

ECOLOGICAL ASPECTS OF GREEN TURTLES NESTING AT SCILLY ATOLL IN FRENCH POLYNESIA

George H. Balazs¹

Philippe Siu²

Jean-Pierre Landret²

¹Southwest Fisheries Science Center Honolulu Laboratory National Marine Fisheries Service, NOAA
2570 Dole Street, Honolulu, Hawaii 96822-2396

²Etablissement pour la Valorisation des Activites Aquacoles et Maritimes (EVAAM)
P.O. Box 20, Papeete, Tahiti, French Polynesia USA

INTRODUCTION: The three small neighboring atolls of Scilly (16°30'S, 154°40'W), Motu-one (15°49'S, 154°31'W), and Mopelia (16°49'S, 153°57'W) are located in a remote and seldom-traveled region of the South Pacific at the western limits of French Polynesia. Maupiti and Bora Bora, two high volcanic islands with permanent human habitation, are situated 250-300 km to the east. Tahiti and the capital city of Papeete lie another 300 km to the southeast of Bora Bora. Although green turtles, *Chelonia mydas*, used to nest in great numbers at Scilly, Motu-one, and Mopelia, considerable declines have occurred during recent decades due mainly to commercial exploitation for markets in Tahiti. At present, only Scilly continues to have significant numbers of nesting turtles. Few researchers have visited these three isolated nesting sites to tag turtles and gather relevant ecological information. However, turtles intermittently tagged there in the past by local authorities have shown some amazing long-distance migrations across a broad expanse of the Pacific: from longitudes 155°W to 165°E (Doumenge 1973, Anon. 1979). These movements, ranging up to 4000 km, represent some of the longest migrations ever documented for green turtles worldwide. Except for Scilly, there are no other known nesting sites of any magnitude for sea turtles throughout the 130 islands and atolls comprising French Polynesia.

During October 1991, we visited Scilly and Motu-one via Bora Bora aboard the 20-m research vessel Aorai to conduct biological studies that included tagging nesting turtles. Several hundred eggs and hatchlings also were collected for ongoing captive-rearing experiments in Tahiti. The expedition was undertaken by EVAAM, an agency of the Government of French Polynesia. Additional financial assistance was provided by the Regional Marine Turtle Conservation Programme of the South Pacific Regional Environmental Programme. An overview of the results of the expedition are presented herein, along with some historical aspects of green turtles in the area and preliminary conservation recommendations aimed at preventing the further depletion of this important resource.

HISTORICAL OVERVIEW: As elsewhere in Oceania, green turtles have been and continue to be a prized food to the native people of French Polynesia (Leach et al. 1984). In ancient times, turtles were held "sacred for the gods" and only eaten by kings, priests, and marae (temple) keepers (Henry 1928). Icons of turtles were associated with royalty, the supernatural, and the afterworld. Petroglyphs of turtles as sacred symbols were carved on certain boulders and limestone slabs incorporated into the marae. In the interior of Bora Bora a boulder known as ofai honu (turtle stone), contains numerous turtle petroglyphs. This stone was believed to be the parent of the island and its chiefs.

There is no evidence that permanent human settlements ever existed on Scilly, Motu-one, or Mopelia until recent times, although historically the rugged seafaring people of Maupiti visited these sites to obtain turtles and other resources. Beginning in the late 1800's, longer and more frequent visits occurred to make copra. Mopelia, the closest of the three atolls to Maupiti, appears to have had the most continuous human occupation for copra production. During the 1950's, as many as 200 copra workers occupied Motu-one where a concrete warehouse and other facilities were constructed. However, during the 1960's with the advent of nuclear testing and associated higher paying jobs elsewhere in French Polynesia, Motu-one was virtually abandoned along with

many of the other atolls worked for copra. During our short two-day visit in October 1991, only eight people were living at Motu-one. The relatively small numbers of nesting turtles remaining today at Motu-one and Mopelia are undoubtedly the direct result of persistent exploitation associated with human habitation.

At Scilly, the earliest settlement established to make copra appears to have been about 1952. The elder of the Taputu family (deceased in 1985) arrived in 1952, and his descendants continue to live there. Rene Taputu, who was born at Scilly in 1955, currently oversees 25 residents that include many children. Rene Taputu is also the principal person knowledgeable about the atoll's turtles, since they continue to be a prominent component of the local diet. Up to 50 adult turtles of both sexes are consumed annually under special permission previously granted by government authorities.

The main nesting season extends from October to December, but some turtles sporadically nest throughout the year. Very few immature turtles are encountered, and the green turtle is the only species ever seen. The Taputu family has a history of raising small numbers of hatchlings in captivity for a year or so prior to releasing them as a restocking effort.

According to Rene Taputu, and verified by other sources, between 1952 and 1969 about 1000 adult turtles of both sexes were taken annually for markets in Tahiti, as well as for local consumption that included food for pigs. Eggs are not presently eaten, but it is unclear if they were in the past. During 1967, 100 nesting turtles were captured in a single night on the most southerly islet of Motu Honu. A stone flung by a turtle nesting at this site fatally struck one of the atoll's inhabitants. Pens constructed on the islets of Motu Rahi and Motu Oia along the east side of the atoll made it possible to hold several hundred turtles alive for months until a transport vessel arrived from Tahiti, Maupiti, or Bora Bora.

During September 1970, FAO consultant Harold Hirth visited French Polynesia as part of a broader survey of sea turtles in the South Pacific region (Hirth 1971). The visit included an overflight of Scilly and Mopelia. Partly because of Hirth's conservation recommendations, legislation was enacted in 1971 prohibiting the sale of turtles throughout French Polynesia. Restrictions were also placed on the time of year and minimum size that turtles could be captured. However, enforcement of these laws has been difficult. In separate legislation that same year, Scilly and Motu-one were given "sanctuary" status that provided some additional but limited protection for turtles.

In April 1972, 67 adult females held in pens at Scilly were confiscated, tagged (with Monel alloy tags supplied by Hirth), and released by government officials. Later that year in December, 168 more females and 13 males were tagged and released from the same holding pens. During 1973-74, an additional 131 adult females were tagged at Scilly. Of these 379 turtles tagged during 1972-74, 12 long-distance recoveries were made, encompassing the islands of Tonga (1 turtle; 2000 km), Fiji (5 turtles; 3000 km), Wallis (1 turtle; 3000 km), New Caledonia (2 turtles; 4000 km), and Vanuatu (3 turtles; 4000 km). All recoveries were made to the west of Scilly, and none occurred within French Polynesia. Two of the recoveries involved males that were recaptured in Kandavu and Druadrua, Fiji. Also, a female, and one of the males, tagged in December 1972 were recaptured nearly 2 years later within 12 days of one another both in Kandavu, Fiji. All of the 12 recoveries were made in coastal waters and presumably involved turtles remigrating to seagrass or algal foraging pastures where they resided before migrating to Scilly to breed. During 1979, 42 females were tagged at Scilly by government officials, and 40 more were tagged in 1983-84 by Lebeau (1985). One turtle from this latter group was recaptured 3 months later in the Cook Islands, 500 km to the southwest of Scilly.

In 1990, several hatchlings were collected at Mopelia by EVAAM and transported to the University of Georgia, via Honolulu, for use in mitochondrial DNA studies of globally distributed green turtle populations. The extensive black pigment seen for a short time in the plastron of post-hatchling green turtles from Hawaii (Balazs 1986) was documented as also occurring in turtles from Mopelia.

FINDINGS AT SCILLY ATOLL: Nesting activity was monitored at Scilly for 10 consecutive nights (14-23 October 1991) on the islets of Motu Honu and the southern portion of Motu Oia. This fairly

comprehensive level of coverage was made possible by the fine cooperation of Rene Taputu and several family members who assisted in walking the beaches throughout the night. The northern segment of Motu Oia, Motu Rahi, and other islets to the north were not surveyed. Eleven nesting turtles were tagged on Motu Honu and 39 were tagged on Motu Oia. Two other adult females were tagged and released from a pen where, along with eight other turtles, they were being held for food. All turtles were triple or quadruple tagged on the flippers (both front and hind) with titanium tags and/or Inconel alloy tags. No previously tagged turtles were encountered, nor were any recently seen by Rene Taputu. Based on limited data, Lebeau (1985) estimated that 300-400 turtles nested annually at Scilly during the 1982 and 1983 seasons. With some speculation, our survey suggests that a similar number of nesting turtles may have been present throughout the atoll during the 1991 season.

The curved carapace lengths of 51 of the 52 tagged turtles that we measured ranged from 95 to 112 cm (mean, 103 cm). Six shells used by Rene Taputu as ornaments at his home on Motu Oia ranged from 94 to 109 cm (mean, 99 cm). Carapace coloration was predominately mottled brown, amber, olive, and black-- similar to green turtles seen nesting at Rose Atoll in American Samoa and Fakaofu Atoll in Tokelau. Plastrons were yellowish-orange; however, three of the turtles examined had distinct black spots ranging 1-5 cm in diameter. One of these turtles had multiple spots scattered throughout the plastron, while the other two only had a couple. Rene Taputu indicated that about 10% of the turtles he eats have these spots which he calls, roughly translated, "chicken fecal-drop turtles." Although externally these turtles appear healthy and fat, when butchered they have a thin fat layer, and excessive water comes from the meat when cooked.

Turtles tagged at Motu Honu were found to nest mainly on the lagoon side of the islet where the beach consists entirely of fine-grained coral sand with no offshore obstructions. This beach is accessible at all tidal stages. In contrast, all nesting turtles encountered at Motu Oia, except one, came ashore on the ocean side of the islet, which is bordered by a very shallow fringing reef that drops abruptly into deep oceanic waters. Access along this coastline is further hampered by rugged, often sharp limestone onshore that a turtle must crawl over once it leaves the water. Expanses of this beach rock extend for 10-50 m above the high-tide mark and must be crossed to reach sand areas suitable for nesting. The lagoon-side beach of Motu Oia is narrow and free of obstruction, but composed of coarse coral sand and rubble. Nevertheless, nesting can successfully occur there, as shown by the turtle encountered and information supplied by Rene Taputu.

During one of our nightly surveys, hatchlings were found from a newly emerged nest close to Rene Taputu's home on Motu Oia. The hatchlings were reportedly from oviductal eggs removed from a butchered turtle that were buried as a conservation effort about 2 months earlier. No predation on these hatchlings was observed, nor was the presence of potential terrestrial or marine predators noted in abundance anywhere in or around the atoll. A partially filled stomach from a nesting female butchered a week earlier was salvaged from a garbage pit near Rene Taputu's home. The contents were found to consist of 50% *Microdictyon japonicum*, 25% *Caulerpa serrulata*, and 25% *Turbinaria ornata*. These benthic algae were not seen in abundance in the lagoon or along the fringing reef. However, *Caulerpa racemosa*, an alga sometimes grazed by green turtles elsewhere, commonly occurs in the lagoon at Scilly and is often eaten by human inhabitants.

Mating turtles were seen both in the lagoon and just outside the seaward edge of the fringing reef where courtship and copulation, according to Rene Taputu, most commonly occur. Turtles mating in this latter area are openly susceptible to capture by high-speed 12-m bonito fishing boats visiting waters surrounding the three atolls. A month prior to our arrival, seven turtles and a bonito boat were taken into custody at Maupiti for violating the August through March closed season for taking turtles. Considerable incentive exists for poaching, since an adult turtle can be illegally sold in Tahiti for about US\$1000. Turtles inside the lagoons at Scilly, Motu-one, and Mopelia are safe from hunting by bonito boats, because it is impossible for vessels of that size to enter the narrow and extremely hazardous passes. In addition, turtles in the lagoons at Scilly and Motu-one are legally protected under the 1971 sanctuary designation.

A nesting turtle that we tagged on Motu Oia on 18 October 1991 was recaptured 5 months later in a fishing net near Suva, Fiji. A photograph taken shortly after capture showed an otherwise healthy turtle with numerous, partially healed, deep gouges in the plastron. Injuries to this extent were not seen when the turtle was originally

tagged, nor on any of the other turtles examined. Possibly they were caused by the effects of cyclone Wasa that passed by the three atolls on 9-10 December 1991 with winds of 180 km/h.

CONSERVATION RECOMMENDATIONS

- The number of turtles taken for food by the residents should be limited to two per month, and preferably should be male turtles.
- The number of people allowed to live at the atoll should be stabilized at the current level or less.
- Rene Taputu should be designated as the official warden of the atoll under the sanctuary status. He should also be supplied with a portable shortwave radio to allow communications with Tahiti.
- The sanctuary status of Scilly and Motu-one should be redefined to include the surrounding waters within one kilometer of both atolls.
- Turtle poachers should be apprehended, prosecuted, and heavily fined.
- Additional tags, applicators, and data books should be supplied to Rene Taputu so he will continue to be motivated, and have the ability, to tag turtles following the training provided during our visit.
- Satellite telemetry should be conducted with several nesting turtles to determine migratory routes, speed of travel, and ultimate foraging pasture destinations. This work should be in conjunction with additional saturation tagging throughout as much of the nesting season as possible.
- The number of nests (eggs or hatchlings) removed annually for experimental captive rearing and restocking efforts in Tahiti should not exceed 3% of the estimated total available.

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U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, FL 33149

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