms, and had no noticeable predation damage.

The origin and destination of these adult turtles is not known but they may be part of the population reported in Sachet (1954) to nest in August and September on nearby Rose Atoll, American Samoa (Fig. 1). It would seem likely then that the resident Western Samoa juvenile green turtles may be the progeny of the Rose Atoll nesting population. There have been no reported returns of tagged Samoan green turtles, either nationally or internationally, and no reported captures in Western Samoa of turtles tagged elsewhere.

The Samoan people recognize the difference between green and hawksbill turtles as two forms of a single sea turtle stock. Therefore, the relatively large numbers of juvenile green turtles found year-round on Samoan reefs hinder any conservation efforts for the declining nesting population of hawksbills. Similar situations may exist elsewhere in the Pacific, and can only be resolved by long term conservation education of the local people and by extensive marine turtle surveys throughout the Pacific region.

Exploitation.—The majority of the green turtles seen harvested in Western Samoa were captured by skin divers. The method most frequently used was to affix a high intensity gas lamp to the bow of their outrigger canoe at night and swim along the reef edge looking for sleeping turtles. Large turtles were usually speared in the neck and juveniles were either taken by spear or by hand. The instability of the Samoan outrigger fishing canoe and the flimsy barbless spears used generally precludes capturing large thrashing turtles. Turtle nets were not seen fished, although one group of fishermen on the island of Savai'i reportedly

encircles adult green turtles every December with a village owned net. These netted turtles are believed by the fishermen to be attracted to floating taro leaves which they place on the water.

Marine turtles are a valuable resource economically, bringing high prices in the market. Consequently, most turtles observed captured by the rural fishermen were transported by bus to Apia, where they were usually sold to affluent Samoans for consumption at important celebrations.

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AN UNUSUAL AGGREGATION OF ADULT *NOTOPHTHALMUS VIRIDESCENS*.—On 19 March 1980 three large, dense aggregations of adult *Notophtalmus viridescens* were observed in a pond in Leverett, Franklin Co., MA. These clusters resembled those reported and illustrated by Coates, Benedict and Stephens (1970) in *Taricha granulosa*, but have not, to our knowledge, been reported in *N. viridescens*. The aggregations occurred in 18 cm of 5 C water in an ice-free area near a spring at the pond's edge, where many individuals but no clusters had been observed on 13 January 1980.

On 20 March 1980 the temperature 20 cm below the water surface near one of the clusters was 6 C while the temperature in the mass was 8 C. No difference was detected between the water temperature (6 C) in and surrounding another cluster. Some newts were active, swimming to the surface for air and thrashing about while ingesting their molts. Solitary individuals and a few courting pairs were distributed throughout the ice-free area. With three scoops of a dip net, 589 newts were collected from a single cluster (measuring approximately 45 × 30 cm), sexed, and released. The sample contained 299 females (51%) and 290 males (49%). The following morning, after a period of heavy rain, the disturbed aggregation had reformed. By 30 March, when the water temperature was 7 C, it had dispersed.

Twenty newts, in the vicinity of the clusters, were collected on 19 March. Dissection revealed 7 females with mature eggs and 13 males with two-lobed testes. Seventeen of the newts had molt material in their digestive tracts, and one specimen had ingested a sphaeriid clam.

The site of the clusters was again visited on 14 May. No newts were seen in the area where the clusters had been, but a sample collected about 30 m away and 5 m out from the shore in a mass of vegetation contained 37 males and 30 females. The water temperature 15 cm below the surface was 14 C and the water depth was approximately 1 m. Neither this nor the 20 March sample from the cluster differed significantly from a 1:1 sex ratio (chi-square tests, $P > 0.3$).

Smaller winter aggregations of adult *N. viridescens* have been reported. Morgan and Grier-son (1932) described clusters of 20-40 semiactive, easily disturbed newts beneath flattened