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300 S. Ferry Street

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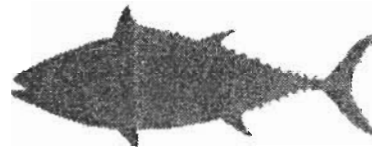


**A REVIEW OF INFORMATION ON THE SUBSISTENCE
USE OF GREEN AND HAWKSBILL
SEA TURTLES ON ISLANDS
UNDER UNITED STATES JURISDICTION
IN THE WESTERN PACIFIC OCEAN**



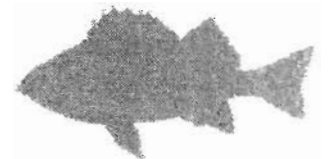
By

R. E. Johannes



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ERRATA

Page 27. The first sentence under American Samoa should read "American Samoa, in the Central South Pacific, consists of the inhabited high islands of Tutuila and Olesega, the smaller *inhabited* high islands of Ofu and Tau, and uninhabited Rose Atoll."

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OF GREEN AND HAWKSBILL SEA TURTLES
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IN THE WESTERN PACIFIC OCEAN

By R. E. Johannes

33 Garland Way
Trigg, 6020
Western Australia

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PREFACE

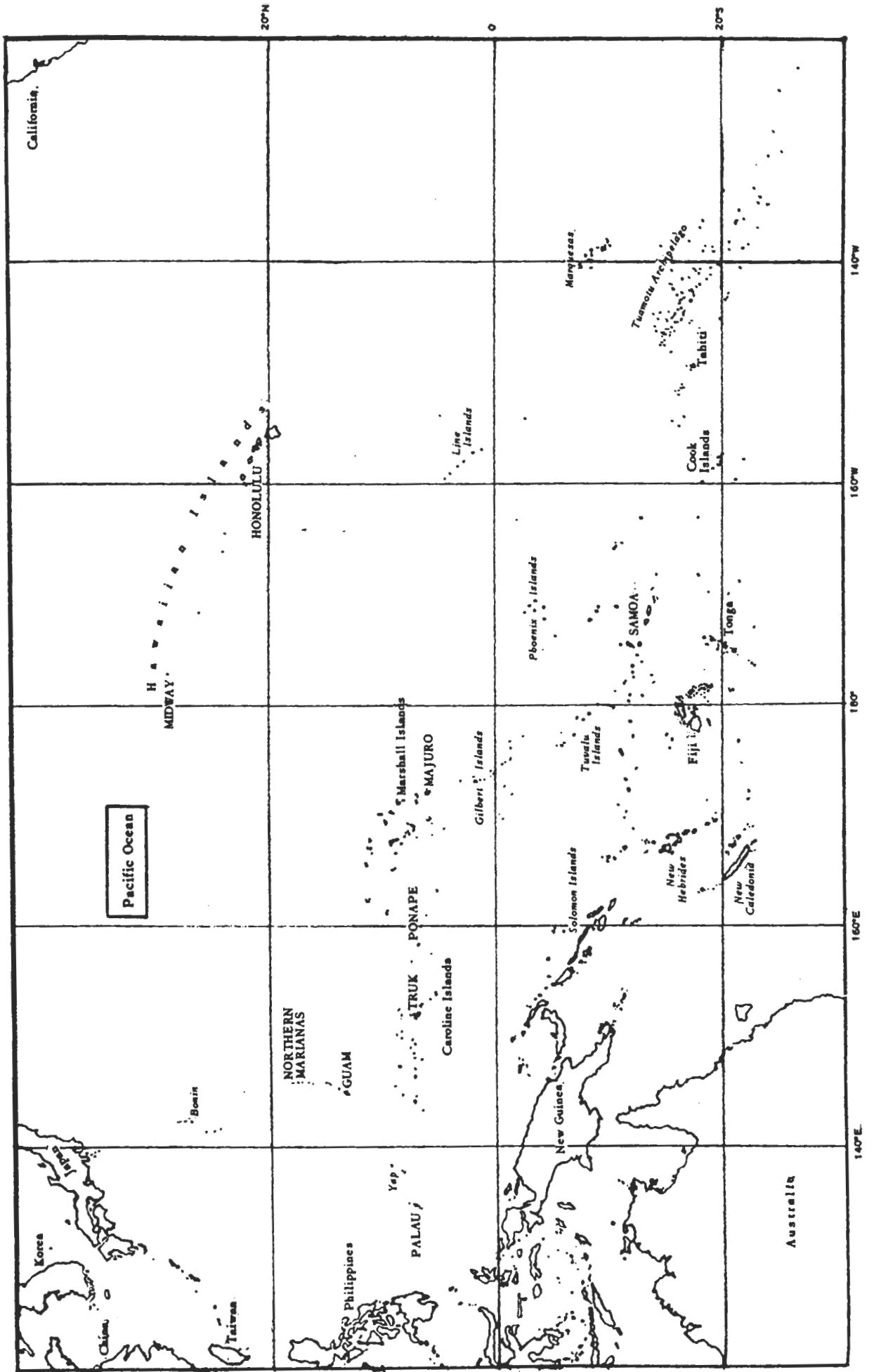
This report was prepared under contract 83-ABA-02853 by R.E. Johannes. Dr. Johannes is currently Principal Research Scientist at Australia's Commonwealth Scientific and Industrial Research Organization, Division of Fisheries and Oceanography. He is the author of many articles on marine ecology, particularly the ecology of coral reefs. He has published one book, Words of the Lagoon (Fishing and Marine Lore in the Palau District of Micronesia). The main objective of the contract work was to provide current information on the traditional use of sea turtles in Hawaii and other western Pacific islands under United States jurisdiction.

In addition to the text and references a chart has been added to provide some geographic perspective for readers unfamiliar with the areas described. Because the report was prepared under contract, the statements, interpretations, and conclusions herein do not necessarily reflect the views of the National Marine Fisheries Service.

Eugene T. Nitta
Coordinator, Protected Species
Program

Figure 1

MAJOR ISLAND GROUPS IN THE PACIFIC BASIN



INTRODUCTION

The islands discussed in this review are those of Micronesia (excluding Kiribati), Hawaii, and American Samoa. For many centuries the green sea turtle, Chelonia mydas, and the hawksbill turtle, Eretmochelys imbricata, have served a wide range of important functions in the lives of the inhabitants of these islands. The eggs and flesh provided food. The shell of the hawksbill has been described as the "world's first plastic" and has served a wide variety of ornamental and practical uses. Turtle bones were used to make tools. Various parts of the turtle were used to make medicine. In addition, turtles have been (and still are on some islands) the focus of important religious or ceremonial practices.

Overharvesting has led to the apparent widespread decline of sea turtle populations in these islands. An important question, under the circumstances, is, to what extent can the traditional use of sea turtles by the islanders continue without unacceptable damage to turtle populations? It is not the purpose of this review to address this difficult question. Rather, it is to provide, as an aid to others whose responsibility it is to wrestle with it, a summary of what is known about the traditional use of sea turtles in Pacific islands under U.S. jurisdiction.

I do not intend to define rigorously the terms "traditional" or "subsistence," which I shall use interchangeably in this review. A book could be written concerning how and why these terms have been so variously defined. Subsistence and commercial activities lie along the same activity spectrum; to draw a line separating the two classes requires making an arbitrary judgment. For example, a Pacific Island turtle hunter who gives meat to his relatives is clearly engaging in a subsistence activity, while one who sells his turtles to commercial exporters is not. But what about one who sells turtle meat to his relatives? Some would say this falls within the framework of traditional subsistence activities. They would point out that traditions are not static; they evolve to fit the times. Thus, the involvement of cash in a transaction in what was originally a cashless society does not automatically render that transaction non-traditional. Such an argument is not unassailable but it has merit. It could, however, be pushed to ridiculous extremes. Using it, one might claim, for example, that sophisticated modern long-liners are part of a traditional fishery insofar as one could trace their long, stepwise evolution all the way back to the primitive traditional stone age gorge.

For the sake of deciding what activities to exclude from this review I will simply consider as non-traditional, the sale of turtles or turtle products to people who are neither one's relatives nor belong to one's village or local

community. Clearly there are other equally justifiable dividing lines I might have chosen.

I would, however, like to take exception to the definition on "non-commercial hunting" given in a statement on Sea Turtle Conservation Strategy emanating from the 1979 World Conference on Sea Turtle Conservation. Here, non-commercial hunting is defined as, "a traditional way of obtaining food practiced by aboriginal people who are not yet part of a cash economy or technological society." This definition is so restrictive as to have no practical utility. No Pacific Island society (and vanishingly few elsewhere) can be said today to be "not yet part of a cash economy or technological society." The transition from subsistence to cash economies does not occur overnight. It often takes several generations, during which both types of economies co-exist. This state of affairs is strongly in evidence today in one of the geographic foci of this review, Micronesia.

MICRONESIA

Micronesia occupies an area of land and water equal to that of the United States in the western central Pacific. (Fig.1). It contains three large island groups under various forms of U.S. jurisdiction. These are the Caroline Islands, the largest group, lying in the south and central portion of the area, the Mariana Islands, occupying the northwest sector, and the Marshall Islands in the east. The approximately 2,200 islands in the area are all small. Only about 100 are inhabited and the total population is less than 200,000.

CAROLINE ISLANDS

For ease of discussion it is useful to subdivide the Caroline Islands into several districts - Palau, Yap, Truk, Kosrae and Ponape. Each has distinctive cultural and environmental features. Each also contains small, low, sometimes remote coral islands as well a high volcanic islands on certain of which district and commercial and political centers are located. Because turtles generally prefer to nest on the beaches of the low islands, the inhabitants of such islands tend to have the most contact with them. Due to their typical remoteness from commercial centers these islanders have also tended to retain a greater fraction of their traditional subsistence culture. As will be discussed below, sea turtles continue to play a major role in the nutrition, ritual, and social life among the people of certain of these low island groups. Turtles generally assume less importance today around high islands and district population centers.

THE PALAU DISTRICT

The Palau (Belau) District, in the southwest corner of Micronesia consists of the Palau Archipelago plus the tiny, isolated and culturally distinct South West Islands.

Palau

Since western contact Palauans have held the reputation for being the best fishermen in Micronesia. Today outboard motors and imported runabouts have replaced dugout canoes, but subsistence fishing remains important, especially in the outlying villages.

Catching Turtles

Kubary (1895) and Kramer (1929) described the maramas net once used by Palauans to catch sea turtles in shallow water. The net was made of 3 mm dia. sennet line, 30-40 m long, 4-5 m deep and with meshes of 25-30 cm. It was apparently still in use in the late 1950s (Anonymous, 1961). But I did not see or hear of it, or of any other kind of net being used for turtles in Palau in the mid-1970s. Nevertheless, I suspect that an occasional turtle was caught accidentally in nets set for mullet or other net-prone fish.

Another method of catching turtles was probably not developed until the introduction of diving goggles to Palau by the Japanese. The following description comes from Anonymous (1961). "A turtle hunter will dive in a likely looking area of the lagoon until he locates a large coral rock with an excavation or hollow under it. By examination he can tell from experience whether or not this is a place where a turtle frequently comes to "rest". If it proves to be such a place, the man will wedge a wooden stick in the middle of the entrance to the hollow and tie a rope to it. At the other end of the rope, which must be at least as long as the depth of the water at that point, he ties a stone which is set on the lagoon bottom a short distance from the hollow. The man returns to the spot by canoe several times each day. If the stick is found to be floating on the surface the hunter knows that probably a turtle has gone into the hollow to "rest" and in doing so has dislodged the stick which rose to the surface. The man then dives down to the rock and quite often the turtle will still be in the hollow and can easily be caught by spearing or by tying a rope on one of its flippers. This particular method of capturing turtles is infrequently used today."

Anonymous (1961) also states, "Sometimes several canoe loads of men will go out to the reef and line the canoes up in such a way that they can be poled along the same direction. Large areas can be "combed" in this way and turtles are seen and speared. The animal is retrieved by one of the men who

will jump into the water after the speared turtle and stick his fingers into its eyes and bring it to the surface." (I never heard of this method being used in the mid-1970s, in part, perhaps, because reef fishing was becoming increasingly an individual rather than group activity [Johannes, 1981].)

Divers sometimes swim about the lagoon until they see a turtle which they will try to spear in its neck or flipper or head in order to keep from damaging this shell. If the diver can get close enough, he sometimes implants a hook in the soft parts of the turtle by using a long pole to which the hook is detachably fastened. The hook is tied to the end of a rope at the other end of which is a float. The turtle will swim about dragging the float, eventually becoming exhausted and is then easily caught. This latter method was reportedly introduced by the Okinawans during Japanese times," (Anonymous, 1961).

Also, according to Anonymous (1961), "whenever a pair of turtles are seen having sexual intercourse in the water, the observer simply waits until they have exhausted themselves at which time they are relatively easily caught." This statement is incorrect. When sea turtles are copulating they are, like many marine vertebrates, in a sort of stupor that renders them seemingly oblivious of approaching danger; fatigue has nothing to do with it. Thus, fishermen do not wait when they see copulating turtles. To do so would be to invite the possibility of the turtles completing the act, after which they recover their wariness very quickly.

When Palauans go spearfishing along the outer reef slope they often attach a polypropylene rope to the butt of the speargun. The other end of the rope is tied to a combination float and fish-stringer made from a length of bamboo, or a plastic bleach bottle. When something is speared that is strong enough to pull the diver beneath the surface, the speargun is released and the prey allowed to tire by fighting against the float. This practice also occurs in Yap (Anonymous, 1961). I once saw a large green turtle captured in this manner in Palau. The turtle sounded and the gun, line, and float disappeared from view into deep water. Only one hour later did the float pop to the surface signalling that the turtle had finally given up the struggle.

Turtles, according to Palauans, feed mostly during early morning and late afternoon. Often around midday they move into the lagoon and sleep on the bottom for two or three hours. The hawksbill generally sleeps in a crevice or cave in the reef; the green turtle more often chooses a sandy bottom under an overhanging coral head. Both species sleep during part of the night, hawksbills generally sleeping longer than green turtles.

Both green and hawksbill turtles have customary sleeping places with which some Palauan fishermen are familiar.

One fisherman in a village in which I lived was clearly more knowledgeable than the others about such sleeping places. When he went turtle fishing, I was told, he invariably returned with a large green. I witnessed the return from two such successful trips (involving two out of a total of only four green turtles I saw caught during 14 months of residence in Palau). Green turtles are easy to catch when sleeping because they are almost oblivious to disturbance. Palauans call a person who is hard to wake up bad el wel - "sleeps like a turtle."

Palauans today often keep spears handy in their boats in case they happen to see a turtle in their travels. Fishermen say that hawksbills and small green turtles tend to head straight for deep water when pursued. Consequently they are approached, if possible, from deeper water so that they will have to run toward the boat. Hawksbills seem to have less stamina than greens and tend to give up quickly, making them comparatively easy targets. Larger green turtles, say Palauans, typically run only a short distance then circle the boat, apparently trying to confuse the pursuers. Eventually they either come up for air or seek shelter, in either case becoming easy prey.

Harvesting of Eggs

A few green turtles nest on small islands near the northern and southern ends of the Palau Archipelago, but the major nesting sites for this species in the Palau district are Helen Reef and Merir, two small, almost uninhabited islands in the South West Island area.

Within Palau's main lagoon hawksbills nest in the Seventy Islands area. Here for centuries their eggs have been collected and eaten. Palauans state that more turtles lay their eggs here around new and full moons than at other times of the lunar month. (Such lunar reproductive periodicity has been found at some other sea turtle rookeries in the Indo-Pacific, but not at others.) Palauans have long known that the hawkbill lays eggs at approximately 14-day intervals in their area. A well-known Palauan folk tale relates how two lovers accidentally discovered this egg laying pattern.

Palauans have taken the ability to anticipate when a turtle will return to its nesting beach two steps further. They have learned, according to fishermen I interviewed, that by examining the eggs in a nest they can deduce how long ago they were laid (see also Anonymous, 1961 and Helfman, 1968). Newly-laid eggs are rubbery and flesh colored with a white disc at one end. But the shell begins immediately to calcify and harden. The white calcifying disc gradually enlarges and spreads over the entire shell. The experienced turtle egg hunter, it is claimed, can estimate the age of an egg, up until six days after laying, by the size of the calcified

white spot. After the sixth day an egg must be peeled and the size and state of the developing embryo used to determine the age of the nest. By the fifteenth day, for example, the umbilical cord is clearly visible. (Solomon Islanders apparently use similar criteria to determine when turtles will return to lay their next batch of eggs [Hocart, 1929]). Using a piece of twine the Palauan fisherman ties a number of knots equal to the calculated number of nights that will elapse before the turtle will return to lay its next batch of eggs. By removing one knot each day he knows when it is time to intercept the turtle on its return to the beach.

This technique is not perfect because the fifteen-day egg-laying cycle is only approximate; the female may return on the fourteenth day, or more rarely on the sixteenth day, according to egg hunters. In addition, according to egg hunters, the embryos do not develop at exactly the same rate, growing more slowly in shaded or overly moist nests or in rainy weather. (Too much fresh water collecting in the nest is liable to cause the eggs to rot, they say.) Roots growing too densely around the eggs will hinder the escape of the hatchlings.

A second observation allows the Palauan egg hunter to distinguish between an individual turtle's first clutch of eggs for the year, its last clutch, and intermediate layings. The eggs at the bottom of the first clutch are small, elongated, have little yolk, and seldom hatch. There are few misshapen eggs in the intermediate clutches. In the last clutch the eggs on top of the clutch are small and misshapen. It is as if the reproductive machinery of the turtle is a little rusty early in the season and falters once again just before it shuts down at the end of the season, producing inferior eggs in both instances. I know of no scientific studies that have any bearing on this contention. But two bits of circumstantial evidence lend some credence to it. First, the Polynesians of the Tuamotus have made similar observations. According to Emory (1975, p. 217) "the last eggs to be laid were smaller than the others and were called teke titi. When such eggs were observed it was a sign that the turtle would not come ashore again that season." Secondly, the first and last eggs laid by certain geckoes during their reproductive lives are similarly small and misshapen (M. Falanruw, personal communication).

Utilization

According to Kramer (1929) turtle meat was very popular with chiefs. It is not possible to tell from this comment or any other early account whether or not turtle meat was actually reserved for the upper classes in Palau as it was, and sometimes still is, in some other parts of Oceania.

Kramer (1929) describes preparation of a turtle for a meal: "First the animal, which was still alive, had to be killed. Two men seized it and pressed it vertically against the stone wall of the golbed; one held back the right front limb, another bent back the head so that the throat was exposed and the third delivered seven strong blows on the underside of the neck with a stick. Hot water was poured over the dead animal and the shell was loosened with a knife. Then four posts were driven into the ground and the turtle was laid on top of them with the back up, a fifth post was set up as a support under the head so that it would not hang down. In this manner it is possible to cook the animal in the shell. A screen is set up as a protection against the fire. When the meat is done, the abdominal plate is taken off and is laid on a mat in the blai for the family to look at."

The above description applies to the green turtle. According to Kramer (1929) eating of hawksbill was taboo to all except old women. Sixty-five years after Kramer's research a reliable Palauan informant told me that originally hawksbills were not eaten in Palau because the smell was considered unpleasant. Then it was discovered that by boiling the meat in water that is changed several times, the disagreeable smell is removed. Now, when hawksbills are caught primarily for their shell (see below) the meat is no longer wasted. No taboo apparently exists against eating this species today. Nevertheless, Palauans, like most Micronesians, prefer the taste of green turtles.

According to Anonymous (1961) "When a man killed a turtle, he would take it to his house and call the women members of his clan in the neighborhood to come and partake of the meat. The women would gather and bring their own taro and feast on the meat. At the close of the feast the women would take some of the meat to their homes for their husbands and family. At this time the man who killed the turtle would claim some of the meat for himself and his own family."

Turtle meat was sometimes used in treating illness (Anonymous, 1961). "If a household had a sick member it could sometimes be determined by divination which spirit (Chelid) was causing the malady. A turtle would then be caught and killed and taken to the place in the forest where this particular spirit was known to dwell. At this spot (sometimes a hut was erected there) the members of the sick person's household would gather to eat the turtle meat and plead with the offending spirit to restore the sick person to good health."

In the 1920s a charismatic leader in Palau founded a new religion and persuaded Palauans to discard many of their old religious beliefs and rituals. One of the ceremonial practices of this new religious group, the Modekngei, involved the burning of turtle meat as an offering to their deity on

special offering days. Some people still made such turtle meat offerings in the 1950s (Anonymous, 1961). The Modekngei religion is still strong in some areas of Palau today and the practice may continue even now. But the investigation of their practices by outsiders is discouraged by adherents to Modekngei.

If any persons killed or captured a turtle at Ngerduais beach in Airai municipality in the old days, he was obliged to take the meat to the house of the Nger Kikelang family, for they were the family of the god of Airai (Medechiibelaw). Only this god required such an offering and the practice has been abandoned for many years (Anonymous, 1961).

Kramer (1929) reported that the employment of hawksbill shell in various ways constituted "a regular industry such as can be found in no other oceanic group." Among the implements and adornments made from it were fish hooks, combs, spoons, bracelets, armllets, rings, ladles, cups, dishes, ornamental daggers and lime container stoppers (Semper, 1873; Kramer, 1929; Force, 1976). According to Force (1976), an object made of turtle shell was appreciated for its size, the beauty and thickness of the shell, the quality of the artisan's skill in producing the object and for its age. To form these objects the shell was immersed in hot water and then molded with carved wooden forms (Kubary, 1895). Early visitors to Palau remarked on the beauty of some of these objects and one even questioned whether they could really be of local manufacture (Dumont d'Urville, 1843).

According to Force (1976), "today toluk are rarely made. In the 1950s only a few men continued to work in turtle shell. By 1971 only two men were acknowledged artisans and most of their work consisted of making bracelets and earrings for sale to visiting tourists. Toluk, themselves, are considered rare." Similarly, I saw little evidence of Palauans making turtle shell objects for their own use in the mid-1970s. Individual scutes were sometimes inscribed with drawings and sold to Japanese tourists, but my impression was that the volume sold was minor. Force (1976) attributes the reduction in turtle shell use in part to the introduction of conservation measures.

During the mid-1800s, Palau turtle shell possessed a high foreign trade value owing to the activities of such dealers as Andrew Cheyne.

It has been stated that in Palau, "there never seems to have been any particular class or group of individuals to whom the catching or killing of turtles was restricted. Any man was able to hunt these animals" (Anonymous, 1961). The same writer states also that no restrictions were placed on the collection of turtle eggs. These statements are not consistent with other information. I suspect that the

anonymous author's Palauan informants were simply unaware of traditional prohibitions (see below) that were apparently practiced in restricted areas of Palau or that have fallen into disuse.

Kramer's (1929) description of the taboo on eating hawksbills has already been mentioned. Kubary (1895) states that turtles were difficult to catch and expensive to purchase, and that not all Palauans were allowed to catch them. According to Palauans I interviewed, the god of the small island of Ngerur, north of Babeldaub, owned the island's turtles. Consequently no turtle could be caught while on the island (green turtles nest there) and no turtle eggs could be dug. I do not know if this taboo is still in effect. Palauans also told me that in certain areas people were not supposed to kill a turtle until it had laid several batches of eggs. It was also reportedly the law in certain parts of Palau to leave some of the eggs to hatch when a nest was dug up.

In the mid-1970s hawksbill turtles could be seen on almost every dive in many areas of Palau Lagoon, and juvenile green turtles were not uncommon, especially along the outer reef slope. Nevertheless, older Palauan fishermen seemed unanimous in their opinion that turtles were far less abundant than they had been 10-20 years before, with a decrease in the numbers of large green turtles being especially noticeable.

According to a Palauan conservation officer, taking of eggs by Palauans decreased in the 1960s after a turtle hatchery was set up and efforts made to educate Palauans concerning the need for turtle conservation (Helfman, 1968). The hatchery has since been discontinued, along with relevant education programs. Eggs are reportedly heavily exploited. Pritchard (1982) states that 80% of the eggs laid in Palau are harvested. He does not indicate the source of his data.

One old, conservation-conscious chief told me in 1974 that whereas his authority to enforce Palau's traditional laws was acknowledged by his people, his attempts to make them obey government conservation laws was not always heeded. As an example, he told me of chiding a young fisherman for bringing in an undersized turtle, only to be told that this was none of his concern. I am uncertain as to whether any traditional Palauan customs that contribute to turtle conservation are still practiced today.

A few fishermen in Palau respect government laws concerning harvesting of turtles and eggs. Many do not. Some, especially younger fishermen, are not even aware of these laws.

As with most other islands in Micronesia, it is not possible to gauge current harvest rates nor estimate the

degree to which turtles are threatened by overharvesting. During a total of about 14 months in the Palau archipelago I gained the impression that while turtle meat and eggs were relished, they were nowhere an important item in the diet.

The South West Islands

The South West Islands lie within the Palau District but are inhabited by people whose culture and language is quite distinct from that of Palau. Three of these islands, Tobi, Sonsorol, and Pulo Anna are continually inhabited. Two others, Merir and Helen Reef are sporadically inhabited by a few individuals. Linguistically and culturally the inhabitants of the South West Islands are related to the people of Fais and Ulithi, two islands in the Yap district about 1500 miles to the east. The South West Islands are very small, the largest having an area of only about one quarter of a square mile.

Some nesting of green turtles occurs on Tobi, Sonsorol, and Pulo Anna but the main rookeries for green turtles in the Palau district are at Helen Reef and Merir. These have been described as the most important rookeries for green turtles anywhere in the Pacific under U.S. jurisdiction (Pritchard, 1982). The nesting season extends from April to October according to South West Island fishermen, with clutch sizes decreasing as the season progresses.

Hawksbill turtle shell was extremely important traditionally as the main source of material for the manufacture of fish hooks. Line fishing played a very important part of the acquisition of animal protein in the islands. The land area was too small to support significant terrestrial sources and the reefs too small to support much net fishing (Johannes, 1981).

Because the traditional manufacture of turtle shell hooks was very time consuming, they were treated with great care. If a grouper ran into a hole in the reef with a hook, the line was not broken off and the hook sacrificed as metal hooks are today. Instead a steady tension was kept on the line until the grouper finally emerged - sometimes as much as an hour later. If a hook got snagged on a coral, a rock was attached to a second line, hooked on the fishing line, and slid down it. A little slack was let out in the fishing line so that the rock weight would pull on the hook from below, thereby sometimes unsnagging it in situations where an upward pull was of no avail (Johannes, 1981).

According to Black (1977) there has been an "abandonment of many onerous prohibitions associated with pre-Christian fishing." He does not state whether any of these relate to the taking of turtles, but, judging by the situation in other parts of Micronesia, some of them probably do.

Although turtles have never been abundant around Tobi within living memory (see also Holden, 1836) their numbers seem to have decreased even further in recent years according to Tobians. About ten years ago it was decided at a meeting that turtle eggs (a great delicacy) would no longer be eaten, so that there would be more turtles to eat in the future. Anyone who violated the new law would be fined.

A person finding a nest reported it to the island magistrate, who immediately fenced the site to keep the hatchlings safe from cats. When the eggs hatched the hatchlings were gathered up and kept in a large bucket where they were fed finely chopped fish. When they were judged big enough to have a good chance of surviving they were ferried by canoe out to the open sea and released. (The extent to which turtles depend on their trip across the beach and reef in order to "imprint" on the birthplace and find it again at egg laying time is unknown.) If this trip is an important part of the imprinting process then these efforts at conserving turtles may be counter-productive.

Unfortunately, a new crop of teenage boys not in on the original decision began eating all the eggs they could find a few years later. The current state of egg conservation efforts on Tobi is unknown. A similar conservation measure was introduced at about the same time on Sonsorol (Johannes and Black, 1981).

Traditionally, South West Islanders sailed periodically to Helen Reef to obtain turtles and giant clams. Today this does not occur. The population of the South West Islands is an order of magnitude lower than it was eighty years ago (Eilers, 1936) because of emigration to Palau. Pressure put by these islanders on their turtle resources is thus probably reduced over earlier levels. However, Helen Reef was the subject of considerable depredation by Taiwanese trawlers in the 1970s. In addition, a small number of Palauans habitually harvested turtles illegally during visits of the government supply vessel to Helen Reef. South West Islanders resented these intrusions - illegal according to both traditional and modern laws - but could not stop them; the Palau government ignored complaints concerning these activities.

YAP DISTRICT

The Yap District consists of the main Yap Islands plus a number of outlying islands and atolls. The latter include the islands of Satawal, Fais, and Gaferut and the atolls of West Fayu, Elato, Olimarao, Faraulep, Ifaluk, Woleai, Eauripik, Sorol, Lamotrek, Ulithi, and Ngulu.

Yap

Turtles do not seem to be very abundant around Yap itself. (But, as will be discussed below, turtles nest on a number of outlying islands and play important roles in outer island cultures.) Traditionally in Yap, certain high ranking estates (tabinaw) had the right to turtles caught on certain fishing grounds (Anonymous, 1961). Certain individuals or groups might possess exclusive rights to particular fishing methods or particular species within the boundaries of fishing grounds owned by others. Thus, a fisherman finding a turtle in his fish weir would be obligated to present it to the owner of sea turtles in the area. By 1961 this requirement was no longer rigidly observed, but violations were nevertheless not openly displayed (Anonymous, 1961).

According to Muller (1917) turtles caught in Yap waters had to be taken to certain specified localities from which they were distributed by authorities. The chiefs, he says, got the breast of the turtle. "The capturer may do any kind of work; the killer must refrain from noise for three days."

In Yap it was believed that burning of the shell of the hawksbill turtle causes leprosy. The Yapese word for hawksbill and leprosy is the same - darau.

Anonymous (1961) states, "There seems to be no apparent design on the part of the Yapese to conserve turtles. Instead, the intent is that they should capture as many as possible and collect their eggs as well.....Most turtles are captured ashore during the breeding and laying season but the number captured each year by this method is not excessive."

Yap Outer Islands

McCoy (1974, 1982) has provided for the outer Yap Islands, especially Satawal, the best summary of information concerning traditional use of turtles that is available for any island group covered in the present review. (Nevertheless, even this account falls short of being comprehensive or adequate for management purposes.)

Turtle Catching and Harvesting of Eggs

For many years the people of Satawal have sailed to the uninhabited atoll of West Fayu, 47 miles away, to exploit the resources there. All fish and turtles taken there are recognized as the property of all Satawalese but are placed at the disposal of the chiefs for distribution.

McCoy (1974) described the star calendar used by the Satawalese to determine mating and nesting seasons and thus to

determine the appropriate times for trips to West Fayu. The following is his account of the catching of green turtles there.

"If the island is reached at night, as is often the case, one of the younger members of the crew immediately jumps off in shallow water and proceeds to walk around the island looking for nesting turtles or signs of nesting. If one is spotted on the beach, it is flipped over immediately. This sets the tone for the remainder of the stay, as each night various men are delegated the task of watching for nesting turtles as well as those that might be swimming in the shallows near the island.

"During the day, a close watch is kept for mating turtles within the lagoon. If mature turtles are spotted a canoe races to the position. The men affix large hooks to strong lines and then place the hook in a notch in the end of a piece of bamboo or stick approximately six feet long. The ends of the lines are then tied to a large boom carried on the canoe or, if the line is not long enough, tied to the canoe itself. Two men are given the responsibility of silently swimming up behind the mating turtles with the hooks. They then swim under the mating turtles, each man hooking one with the hook in the bamboo into the skin on the turtle's neck. A sharp watch must be kept for sharks which occasionally cruise around mating turtles and take nips off their flippers. For the most part, mating turtles are oblivious to what is taking place around them. The swimmers are usually successful in their attempts. Once hooked, the turtles immediately sound and a tug-of-war ensues, with the turtle usually losing in the end. Oftentimes the necessary hooks, lines or other paraphernalia for this type of capture are not available. This happens most often when canoes which are on fishing voyages sight mating turtles. In this case, the men still swim up to the unsuspecting turtles, grabbing them in a "full nelson" hold from the underside. The man's hands are then placed under the chin of the turtle and forces its head back, minimizing the chance of being bitten. Other men then jump off the canoes with whatever ropes are available and attempt to tie the front flippers in a manner which will allow them to drag the turtle on board. This is a much more dangerous and less successful operation than the hook and bamboo pole method.

"During moonlit nights on West Fayu, it is also possible to tether a previously captured female to a tree, and allow her to swim in the shallows around the island. Men then climb into trees near the water's edge and wait for her to attract mates. This method, known as efitefit, is more successful on an island like Pikelot where there is no lagoon, but is practiced elsewhere as well.

"Although the methods described are obviously not the best ways of capturing turtles from a conservationist's point

of view, it must be remembered that the people here are procuring food for themselves and their families in a never-ending struggle against a sometimes hostile environment. It should also be noted that the people of Satawal are concerned directly with their own survival and means of procuring food are ultimately justified in their eyes by the immediate results produced."

McCoy (1974) states, "Unlike the islands of Lamotrek, Woleai, and others to the West, the people of Satawal have retained much of their canoe building and navigating skill. Much of this is due directly to the need to journey to West Fayu for turtles. In the islands to the west, where lagoons offer larger amounts of sea fauna and the opportunity to utilize motorboats, much of this traditional knowledge has been discarded. In many ways, this can be seen to have a direct effect on the harvesting of turtles.

"For example, the uses of motorboats in Lamotrek and Elato have meant that turtles are more vulnerable during all seasons in which they are present. Periodic times of calm weather prevail during the summer months which prohibit the people of Satawal from voyaging to West Fayu. During these periods, motorboats may be effectively used on Lamotrek and Elato for the purposes of hunting turtles. During one period on Lamotrek in 1972, motorboats journeyed to the various islands in the lagoon and Namoniur, capturing ten to twenty turtles on different occasions and returning them to Lamotrek. For the same number to be harvested on West Fayu by the people of Satawal would mean a major expedition by a flotilla of canoes which might be gone from the island for a week to a month."

The introduction of motorboats to the island had occurred only within the five years prior to McCoy's (1974) paper. This, he states, "has meant greatly increased pressure on the turtle populations in all of the areas visited by inhabitants of the central Carolines, with the possible exception of Gaferut."

Occasionally the Satawalese visit the islands of Olimarao and Elato and obtain turtles there. To do so permission has to be sought from the chiefs of Elato or Lamotrek.

The Satawalese are also familiar with turtle nesting on East Fayu in the Truk district. The islands with which the Satawalese are familiar stretch almost 400 miles roughly in an East-West chain. These islanders say that nesting occurs first on the islands to the east and then proceeds westward in sequence (McCoy, 1974).

McCoy (1974) describes an unusual feature of Gaferut Island and its influence on turtle-catching there: a reef

extension to the northwest side of the island "contains a large, deep hole big enough to accommodate many large turtles. The turtles often stay in this natural hole during the day or days preceding their nesting. A standard method of capture on Gaferut is to silently sneak up on this depression in the reef and capture the turtles resting there."

Customs and Utilization

According to McCoy (1974) the taking of turtle eggs was not covered by taboos, and the exploitation of the resource has continued unchecked in almost all islands in the Central Carolines. Local inhabitants believe that the sea has been and always will be an adequate provider for all things. "In my great concern over the taking of eggs or, when concern was expressed, it was always by a bird-in-the-hand philosophy."

Hijikata (1941) stated that on Satawal Island the hawksbill turtle was treated like a god and could not be caught or eaten. If someone killed or touched one, he was completely isolated from other people for two months. He built a hut by the shore and lived there in isolation. His food was prepared for him by members of his family and brought to him on the beach. (I have been told by islanders that a similar attitude toward the hawksbill prevailed at Ifaluk Atoll.) There are no legends or myths about the hawksbill turtle nor any rites or ceremonies connected with it, just "an unreasoning fear and strict taboo," (Hijikata, 1941).

Nevertheless, the shell was needed for many essential items such as fish hooks and combs according to McCoy (1974), who states, "all shell thus utilized was procured from other islands, principally Puluwat and islands to the east. Occasionally people from other islands would harvest hawksbill on Satawal for shell utilization. In such cases, they were required to build a small house on the beach away from the other houses of the island and to carry on their operations out of sight of the local inhabitants. Today on Satawal this taboo is no longer observed and the turtle is captured for utilization whenever sighted. As in the case of Ifaluk, many people on Satawal refuse to eat the meat, giving various excuses for doing so. This is another example of the "buffer" created by the Carolinians to protect their environment and the creatures within it. Hawksbills today are extremely rare throughout the area and Satawal is no exception. During the year 1972 only two were taken near the island, with only two more sighted at different periods. Those taken were consumed, with the carapace used to barter with passing ships." The "almost complete disappearance of hawksbills from the waters around Satawal since the pre-war taboos were lifted has not deterred islanders from attempting to capture those few that were sighted," (McCoy, 1974).

At the time of Hijikata's study in the late 1930s the green turtle could be caught and eaten on Satawal providing certain taboos were not infringed. Green turtles were not commonly found near the island but occasionally one was taken. If the eggs were found on the beach, islanders examined them and, from their condition, determined when the turtle would next come ashore to lay again (see Palau section for details of method). They then kept watch for it, either turning it over when it came ashore, or grabbing it or tying a rope to a flipper if caught in the water. A turtle that was caught in such a way could be eaten but certain taboos applied. In general, only old persons, children, or sick people could eat such a turtle. At the time Hijikata (1941) made his observations no hooks or other method that shed blood could be used to capture the turtle. This restriction is no longer in effect (McCoy, personal communication).

Persons who even touched green turtles which were caught at the island were confined for a specified period of time to the village and the seashore. Pots, knives, baskets and dishes which had touched the turtle were also taboo and had to be placed where people would not come in contact with them.

Green turtles caught at other islands were not subject to these taboos as long as they were brought back to Satawal alive. According to Hijikata (1941), even when turtles were caught away from Satawal, the fishermen "must not shed blood into the sea. When they sight a turtle, five or six men leave the canoes and swim after it. Two or three of the strongest and most adept go ahead and catch it with their bare hands, and the others follow towing a log about six feet long with a stout rope attached to it. They approach the turtle quietly, catch hold of it, and tie the rope to it and bring it back to the canoe. Turtles collected by this method, which may be as many as five or ten, are kept on their back alive until the day before the party is to return to Satawal." Then they were butchered and divided into large sections which are cooked on heated stones, then returned to Satawal.

The green turtle was taboo to pregnant women and those who had recently given birth. Women were not permitted to eat it until two or three years after bearing a child, and babies not until they were able to walk. Although this taboo still persisted in theory in the 1930s (Hijikata, 1941) it had by then become possible to be released individually from it by means of a ritual performed by a priest. Since most women followed this practice, the taboo was no longer really effective. If a mother had this rite performed while pregnant it automatically released her child from the taboo.

According to Hijikata (1941), "when the people go, as noted earlier, to the uninhabited islands of Pik (Pikelot) and Pugolo (West Fayu) to catch green turtle, a prayer is offered up to the god of the island. When I accompanied them to

Puholo Island, as soon as they arrived and got the mats and food ashore, the captains of the two canoes, each carrying one coconut, went off to the place of the island god to pray that there would be turtles.

"The god of the island is called Waim. Formerly rang (turmeric) was brought and smeared on a large moele tree at his place. It may be that this was a sacred tree which was the master of this island. The god Waim probably dwelt in the tree. Nowadays they take only one coconut and hang it on a small tree in the vicinity or on a small pole and make their prayer. Until recently they would set up five or six poles in fronds of the moele tree and hang a small wreath made of the flowers of the moesor or lat tree on each one and then retire a short distance to sit and pray. Of course, in approaching this place they would bend their bodies low from a long distance off, and as they drew near to it they would end up practically crouching." McCoy's (1974) description of turtle catching by the Satawalese on West Fayu implies that these rituals were subsequently abandoned.

All fishes and turtles at Pikelot and West Fayu are the traditional property of the Satawalese. However, although Pikelot is part of Yap District, it is exploited primarily by the people from Truk District. Whenever canoes from Truk District islands sail to the Satawal they invariably stop first at Pikelot, winds permitting, and bring turtles to Satawal.

According to McCoy (1974), "there are two Carolinian clans (of the eight represented on Satawal) which have turtles as their totems. The members of these clans, and their spouses had to observe taboos in addition to the island-wide taboos. One of these decreed that any pregnant woman or her spouse from either of these two clans (Sowen and Katamang) could not eat turtle." Catholic missionaries brought about the abandonment of these and many other traditional practices.

McCoy (1974), further states, "While on an island, the crews of the canoes usually feast on turtles if they are plentiful. In the case of captured mating turtles, the males are usually eaten on West Fayu, with the larger females saved for transport to Satawal. Turtles caught in the waters around the island are returned there alive and rested upside down on their carapace until such time as they are eaten or prepared for transport to Satawal. For the purpose of cooking, they are simply dragged to the beach and placed in a shallow pit. A small incision is made just in front of the left rear flipper and the small intestine and colon are pulled from the turtle and cleaned. The intestine is then cut into pieces and roasted on sticks over the fire. Usually the flippers are cut off before this operation to minimize the chances of injury to people preparing the turtle. Sometimes, however, a blow to the head renders the turtle unconscious and makes this

operation unnecessary. The incision is then plugged with a handful of leaves and a fire is built on the plastron of the turtle. After cooking for 25 to 45 minutes, the plastron is ripped off and the turtle is then systematically butchered and the meat divided. All the meat and internal organs are eventually consumed and there is very little waste.

"If the turtles are to be transported to Satawal, they are left in the shade of the trees of West Fayu and can last ten days to two weeks without any ill effect. On the day that the canoes are being prepared for the return voyage, the turtles are dragged down to the beach and their flippers are securely tied together over the plastron. They are then hoisted onto the canoes and placed under mats or under the large seats of the canoes for the return trip to Satawal. Once on Satawal, they are placed under the authority of the chiefs, who ultimately decides how many and on what day they are to be consumed.

"During 1972, a total of 42 turtles was captured, 3 males and 39 females. Of these, 16 were consumed on West Fayu, 10 were partially consumed, and partially salted and returned to Satawal. The remainder were returned live to Satawal."

Turtles at Ulithi Atoll belong to some of the high lineages residing on the island of Mogmog. The chief turtle grounds are around the islands of Yorr and Gillab which are controlled by the chiefs of Falalop. Neither turtles nor their eggs may be taken from these islands without the consent of the Falalop chiefs. Turtles caught in the atoll are taken to these chiefs. They are killed and distributed with the head and intestines reserved for the atoll chief. Changes have taken place in their method of distribution to what is now believed to be more equitable although Mogmog still seemed to be getting the lion's share in the late 1950s. Turtle eggs need not be presented to the Mogmog chiefs (Anonymous, 1961).

The following incident indicates the rigor with which traditional taboos have sometimes been enforced, even in recent times. In 1974 a Mogmog chief discovered the remains of a butchered turtle on the beach frequented by the people of Falalop. The Mogmog chiefs angrily issued an edict, "No one on Falalop may touch the sea water for three weeks; do not use the sea for cooking; do not catch any fish or anything from the sea; do not use the sea for 'benjo' (toilet); do not swim into the sea; do not use, travel on or under the sea within or outside the lagoon in the vicinity of Ulithi atoll; there is nothing in the sea which you can eat."

Failure to obey the order could have resulted in the destruction of personal possessions including crops and houses. Sixty traditional lava lavas (traditional skirts woven from vegetable fibers) were demanded in atonement and subsequently presented, along with abject apologies, to the

offended Mogmog chiefs. The proscription on any use of the sea applied even to U.S. government employees on the atoll, Peace Corps personnel, and a Jesuit missionary. Other government officials were warned by radio to stay away for the duration of the atonement. Never are U.S. or the Trust Territory conservation authorities accorded such obeisance!

Graduation ceremonies at the Outer Islands High School at Ulithi have involved the consumption of 30 or more turtles each year in the early 1970s, according to McCoy (1974).

On Ifaluk Atoll, inhabitants until recently considered turtles as food for the chiefs only (Burrows and Spiro, 1953; McCoy, 1974). After their conversion to Christianity and renunciation of traditional taboos, many of the Ifaluk people still refused to eat turtle meat (McCoy, 1974).

Gaferut is said to be a favorite place for turtles, but Faraulep Islanders who own this uninhabited island ceased going there in 1950 when canoes traveling to Gaferut were caught in a storm and 12 lives were lost including that of the chief (Anonymous, 1961). The island is sometimes visited by the Trust Territory field trip vessel and occasionally passengers from Faraulep, Ifaluk, and Woleai take turtles to be carried to their home islands. Ten to twelve turtles were taken in this manner on one evening in 1971, according to McCoy (1974). To a lesser extent Gaferut is also used by the people of Woleai and Ifaluk (McCoy, 1974).

Alkire (1965) states that turtles were roasted alive on Lamotrek Atoll after the flippers were cut off.

The people of Ngulu Atoll had to bring items of tribute, including turtle shell, when visiting Yap (Muller, 1917).

Baby turtles are occasionally kept as pets on various islands, sometimes being released, sometimes being slaughtered after reaching a certain size (e.g. Anonymous, 1961; McCoy, 1974).

Truk District

Truk District in the central Caroline Islands consists of Truk itself - a large almost-atoll with six fairly large high islands and many small ones - plus ten outlying atolls and four outlying islands.

Hawksbills nest on a number of islands in Truk Lagoon and on uninhabited islands in the lower Mortlock Islands. Green turtles, although present in Truk Lagoon, are not known to nest there (Pritchard, 1982).

The Trukese once used sennet nets, about 200 feet long and 10-20 feet wide, to catch turtles. On high nighttime tides the net would be tied to poles and suspended in the

water. When a turtle was sighted the net would be drawn around it and closed (Bollig, 1927; Anonymous, 1961). According to Bollig (1927), "charms (safei) are attached at particular places on the net in order to make the turtles go in the net there. The first turtle that is caught with a new net is the property of the one who made it." This method is no longer in use (Anonymous, 1961).

Le Bar (1964) states that inhabitants of Romonum Island, Truk, would visit the nearby islet of Fenesiic and look for tracks of nesting turtles. If some were seen, the islanders would camp and stand watch for up to a week, anticipating the return of the nesting turtles around the time of the new moon. Also during new moon periods, Trukese speared turtles attracted to coconut torches at night. This technique was apparently learned from the Japanese (Le Bar, 1964). Captured turtles were killed by first cutting a hole in the outer flesh at the point between one of the rear flippers and the ventral shell. The entrails were removed through this hole (Le Bar, 1964).

An illogical method, but one found in use with minor variations here and there in Oceania, was used to predict when a turtle would return to the beach to nest. When a nest was found, the eggs were counted. The number of eggs over one hundred was believed to indicate the number of days after which the turtle could be expected to return to nest again (Anonymous, 1961). Divination and prophetic knot-tying was also used to determine the nights on which turtles would appear (Le Bar, 1964).

The Trukese made fish hooks and various ornaments, including pendants, women's belts and armbands, from turtle shell. Le Bar (1964) describes the method of making an armband: First the horny plates were removed from the carapace by applying heat from a burning coconut spathe. The shell was stored in a cloth wrapping. "In order to work the shell it was first washed thoroughly in salt water and then again wrapped in cloth, together with the leaves of Fagraea sp. (poongas). Informants stated that these leaves, which had to be red in color, were used to bring out the mottling in the shell. A piece of about 1 1/2-inches wide and 9-inches long was cut from a plate using a shark's tooth lashed to the end of a short stick. The same instrument was used to scratch a series of parallel longitudinal lines on one side of this piece. Next, the piece was made pliable and soft for handling by boiling in a mixture of salt water and coconut milk. This was done in a (trochus) shell placed over a fire. Then the pliable piece was removed and bent in a circular shape with a slight overlap; a split stick was fitted across the overlap and the slit ends bound together, thus holding the piece in shape until it cooled." The Puluwatese were considered the best workers in turtle shell in the area (Le Bar, 1964).

Today, in Truk Lagoon, according to Pritchard (1982) a turtle can be obtained on demand within 24-hours by certain fishermen. Reportedly, hawksbills are killed for the use of their shell, which is sold in souvenir shops, although Pritchard did not see any for sale during his visit.

Turtle nesting has not been reported in the Western Islands of Truk District, all of which are inhabited (Pritchard, 1982).

Le Bar (1964) reports that the Trukese consumed turtle blood baked and eaten with breadfruit.

Fuchs (no date, but probably written in the early 1970s) states that turtle populations in Truk Lagoon were reportedly lower than in the past, and that this was probably due to overharvesting of eggs and adults. Conservation regulations regarding turtles, he states, were generally ignored. In contrast, Pritchard (1982) cites an informant as stating that the frequency of nesting in this area has not diminished in the past 50 years.

There were reportedly no special regulations or taboos restricting harvest rights to any particular individuals in Truk District (Anonymous, 1961). This assertion may be questioned in view of the dearth of information that is available on the use of turtles in the district. Hall and Pelzer (1946) stated that chiefs could place a restriction on fishing in observance of a death or "because of depletion due to overfishing" Bollig (1927) states that copulating turtles could not be caught for fear that sudden death would ensue.

Traditionally, the head of a captured turtle, certain strips from the belly, and the sexual organs were offered to one's own chief or the most important person on whose island or reef the turtle was captured. This custom is no longer observed (Anonymous, 1961).

Young turtles were often kept in wooden bowls for the amusement of children (Bollig, 1927).

The uninhabited island of Pikelot in eastern Yap District is visited primarily by canoes from the islands of Puluwat, Tamatam, Pulap, and Pulusap in western Truk District in order to obtain turtles. The island is also visited by the Satawalese, the traditional owners (McCoy, 1982). Turtles are reported to be diminishing at Pikelot (Pritchard, 1982).

East Fayu is a tiny island but an important one for green turtle nesting. The traditional rights to these turtles belong to the people of nearby Nomwin Atoll (Pritchard, 1982).

Pritchard (1982) lists other minor nesting areas in Truk District.

Ponape District (including Kosrae)

Ponape District, in the eastern Caroline Islands, contains the high island of Ponape, its many satellite islands, and eight atolls. Until recently it also included the high island of Kosrae (previously known as Kusaie), the easternmost island in the Caroline Islands. Kosrae now has separate political status but will be discussed for convenience in this section of the report. Two of the outlying atolls in the District, Nukuoro and Kapingimarangi, are inhabited by Polynesians, the only ethnically distinct groups of traditional inhabitants of the Caroline Islands.

Ponape is a volcanic dome surrounded by about 25 islands of both coral and volcanic origin in a lagoon bordered by a barrier reef containing many passes. According to Pritchard (1982) populations of sea turtles around Ponape appear to be relatively small and very little nesting, if any, occurs. Gawel (personal communications) cites observations of some nesting activity, but the species has not been identified.

The following account of turtle harvesting on Ponape is extracted from Anonymous (1961). On outgoing tides during the windy season convergence zones create long lines of seaweed floating on the sea surface outside the reef. Turtles tend to feed on these detached macrophytes. Knowing this, Ponapeans would patrol these strips in their canoes. When a turtle was sighted someone would tie a rope around his waist, jump on the turtle and transfer the rope to a hind flipper so that the turtle could be boated by one of the other men.

During the calm season, turtles were also captured inside the reef by jumping on them and stunning them (the implement used is not mentioned).

Certain marked areas of reef were baited with a type of seaweed believed to be attractive to green turtles. The fisherman would wait near the bait spot in order to spear any turtle that came to feed.

Sometimes several canoes would set out and lay a large net in the water in areas frequented by turtles. When a turtle was seen, the net was maneuvered so as to block their escape. Stones were then thrown to frighten the animal into the net.

When copulating turtles were sighted, the male was captured but the female was left in the water with one flipper tied by a length of rope to a floating log. Any other male that subsequently engaged in copulation with the tethered female was also taken. Probably the most common hunting technique traditionally used in Ponape was simply to catch turtles when nesting.

Gawel (personal communication) states that Ponapeans today are generally familiar with laws protecting turtles but generally ignore them.

According to Anonymous (1961) "The actual capture of certain kinds of turtles or the collection of their eggs has never been regarded as the special prerogative of certain individuals but the use of the meat was quite rigidly specified. This was a favorite food to offer to Nanmwarki (highest ranking individuals on the island). The Nanmwarki and other high-ranking individuals had the right to confiscate a turtle or its eggs from a fisherman who had failed to offer them to the Nanmwarki. The high-ranking people had certain property rights to turtle meat and eggs. Punishments were meted out to individuals who failed to offer the meat or eggs to appropriate high-ranking persons, especially the Nanmwarki. A person neglecting this traditional custom might be exiled from his land, have his house burned, be forced to make prolonged atonement feasts to the Nanmwarki or even be killed.

Anonymous (1961) states that in the old days there were several cases of raising turtles in captivity, but the meat of such turtles was not valued highly. During Japanese times, several individuals raised turtles under government sponsorship and special pens were constructed for the purpose. On Mokil Atoll such pens were still kept for this purpose in the late 1950s. I do not know if this still holds today.

Ornaments, containers, and tools were made from turtle shell according to Anonymous (1961). This assertion undoubtedly refers to the shell of the hawksbill since green turtle shell is too thin to be of use in this connection.

"Apparently the only turtle rookery of importance in Ponape District is Oroluk Atoll," (Pritchard, 1982). Once uninhabited, it has been occupied by 10-20 people from Kapingimarangi since the late 1960s. The consequences, states McCoy (1982), have been startling: "The inhabitants have built a stone holding pen, and captured turtles are placed within the pens to await the government field trip ship which calls about six times per year. Until recently turtles were loaded aboard the field trip vessel for return to Ponape, where they were either sold or eaten in Polynesian villages there. The enforcement of the U.S. Endangered Species Act has put a stop to commercialization." In 1975 the inhabitants of Oroluk reported that the numbers of turtles nesting the past two years had dropped considerably. This may have been due to human disturbances, especially the use of campfires and display of lights on the island at night (Pritchard, 1982).

According to Niering (1963) turtles had once been an important source of food on Kapingimarangi but had more recently become rare in the area.

There seems to be no published information on traditional fishing on Kosrae. According to Gawel (personal communication), any traditional marine conservation measures that may have existed there are no longer in evidence. Foko Pe Beach is the only regular nesting site today on Kosrae. Although remote from settlements it is regularly checked by turtle hunters. Turtles are also occasionally speared, harpooned, or grabbed in shallow water. According to Gawel (personal communication) the present numbers of turtles in Kosrae are too low to allow any commercial harvesting, and "even permission of subsistence catches should be questioned."

Marshall Islands District

Unlike the other districts covered in this report, where high volcanic islands are common, the Marshall Islands consist entirely of low coral islands, most of which are the constituents of atolls. Twenty-nine atolls and four isolated islands are found within the area. The atolls are aligned roughly in two parallel rows, the northeastern Ratak Chain and the southwestern Ralik Chain.

Pritchard (1982) provides a useful description of the distribution of nesting beaches in the district. Nesting of green turtles is concentrated in uninhabited islands, but limited nesting is widespread on the more remote and uninhabited islets of larger inhabited atolls. Pritchard (1982) states that Bikar Atoll has the largest nesting population, probably followed by Bikini and Taongi Atolls. Ebon was reportedly the best spot for catching turtles in the water.

A number of the more northerly atolls in the Ratak Chain have been used traditionally as game reserves by the Marshallese. Periodically, turtles were harvested there, with the chief "opening the season" on the first visit of the year (Anonymous, 1961).

Tobin (1952) described the elaborate ritual attending this event on the isolated island of Jemo. Divine sanction was requested before the landing party began its search for eggs. This entailed carrying a coconut leaf and walking single file behind the chief, stepping in his footprints, as the landing party walked towards a sacred tree in silence. Women had to hold mats over their heads. Upon reaching the tree each man placed his coconut leaf on a leaf branch, sat down and waited for a breeze to blow the leaf off.

Once this condition had been satisfied, the party progressed to a special place where a small rare plant grew. Three yellow and three green leaves from the plant were pounded together and the extracted juice drunk by all. This was to prevent anal bleeding and diarrhea, which might result

from the unaccustomed meal of turtle and birds' eggs that was anticipated. Turtle eggs were then gathered independently.

Before eating, everyone reassembled before the sacred tree where the chief or his representative uttered a special chant. As the four cardinal directions were named in the chant, four eggs were thrown in each of these directions as an offering. The eggs were recovered and the chanter consumed all of them. The remaining eggs were then divided and eaten.

Another chant was used to obtain supernatural aid in attracting turtles ashore.

While on the reserve island sexual intercourse was forbidden, as was the use of normal Marshallese language.

After this initial trip was made by the chief or his representative, anyone could travel to these islands during the rest of the season.

Tobin (1952) states, "Rather than allow people to swarm all over the island, possibly frightening away nesting fowl and egg-laying turtles, the iroij (chiefs) and senior people led the way and the food gathering proceeded in an organized, methodical fashion."

Missionaries discouraged such customs. The sacred tree on Jemo Island was cut down for boat timber and by 1952, Tobin stated, "people gather turtle eggs and birds' eggs, etc., at any time of year and walk wherever they wish on Jemo. None of the taboos are observed as far as may be determined. This is true for the other bird islands as well. This religio-economic pattern clearly illustrates the close affinity of the aboriginal Marshallese relation to the ecology."

Tobin (1952) states that distribution of turtle flesh according to a specified traditional pattern is no longer followed.

On Enewetak Atoll green turtles are seen regularly but are not numerous (personal observations). Some nesting occurs there (Pritchard, 1982). The traditional Enewetak leaders decreed that only some of the turtles sighted were to be taken, so as not to overharvest. This custom was transferred to Ujelang Atoll when the Enewetakese were moved there by the U.S. military (Tobin, 1967).

According to Hiatt (1951) there was no regular turtle fishery on Arno Atoll. Green turtles were not common and are caught only occasionally and by chance. Hawksbills, he states, were even rarer than green turtles. Although occasional references to the use of turtle shell for ornaments in the Marshall Islands can be found (e.g. Kramer and Neverman, 1938) this reader gains the impression that hawksbill turtles were

not as frequently captured here as they have been in the Caroline Islands.

Erikub is an uninhabited atoll near the inhabited atoll of Wotje. The Wotje people, when they caught a female turtle on Erikub, would tether it in shallow water so that it would attract males. The males were captured when they mounted her (Pritchard, 1982). It should be mentioned here that this technique, used in various parts of Oceania, only works during the breeding season, which commences prior to the nesting season and extends into the early part of the nesting season.

Mariana Islands

The Mariana Islands, in the northwest corner of Micronesia, traditionally constituted a single cultural sphere. But today they are divided politically into the island of Guam, which constitutes a U.S. Territory, and the U.S.-affiliated Commonwealth of the Northern Mariana Islands. The latter include the inhabited islands of Saipan, Tinian, Rota, Alamagan, Pagan, and Agrihan, and the uninhabited islands of Farallon de Medinilla, Anatahan, Sarigan, Guguan, Aquijan, Almagan, Asuncion, Maug, and Farallon de Pajaros.

Information on the Mariana Islands that is relevant to this review is scarce. This is due, at least in part, to the grim history of the islands. We know only the bare outlines of the traditional culture of the original Chamorro inhabitants because Spanish colonists reduced the population by more than 90% and shifted the remainder to Guam. They left few records of traditional Chamorro life. "Two hundred and thirty years of Spanish-Catholic rule transformed the Mariana Islanders so thoroughly that their Micronesian heritage was barely discernible," (Oliver, 1961). Saipan, now the capital of the Northern Marianas, was unoccupied for over a century after the removal of the Chamorros by the Spanish. Today no pure-blooded Chamorros remain in the Marianas Islands (Bowers, 1951).

De la Corte (1870) noted that among the valuable marine products that the Marianas did not produce, was "tortoise shell," although attempts had been made 40 years earlier to establish an export market for it. This may be the only surviving historical reference to sea turtles in the Marianas.

Both green and hawksbill turtles nest in the Marianas Islands, but apparently only sporadically and in small numbers (Pritchard, 1982). This may be due in part to the scarcity of suitable beaches in the northern Marianas (Pritchard, 1977) and to human activity along the coastline of Guam. Reports have been made of greater than usual nesting activity in Guam every third year (Molina, 1979). Large turtles were consistently seen in Guam waters during 12 aerial surveys in 1975 (Anonymous, 1975), but turtles seem to play a small role

in islanders' diets, at least during the past decade. No mention is made of sea turtles by Jennison-Nolan (1979) in her study of seafood exploitation in Guam. During 13 years on Guam, Jennison-Nolan (personal communication) recalls turtle meat being served at fiestas (very common events on Guam) only twice. Similarly Callaghan (1978) makes no mention of turtles in his study of seafood consumption on Guam. This is despite the fact that prior to 1979 there were no regulations controlling the taking of green turtles on Guam.

According to Pritchard (1977) "very few Guamanians are expert at spearing sea turtles, with the exception of a few old-timers, and nets are never used nowadays for catching turtles. To the average fisherman, capture of a turtle is looked upon as a fortunate bonus that may add greatly to the value of his catch. In former times, turtle blood was looked upon as a cure for a great variety of diseases, including asthma and tuberculosis." Hendrickson (ms, cited in Pritchard, 1982) states that turtle eggs were harvested in Guam more commonly before the second world war. His comments seem to imply that nesting was more widespread in those days.

A sizeable population of Carolinian immigrants live in the northern Marianas. Their fishing activities come closer to those of a traditional subsistence type, judging by my observations, than do those of the more commercially-oriented inhabitants of local origin. A significant number of fishermen I interviewed from both groups seemed unaware of existing marine conservation laws - especially the laws relating to the taking of turtles (Johannes, 1979).

AMERICAN SAMOA

American Samoa, in the Central South Pacific, consists of the inhabited high islands of Tutuila and Olosega, the smaller uninhabited high islands of Ofu and Tau, and uninhabited Rose Atoll. Remote, low-lying, Swains Island is inhabited by Tokelauan people but administered from American Samoa. The people of the two nearby islands of Western Samoa are of common cultural origin with American Samoans but politically separate. American Samoa is a dependency of the United States; Western Samoa is an independent nation with close ties to New Zealand.

Although traditional fishing in Samoa has been the subject of a number of valuable studies, little has been written specifically concerning turtles. Buck (1930) describes a Samoan turtle net used in the village of Ngataivai on Savai. It was employed in an area where there was no reef. Lookouts on the coastal cliffs would signal fishermen in canoes when a turtle was spotted. The net was dropped in a line parallel with the shore opposite the point indicated. The men then jumped overboard and formed lines from the ends of the net to the shore. They beat the surface of the water

with sticks as they gradually pulled the ends of the net together, enmeshing the turtle.

Buck (1930) states that the special monopoly exercised by the high chiefs of eastern Polynesia over turtles does not seem to have held in Samoa, although a traditional Samoan story suggests that a certain group of expert fishermen may have held such a privilege at one time.

Grattan (1948) states that the turtle was sacred in Samoa: "i'asa, the sacred or forbidden fish, which no fisherman may retain for his own private or family use without risking the grave displeasure of the local ranking chief and of the whole community; such an offender would be punished as custom provides either by heavy fine of foodstuffs such as pigs and taro, or even by banishment for a time from the village. Such i'asa, are the turtle (laumei), the shark (malie), and the ulua...

"When the personal catch includes any of the i'asa, these must be set aside and presented formally to the leading chief for distribution by the orators to the whole village as represented by each family. Where a title of a great chief has status in the whole of a district, any i'asa caught in that district should be taken and presented formally to him. He and his orators will probably then direct that fish be apportioned in such a manner as to make suitable acknowledgment to the village to which the successful ranking chief belongs.

"When a ranking chief is absent from his village or district, i'asa must still be presented to the village when caught rather than retained for personal use by the fishermen or his family. Frequently turtle or shark fishing is arranged as a village activity and the catch is divided up amongst all the families concerned.

"The major divisions in the cutting up are the head (ulu), the forequarters (sagamua), the hindquarters (sagamuli) and the rest of the carcass (sic) (tua) that remains. If it is not cooked before being presented, it will be cooked before it is divided and distributed. The important parts, the flippers ('apa' apa) from both the forequarters and hindquarters, are presented to the chiefs. The head is allotted to the taupou and the aualuma. The remaining parts of the forequarters and hindquarters together with the rest of the carcass (sic) are divided amongst the chiefs and orators. The juice (suapeau) that collects in the shell during cooking is highly prized, being dipped out and consumed by the chiefs and orators or divided amongst all the families of the village."

According to Finsch (1893), "the blue black fat on the inner side of the upper thigh, called vivi, is considered

especially tasty and has a flavor somewhat like that of veal or venison, but is much richer. It is, like a part of the intestines called medjinal, a favorite dish of the chiefs and always served to them."

A massive infusion of American funds in the past two decades has swamped the traditional culture in American Samoa. Among those things being lost in consequences are traditional elements of environmental control. The reefs are now heavily overfished. Only about 17% of the seafood consumed on Tutuila is locally caught; canned Japanese mackerel is a major import (Wass, 1982). Although U.S. federal law prohibits the taking of sea turtles and their eggs it is not effectively enforced (Wass, 1982). Wass (letter to George Balazs, December 10, 1981) estimates that the fishermen of Tutuila and Olosega (where the bulk of the population of American Samoa resides) take about 50 turtles per year. He states that fishermen on Tutuila believed that turtles had declined considerably in numbers in the past five years.

It is not known from how wide an area turtles which are seen in the waters of American Samoa originate, but nesting activity today in the Samoan Archipelago is not great. Only hawksbills nest in Western Samoa, and only at three beaches, two of them very small. Many of the beaches which were once used for nesting in Western Samoa are no longer used, probably owing to overharvesting of eggs and adults (Witzel and Banner, 1980). (Travis [1971] attributes a large part of the apparent decline in abundance of sea turtles in the area to harvesting by visiting European sailing ships.)

A hawksbill turtle hatchery was set up on 1971 in Western Samoa. By 1982 opinion was widespread among fishermen I interviewed on Upolu that the number of turtles in their waters was increasing. In 1982 the turtle hatchery was closed.

Except for scattered nesting by green turtles in the Manu'a group, the only green turtle rookery in the Samoan Archipelago is at Rose Atoll. One 19th century report suggested that "a great number of turtles" came to lay there (Graeffe, 1873). But recent observations suggest that the nesting population today may not be very large (e.g. Travis, 1979).

A series of interviews conducted by G. Balazs and W. Pedro in October 1982 suggested that there was generally little interest among Samoans on Tutuilla and Olosega Islands in catching and eating turtles. However, Balazs (personal communication) believes that there may still be some legitimate subsistence demand for sea turtles among the 50 or so residents of Swains Island.

HAWAII

The Hawaiian Islands stretch in an almost linear chain from 19° to 28° N. lat., a distance of 2,450 km, in the central north Pacific. The seven southernmost, large, high islands are all inhabited. From there, northward stretch a series of small volcanic and low coral islands, atolls and submerged reefs and banks.

Traditionally, Hawaiians were excellent, knowledgeable fishermen, and more has been probably written about traditional use of marine fauna in Hawaii than for any other area covered by this review. Surprisingly, however, comparatively little information has been recorded on traditional Hawaiian use of sea turtles. Nevertheless, the available information indicates that turtles were important in precontact Hawaii. The turtle, or "honu," figures in many Hawaiian chants and stories. Captain Cook observed their use as food by Hawaiians.

The difficulty of piecing together a useful description of the traditional use of sea turtles by Hawaiians is illustrated by the following: According to an Hawaiian historian writing in 1898 (Malo, 1951) eating green turtles was traditionally forbidden to women, who would be killed for breaking this taboo. Dagget, an American minister working in Hawaii, stated in contrast, in his introduction to King Kalakaua's "The Legends and Myths of Hawaii," published in 1888, that eating green turtle was forbidden to all but priests and chiefs. Two American ichthyologists who studied the fisheries and fishing laws of Hawaii also state that "squid, turtle, and two or three species of birds could be eaten only by the priests and taboo nobility," (Jordan and Evermann, 1902). They give no source for this information; possibly they obtained it from Kalakaua's book, published 14 years earlier.

In contrast to both of the above assertions, a contemporary Hawaiian scholar, Piianaia, is quoted in a popular magazine article as believing that turtle was not limited to the upper classes and was common food, and for both sexes (Markrich, 1983). He states that Daggett was an "outsider" writing about customs that had disappeared two generations earlier. "You will find," states Piianaia, "that there are structures like fishponds for the holding of turtles on all the islands, and that what they did was capture them and make them available when they were needed. Once a turtle was held for a chief, that was it; nobody else could eat it. But outside of that, anyone could catch turtle. I know of no edict, except perhaps for seasonal ones, that stopped people from taking turtles."

Piianaia acknowledged, however, that the biggest and best turtles were reserved for the chiefs. Waimanalo Pond, or Pahonu, which means "home of the turtle" was located about 14 miles from Honolulu and served as a source of turtles for Oahu royalty. In the late 1800s turtles from Pahonu were placed in sacks and carried on horseback at full gallop to Iolani Palace in Honolulu to be prepared for dinner (Markrich, 1983). According to one informant, the alii (chief) in this district "was so fond of turtle meat that any one in the district was required to bring any turtles they caught to him (Handy and Handy, 1972).

Turtles were the amakua or ancestor gods of certain families in Hawaii. These families were strictly forbidden to harm or eat turtle (e.g. Pukui, 1972).

The traditional Hawaiian kapu (taboo) system, which contributed to the conservation of marine animals in the islands, gradually eroded after western contact and little of it remained by the mid-1800s (e.g. Titcomb, 1972).

Malo (1931) and Stokes (1906) state that turtles were captured in Hawaii with nets made from bark fibers. The fibers were extracted by scraping the bark with the bevelled edges of a turtle's pleural bone. Turtles were also captured by hand and with spears or harpoons. Cobb (1905) describes a device consisting of two large hooks lashed to a stone attached to a long line. It was apparently used to hook turtles both from shore and by swimmers diving on turtles resting on the bottom and thus easily approached.

Hawksbill turtle shell was used only to a minor degree in Hawaii for making fishhooks, judging by archaeological evidence (Emory et al., 1968). It was also used for the disease called 'ea and for making combs and fans (Pukui and Elbert, 1971).

Recently in connection with efforts to repeal U.S. Federal laws forbidding the capture of turtles in Hawaii, the claim has been made publicly that turtles were traditionally employed to clean fishponds of unwanted algae. I have been unable to find any reference to this practice in review articles on Hawaiian fishponds (Summers, 1964; Cordover, 1970; Kikuchi, 1976) nor in articles referred to therein, nor in the literature pertaining to other island groups in Oceania.

Balazs (1980) states that judging by traditional legends and chants, Hawaiians were apparently not aware of the northwestern segment of the Hawaiian Archipelago, except for Nihoa, prior to European contact. Exploitation was, therefore, limited to the main, southern islands, although archaeological evidence suggests that small groups of Hawaiians (or other Polynesians) may have fished and perhaps hunted turtles around the islands of Nihoa and Necker.

Today 90% of the green turtles that nest in Hawaii do so at French Frigate Shoals north of the main populated islands (Dizon and Balazs, 1982). Only occasional nesting still takes place in the main inhabited islands. This is probably a legacy of generations of intensive exploitation in the inhabited islands, since there are many apparently suitable beaches for nesting there.

CONCLUSIONS

It is not difficult to rank the different Pacific island areas under U.S. jurisdiction on a scale of departure from traditional dependence upon the sea, including sea turtles. Hawaii is clearly the most westernized and least traditional, followed closely by Guam and American Samoa (with the possible exception of Swain Island). The Northern Marianas are not far behind, with little evidence of significant dependence upon sea turtles.

Only in the Caroline and Marshall Islands do sea turtles still play essential roles in the lives of significant numbers of people. And even here this dependence is far from universal. Sea turtles do not appear to be essential to either cultural or nutritional well-being on most high islands or district population centers. Even in the Palau Archipelago, where an impressive reservoir of expertise concerning sea turtles suggests their former importance, only a very few handicraft makers would suffer, I suspect, if turtles became unavailable today. Here, as around many high islands, turtles are now hunted more or less like deer, for sport. A turtle for the pot is now an occasional treat, not an essential ingredient in Palauan life.

It is mainly among some of the remoter low islands of Micronesia that sea turtles remain important. McCoy (1982) and Pritchard (1982) point out that turtles contribute significantly to the cultural stability of some of the peoples of the central Caroline Islands and to their independence of the outside world. "The estimated maximum contribution to the protein (intake), perhaps 40 pounds per person per year, is not nearly as important as the cultural role described," (McCoy, 1982).

The work of McCoy and others suggests that traditional taboos and ceremonies relating to the taking and consumption of turtles have almost certainly contributed to smaller numbers being taken than would otherwise have been the case. But these traditions are fading. Moreover, island population pressures in Micronesia are increasing rapidly. On Satawal, for example, the population has doubled since the end of World War II (McCoy, 1982). These factors, coupled with the introduction of technology which makes sea travel faster and easier, all put increasing pressure on turtle stocks. The need for measures to conserve them thus also increases.

Therein lies a dilemma. The people of those islands on which turtles play a vital cultural role would suffer if turtles were denied them. But there will eventually be no turtles left if harvest rates continue to accelerate. At what point does the survival of a turtle stock dictate the implementation of conservation measures that are painful to those who depend upon turtles? No amount of study, in

isolation, of subsistence use of turtles can answer this question. It requires, in addition, an understanding of sea turtle population dynamics more sophisticated than any that exists for any sea turtle stock in the world today.

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