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## STATUS OF MARINE TURTLES IN THE HAWAIIAN ISLANDS

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### INTRODUCTION

Of the 5 genera of marine turtles which exist in the world today, only 3 are found in the waters around the Hawaiian Islands. The most abundant is the Pacific Green Turtle (*Chelonia* sp.), while the Hawksbill (*Eretmochelys* sp.) is sighted infrequently. Both of these animals inhabit relatively shallow areas where various forms of algae are available for grazing. This underwater vegetation is the Green Turtle's primary source of food, thus it is classified as a herbivore. In this respect the animal is unique in that few large organisms utilize this algae as food to any great degree, thus little competition for food exists. From an ecological point of view Green Turtles represent a valuable position in the marine food chain by being capable of transforming plant material directly into animal flesh. In addition to eating algae, Hawksbills are known to eat small crabs and other crustacea.

The third genus of marine turtle which frequents Hawaiian waters is the Leatherback (*Dermochelys* sp.). The habits of this salt water reptile are pelagic, that is, it is an inhabitant of the open ocean. Differing from other marine turtles by not having a hard shell, this animal is thought to be the world's largest living reptile. Individuals up to 1,000 pounds and 7 feet in length have been reported. Examination of stomach contents shows that Leatherbacks feed upon jellyfish, crustacea and algae. Their occurrence in Hawaiian waters is very rare and visits to the island chain are apparently made only while passing through from one area of the Pacific to another. Few of these animals have been caught near Hawaii and those reported were mostly captured by accident (e.g. entangled in trolling lines). Although this turtle has never been highly valued economically due to its soft shell and the reported unpalatability of its flesh, a limited market for eggs and extracted oil does exist in some areas. Because only a few of its nesting beaches remain unexploited by man, this animal has been declared an endangered species by the U.S. Department of Interior.

The Hawksbill turtle has a shell that is highly prized as an item from which jewelry and other ornaments can be fashioned. The decorative "tortoise-shell" comb is a valued commodity in markets throughout the world. In addition to having an edible flesh and valuable shell, a demand by tourists for stuffed and mounted animals has helped send these creatures down the road to extinction. In recent years even the day-old hatchlings have been exploited. Exporters in the Philippines have attempted to market these animals to aquarium fanciers in Hawaii, and shops in Okinawa occasionally offer them for sale. The above combination of factors has jeopardized the animal's survival and reduced its numbers to such a degree as to also justify placing it on the U.S. Endangered Species List. In an effort to control the international commerce of endangered species, products derived from animals on this list may not be imported into the United States. Unfortunately Hawksbill shell, along with rare animal skins, continues to be transported into the United States from lesser developed countries. Proof can be seen in several establishments in Honolulu where tortoise-shell jewelry, whole shells and stuffed animals with foreign labels are offered for sale. Although the word "shell" is commonly



used, the more correct term for the product is "laminae" - the thin horny plates which cover the outer surface of the bony shell. It is important to make a distinction between the two words. Only 1 or 2 pounds of laminae are obtained from an adult Hawksbill while the entire shell itself may weigh more than 15 pounds. Thus in a recent case where a major airline was charged with importing several hundred pounds of Hawksbill "shell"; the number of animals representative of this laminae may have been in the hundreds and not 10 or 20 as might first be suspected.

Hawaii's most abundant and frequently seen marine turtle is the Pacific Green. Live specimens of this animal can be seen at Sea Life Park, the Waikiki Aquarium and the Kahala Hilton Lagoon on Oahu. Some of the natural grazing habitat of this animal around the main islands includes Kaneohe Bay on Oahu, Makena Point and the Hana area on Maui, and the North shore of Lanai. Green Turtle fillets are served in restaurants on most of the islands. Besides having a palatable flesh, cartilage commonly called "calipee" from the underside of the animal is used to make turtle soup. Green Turtles are also stuffed and sold as curio items. To describe this animal as being abundant would probably be in error because many local residents have observed that the number of turtles sighted in recent years has decreased. This apparent decrease may be due to the fact that the pounds of turtle reported as being caught in recent years has sharply increased, probably following greater demands for turtle steak by the tourist industry. Although large catches were sporadically reported in the late 1940's and 1950's, the trends presently displayed indicate that more turtle is now being taken than ever before. Table 1 was compiled from reports issued by the Hawaii State Fish and Game Division. Fishermen holding a commercial fish and game license are required by law to report, by species, all catch that is sold for profit. Thus the turtle data presented do not include animals captured by: (1) commercial fishermen but not offered for sale, (2) recreational fishermen and scuba divers, and (3) individuals who are not reporting transactions. These categories undoubtedly represent substantial numbers of turtles being taken.

Table 1. Whole Body Weight and Value of Commercial Marine Turtle Catch Reported for Hawaiian Waters for Years 1948 through 1971

<u>YEAR</u>	<u>POUNDS</u>	<u>U.S. \$ VALUE</u>	<u>YEAR</u>	<u>POUNDS</u>	<u>U.S. \$ VALUE</u>
1948	17,650	\$ 2,154	1960	3,739	\$ 527
1949	15,168	2,016	1961	709	139
1950	11,588	1,733	1962	477	48
1951	5,144	1,050	1963	380	79
1952	2,731	533	1964	1,609	321
1953	9,466	2,214	1965	1,510	57
1954	3,040	483	1966	4,715	1,053
1955	11,126	1,731	1967	5,021	1,173
1956	6,819	1,025	1968	3,350	2,400
1957	696	195	1969	10,175	2,820
1958	3,207	1,171	1970	12,506	5,017
1959	714	90	1971	19,884	9,850
			1972	25,583	-

Green turtles are captured in Hawaii by several methods. These include (1) laying nets on the surface which will entangle the animal when it comes up for air, (2) slipping a noose over a flipper and subsequently dragging the animal to the surface, (3) wrestling the animal to the surface by hand, (4) harpooning the turtle while it is on the surface, (5) spearing the animal from beneath the surface, (6) killing the animal with an explosive powerhead spear, and (7) shooting the animal with firearms. Methods 4 and 5 are illegal for commercial purposes and methods 6 and 7 are illegal for any purposes. On occasion turtles have been caught on baited hooks. In Hawaii most turtles are sold by fishermen directly to the user (e.g. restaurant, small fishmarket, etc.). Turtle is very seldom found on the wholesale auction markets of either Honolulu or Hilo.

#### REPRODUCTION AND MIGRATION

All marine turtles reproduce by periodically migrating to nesting beaches where the female leaves the water for several hours to dig a nest above the high tide mark. As many as 175 "leathery" eggs may then be deposited in the sand pit. After covering the egg mass the female once again enters the ocean leaving the young to hatch, dig



themselves out and make their own way in a very hostile environment. Many qualified researchers suspect that the particular nesting beach to which the animal travels for reproduction is, in fact, the location where that turtle itself hatched many years before. However, final proof of this theory will have to wait for a suitable method of tagging a hatchling and the subsequent identification of the same animal at a future date while it is nesting.

It has been positively determined that adult marine turtles return to the same beaches on recurrent seasons to nest. In addition, it is known that animals migrate to these beaches over long areas of open ocean from grazing areas which have an adequate food supply. The exact method of navigation used to find the beaches is still unknown but it is thought that olfactory chemoreception plays an important part. Probably because the open ocean voyage is strenuous and depletes body reserves significantly, migration and nesting takes place only once every 2 to 4 years. Classic research in all these areas has been carried out by Dr. Archie Carr of the University of Florida, the world's foremost authority on marine turtles. His studies have shown that the population of Green Turtles inhabiting the coast of Brazil migrate some 1,100 miles to Ascension Island in mid Atlantic to nest and that feeding pastures off Nicaragua, Panama and Columbia sustain populations which nest in Costa Rica.

Continuing reduction in numbers of marine turtles throughout the world has mainly been due to the animal's susceptibility to capture by man at nesting time both on the beach and in the sea immediately adjacent to the nesting sites; as well as to overfishing in the grazing pastures. The plight of marine turtles is widely recognized. Many sites which formerly supported large colonies of nesting animals now stand virtually unused. Studies carried out in the Caribbean, the Indian Ocean, Malaysia and the Pacific and Atlantic coasts of Mexico show that total population numbers are decreasing. Whether mature adults are removed from the breeding population at the nesting beach or in the grazing habitat makes little difference; the net effect is still the loss of a reproducing member of a delicate colony.

Nesting of Green Turtles took place on some of the main Hawaiian Islands just 40 years ago. Documented sightings of turtles coming ashore were made at: Mokapu Peninsula, Kailua and Makapuu Beaches on Oahu; the West coast of Molokai and the North shore of Lanai. It seems reasonable to assume that sites also existed on Kauai, Maui, Kahoolawe and Hawaii, however the author has been unable to obtain substantiated reports of past nestings on these islands. Today no animals are reported nesting on any of the main Hawaiian Islands. If any still do, it would be so infrequent as to best be left unreported because of possible human interference.

The Hawaiian Islands National Wildlife Refuge extends Northwest from Nihoa Island to Pearl and Hermes Reef, a distance of some 800 miles. Fortunately for the Hawaiian population of Green Turtles, the Hawaiian Monk Seals and many species of birds, this area was afforded complete protection by the United States Government. Under the direction of the Department of Interior, Bureau of Sport Fisheries and Wildlife, entry to the Refuge is strictly controlled. In addition, an active conservation program is currently being carried out by the limited Bureau personnel available. The past history of this chain of reefs and small volcanic islands is exceedingly grim to recall. Americans and foreigners pillaged the wildlife in such an unmerciful manner that complete restoration of the balances of nature can never be totally achieved. Even today, surveillance of the area is difficult due to its remoteness. On several small sandy islets, notably French Frigate Shoals and Pearl and Hermes Reef, remain the final nesting sites of Hawaii's Pacific Green Turtles. No other kind of turtle has been reported nesting in these areas. Each year between May and July Green Turtles congregate at these shores, breed within a half-mile of the beaches and leave the water at night to lay eggs on sandy beaches. For the past eight years, as other duties allowed, administrators in charge of this area have tagged, weighed and measured over 700 Green Turtles that have come ashore. The majority of these turtles were tagged while "basking" in the sun. This particular habit seems to be unique to Hawaii's Green Turtle population and probably represents a method of warming the animal's body since the Wildlife Refuge is at the northern most limits of marine turtle nesting sites. In addition a few turtles have been tagged while coming ashore to nest. Attached to the front flipper, each metal tag bears an identifying number and return address. Eleven tags have been returned from



captured animals since the program began and all of these were taken from animals harvested in the waters around the major inhabited Hawaiian Islands. In addition many tagged animals have been observed on the same beach during subsequent seasons. No turtle tagged in the Wildlife Refuge has ever been recaptured in any other area of the Pacific Ocean. These facts show that at least a part of the Wildlife Refuge turtles are the very same animals found grazing around the major Hawaiian Islands.

Tagging turtles on the nesting beaches is a difficult task. Sporadic transportation, lack of manpower, and necessary involvement with other species has limited the intensity of tagging nesting turtles. For this reason it has not been possible yet to determine the total number of turtles in the Hawaiian population. This has been done with some degree of accuracy in other areas of the world and this censusing has formed a basis for showing whether actual numbers are increasing or decreasing. A concentrated tagging program extended through entire seasons could provide this necessary data for the Hawaiian Green Turtles.

#### GREEN TURTLE GROWTH AND DEVELOPMENT

After a 50 to 60 day incubation period, fully developed 1-ounce hatchlings break free from their eggs. When enough of the eggs have hatched, the slow ascent through the sand to the surface begins. Four or 5 days of digging may be required before the hatchlings reach the surface. Studies have shown that a minimum number of animals are required for the team work effort needed to reach the surface. Once the hatchlings have ascended to a level slightly beneath the surface, temperature dictates the time of final emergence. The cooling effect of night is usually the signal for leaving the nest. Once on the surface and out in the open, brightness cues from the horizon orient the animals in the proper direction for finding the ocean. At the Wildlife Refuge nesting sites, eye witness accounts testify to the environmental dangers for hatchling turtles. Crabs and birds prey on the small reptiles as they move toward the water. Once in the ocean, sharks, ulua and other reef fish devour them. In spite of all the odds, one or two apparently survive to adulthood from each clutch of 100 eggs.

After rapidly swimming away from the nesting beaches the turtles are not seen again until they are about one-year old, at which time they have attained a weight of 2 to 8 pounds and a shell length of 12 to 16 inches. This first year is described as the "lost year" in a marine turtle's life. What they eat and where they go is unknown. Occasionally Japanese fishing vessels arrive in Honolulu from the Wildlife Refuge area with freshly hatched turtles aboard. These turtles are known to be attracted to lights and thus are probably attracted to lighted ships at night where they are easy prey for capture by crew members.

Data available indicate that Green Turtles become sexually mature when they are between 4 and 8 years old. At that time they may weigh as much as 250 pounds and have a shell length of 36 inches. After reproductive age is reached, growth in the wild is exceptionally slow, averaging as little as 1/10 inch per year in shell length.

#### CONSERVATION AND LEGISLATION

Concern by private citizens and governments throughout the world over the dwindling number of marine turtles and the continuing increases in turtle harvest has led to the passage of much needed conservation legislation. Whether the protection afforded is adequate and soon enough in coming, only time will tell. In the Pacific Basin, where entire colonies have not yet been destroyed as they were in the Caribbean, certain island nations have recognized the critical situation which exists concerning the survival of marine turtles. French Polynesia, Tonga, Fiji, Samoa, the U.S. Trust Territory of the Pacific Islands and Midway Island have all passed restrictions which help protect the turtle both on the beach and in the water. Most of these laws have stressed which sizes may be taken and during what months. In addition, in some areas (e.g. French Polynesia) turtles may not be taken for commercial purposes but only for home use. Queensland, Australia, gives full protection for all marine turtles and their eggs.

In the continental United States attempts to conserve the remaining stocks of turtles along coastlines have led South Carolina, Georgia and Texas to provide complete protection. The State of Florida has laws which restrict the capture of turtles by imposing a size limitation and a season.

In the Hawaiian Islands National Wildlife Refuge, all marine turtles are protected while on land and within the non-navigable waters of the reef areas. Outside the



60 fathom curve, which in many cases is less than a mile offshore, they are completely unprotected from U.S. fishermen. Foreign fishing vessels are required to remain at least 12 miles from these islands. Around the major Hawaiian Islands and within the navigable waters of the Wildlife Refuge, marine turtles are completely under the jurisdiction of the Hawaii State Fish and Game Division. The only Hawaii State Law relating to these animals appears in Section 188-25 of the Hawaii Revised Statutes under the heading "Fishing with firearms and spears." This act states that

"(a) It shall be unlawful for any person to pursue, take or kill any turtle, crustacean, mollusk, aquatic mammal or fish other than sharks in the waters of the State with firearms as defined in section 134-1 or to pursue, take or kill any crustacean with a spear" and further that

"(c) It shall be unlawful for any person to sell or offer to sell any turtle or fish other than sharks taken or killed with a spear, provided that turtles or fish may be lawfully taken or killed with a spear for home consumption only."

Violation of this section is punishable by a fine of not less than \$10 nor more than \$50, or imprisonment for not less than 10 nor more than 20 days, or both. In other words, no real State restrictions exists which will help protect and perpetuate these creatures. Even the endangered Hawksbill and Leatherback can be legally taken at any size and in any quantity within Hawaiian waters (outside of Wildlife Refuge) because no Federal or State regulations would be violated. A lack of awareness by Hawaii's law-makers and administrators on the plight of marine turtles throughout the world has undoubtedly been responsible for the scarcity of conservation laws.

In 1971, a report (FAO/UN No. 482/71) dealing with the marine turtle resources in the Pacific was prepared by Dr. Harold Hirth, a consultant for the United Nation's Fisheries Development Agency Project. A section of this report deals with marine turtles in the Hawaiian Islands. Based on Dr. Hirth's knowledge and findings, the following recommendations were made:

The sale of stuffed marine turtles of all sizes should be prohibited and turtle meat and soup eliminated in hotels and restaurants.

An in-depth study should be made on one or several of the nesting atolls in the Wildlife Refuge during the peak nesting season.

A tagging project should be started on the feeding areas of Maui.

Increased cooperation between State and Federal agencies is essential on matters concerning turtles, since the Green Turtles nesting in the Wildlife Refuge (under the jurisdiction of the latter) may well be the same individuals feeding around the main Hawaiian Islands (under the jurisdiction of the former).

All available information on Green Turtles in the Wildlife Refuge should be published as this would be an important contribution to the ecology and taxonomy of the little known Central Pacific Green Turtle.

Perhaps a more widespread concern within the State of Hawaii for the survival of our commercially exploited turtles will result from the publication and distribution of such reports. The opportunity to manage and protect an entire colony of Green Turtles at both their nesting and their feeding grounds is still available in Hawaii. Nowhere else in the world does such a possibility now exist.

As a potential focal point of the Pacific, it would behoove Hawaii to promptly implement both research and legislation that will ensure the continued existence of its marine turtles.

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Editor's Note: For more information on the endangered turtles see March 1972 AUDUBON, Volume 74, No. 2, pp. 24-34: Great Reptiles, Great Enigmas by Archie Carr

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