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# TRADITIONAL MARINE CONSERVATION METHODS IN OCEANIA AND THEIR DEMISE

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*R. E. Johannes*

Hawaii Institute of Marine Biology, P.O. Box 1346, Kaneohe, HI 96744

Islanders perceive their limits more easily than do continental peoples.

Kenneth Brower (14)

## INTRODUCTION

Understanding a conservation system means understanding not only the nature of what is being conserved, but also the viewpoint of the conserver. Knowledge of this second element is essential if we are to comprehend a system of resource management employed by a people whose perception of their environment differs from our own. Watt (83) has said that a prudent civilization should take seriously the ideas of other civilizations about resource use. "Over the short term," he states, "the ideas of civilization A might appear vastly superior to those of civilization B. But over the long term it could turn out that the apparently 'primitive' practices of civilization B were based on millenia of trial and error and incorporated deep wisdom that was unintelligible to civilization A." The following is an account of the rise and decline of a millenia-old system of controlled exploitation of marine resources that incorporates a wisdom Westerners are only now beginning to appreciate after having brought about its widespread decay.

The inhabitants of Oceania [defined here as the islands of Polynesia (excluding New Zealand), Melanesia (excluding New Guinea), and Micronesia] traditionally obtained the bulk of their protein from the sea. They often had no alternative. Population densities commonly reached several hundred people per square mile and sometimes climbed to more than one thousand per square mile. On some islands the land (often consisting of calcareous soil with little humus) barely supplied their vegetable needs.

Terrestrial food supplies were not only limited, but also precarious. On many islands typhoons, droughts, and tsunamis periodically destroyed them. Warm, hu-

mid climates tended to discourage the long-term storage of coconuts, sweet potatoes, breadfruit, or taro as insurance against hard times. Some islanders had pigs, but even on larger islands with sufficient land to support considerable livestock, they were raised indifferently and often sufficed only for feasts or the enjoyment of royalty.

But the supply of seafood was relatively substantial and dependable. And what the islanders lacked as animal husbandrymen they compensated for as fishermen and students of marine life. Of Tahitians, for example, Ellis (30) said, "In no other part of the world, perhaps, are the inhabitants better fishermen." Ichthyologists Gosline & Brock (36) state, "It is probable that the Hawaiians of Captain James Cook's time knew more about the fishes of their islands than is known today."

The sea's produce was dependable but not unlimited. In some island groups extensive reef, mangrove, and seagrass communities produced more fish and shellfish than the population could use. But more often these islands—the tips of submerged mountains—plunged steeply into abyssal depths, and productive shallow waters were limited to a narrow band of coral reef. Offshore waters were not only hazardous much of the time but also far less productive than the waters extending from the island to the outer reef slope. And although those who lived on atolls had sheltered lagoons, these also were much less productive of food than the narrow strip of reef that encircled them (21, 43, 53).

Possessing a clearly limited fishery on which they depended for about 90% of their animal protein, these people viewed marine resources in a way different from that of continental peoples with abundant terrestrial food sources and wide continental shelves. Until recently, Westerners have looked upon the sea's supply of fish as virtually unlimited. T. H. Huxley, for example, once proclaimed, "I believe that probably all the great sea fisheries are inexhaustible; that is to say, nothing we do seriously affects the number of fish." In contrast, the natives of Oceania, knowing that their precious fisheries could easily be depleted, devised centuries ago a variety of measures designed to guard against this eventuality.

## REEF AND LAGOON TENURE

The most widespread single marine conservation measure employed in Oceania, and the most important, was reef and lagoon tenure. The system was simple: The right to fish in a particular area was controlled by a clan, chief, or family, who thus regulated the exploitation of their own marine resources. Fishing rights were maintained from the beach to the seaward edge of the outer reefs. In some areas where the fishermen sought tuna in offshore "holes" (e.g. 69), fishing tenure included deep waters beyond the reef (e.g. 34, 66a, 85). It was in the best interest of those who controlled a given area to harvest in moderation. By doing so they could maintain high sustained yields, all the benefits of which would accrue directly to them.

In the West, recognition that there were practical limits to the sea's productivity developed only around the turn of the last century (67). An awareness of how unrestricted entry to a fishery contributed to the depletion of the stock did not gain momentum until fifty years later when Gordon (35) clearly described the benefits

of limited entry. Hardin (41) extended this analysis to all renewable natural resources, terrestrial and aquatic, and described the depletion resulting from unlimited access to limited natural resources with the now familiar phrase "the tragedy of the commons." For the past twenty years a gradually expanding campaign has been waged by economists and biologists to introduce limited entry in North American commercial fisheries. Meanwhile, ironically, the centuries-old systems of limited entry in the Pacific islands have been crumbling as a direct result of Western influence.

Recently I had the opportunity to examine one of these systems during a year's residence in Palau, Micronesia. Today each of 16 municipalities in the Palau district has the right to limit access to the fishing grounds in its vicinity. Within at least one municipality there are further subdivisions so that each of several villages has control of the adjacent fishing grounds. These fishing rights extend just beyond the outer reef drop-off. Until early in this century, when the custom of shark fishing miles offshore died out, fishing rights extended to where the islands were barely visible from a canoe (about 40 miles).

These fishing rights are controlled by chiefs for the benefit of the people they represent. The chief of a poacher's village may be fined by the chief of the aggrieved municipality. The fined chief and his village thereby lose face, and the fishermen who caused this embarrassment are made to pay for it—today, usually in cash. Formerly, hostility between neighboring districts often precluded the observance of these niceties, and the offenders, if caught, forfeited their lives. (This was the prescribed punishment for poaching in many parts of Oceania).

The system was not inflexible, however. In peacetime, people who sought species unavailable on their own fishing grounds, or whose waters were temporarily too rough to fish successfully, could often obtain permission to fish on their neighbor's fishing grounds. There was usually a stipulation that a portion of the catch be delivered in payment to the village that controlled the fishing grounds.

Sharing of fishing resources sometimes went beyond the temporary "fishing permit"; fishing grounds were sometimes given outright to less well-endowed villages. About 1930, for example, the municipality of Ngeremlengui ceded fishing rights in two areas surplus to their needs to the neighboring municipality of Ngatpang.

Thus the system helped maintain fishing stocks, yet was flexible enough to permit the redistribution of harvest rights when needed. A similar flexibility characterized at least some of the other marine tenure systems in Oceania (e.g. 8, 64, 76).

## OTHER CONSERVATION MEASURES

A wide range of other restrictions traditionally attended fishing in the Pacific islands. Many were related to religious or superstitious beliefs. The eating of certain species was forbidden to particular clans, castes, age groups, or to women (published references to such practices are too numerous to cite here). These restrictions undoubtedly served to conserve fish in some cases; ritual actions sometimes yield practical ecological consequences (e.g. 72). But whether or not this was often their ulterior purpose is almost impossible to judge.

Other restrictions were clearly intended to conserve fish. Almost every basic fisheries conservation measure devised in the West was in use in the tropical Pacific centuries ago (Table 1). A number of these practices were designed to minimize the waste associated with the predictable intermittent gluts characteristic of reef fisheries. Many species of reef fish come together in large schools to spawn at times and

**Table 1** Intentional marine conservation measures employed traditionally by tropical Pacific islanders<sup>a</sup>

Method	Locality (Reference)
Closing of fishing or crabbing areas	Pukapuka (8); Marquesas (39); Truk (38); Tahiti (40); Satawal (61); Yap (31); Niue (87); Samoa (19); Tanga (10); Gilbert Islands (21); Hawaii (77); Solomon Islands (5); Marshall Islands (55); Cook Islands (17, 18); Losap (74a; C. J. Severance, personal communication)
Closed seasons or banning of fishing during spawning periods	Hawaii (70); Tahiti (40); Palau (this review); Tonga (81); Tokelau (62); Samoa (19); Mangaia (18)
Allowing a portion of the catch to escape or deliberately not catching all readily available fish or turtles	Tonga (81); Micronesia (this review); Hawaii (77); Enewetak (79)
Holding excess catch in enclosures until needed	Pukapuka (8); Tuamotus (27); Marshall Islands (57); Palau (R. E. Johannes, unpublished); Fiji (29); Huahine (30)
Ban on taking small individuals	Pukapuka—crabs (8); Palau—giant clams (R. E. Johannes, unpublished)
Fishing in inland lagoons or for certain easily accessible species restricted to times of poor fishing conditions	Nauru (75); Palau (R. E. Johannes, Unpublished); Gilbert Islands (21); Pukapuka (8); Lau Islands, Fiji (44); Mokiil (12)
Restrictions on taking seabirds and/or their eggs	Tobi (this review); Pukapuka (19); Enewetak (79)
Restricting the number of fish traps in an area	Woleai (3)
Ban on taking turtle eggs	Tobi (13); New Hebrides (42)
Ban on taking turtles on the beach	Gilbert Islands (D. Crear, personal communication)
Ban on frequenting favorite spots on turtle nesting beach	Samoa (W. Travis, personal communication; see text)

<sup>a</sup>Marine tenure systems or methods of preserving the catch (see text) are not included.

places well known to fishermen (48). The fish in these aggregations are often much more docile and approachable than they are at other times. This "spawning stupor," plus the large size and the predictable timing and location of these schools, renders their members exceptionally vulnerable to fishermen. Enormous catches are possible over such aggregations.

But there was no export market to absorb the surplus arising from such catches. Sun-drying, smoking, or salting was sometimes used to preserve the excess catch, but the tropical heat and humidity minimized storage time of fish so treated [see (73) for discussion and references]. In individual households, fish or fish stews were reheated once or twice a day to prevent spoilage (e.g. 7, 15, 45, 59, 63). Sometimes a single large stew would be reheated for weeks. [The result, according to Kramer (56), was surprisingly palatable]. In many areas the surplus catch was stored alive until needed in man-made or natural rock enclosures, or in fish traps (Table 1).

The potential catch still sometimes exceeded the islanders' needs or capacity to store it. Accordingly fishermen taught their apprentices that it was wasteful to catch more than was needed. They emphasized the wisdom of letting some fish escape from the nets in order to provide a continued breeding stock. This, in fact, was the traditional conservation practice most often mentioned by the older fishermen I interviewed in Micronesia.

Closed seasons for certain species were also employed. In at least some cases these closures coincided with the spawning season of the species [(40, 88), Johannes, unpublished]. A modern version of such a closure developed recently in Palau. Because the chiefs had lost much of their traditional power, rank and file fishermen took matters into their own hands. Concerned over dwindling spawning aggregations of groupers, they sought and obtained through the Palau legislature a law prohibiting fishing over certain grouper spawning aggregations.

Fishing areas were also often declared taboo. The closure was sometimes instituted for ritual reasons, such as to mark a funeral (e.g. 4, 19, 38). But closure was also invoked to ensure a large catch at the time of a special feast or celebration (e.g. 5), or because the chief felt that the area had been overfished (Table 1). A portion of the reef at Satawal, for example, was closed to fishing by a chief in order to preserve the area as a breeding ground for fish to supply the surrounding reefs (61). The reefs around uninhabited islands were sometimes declared taboo in order to provide good fishing for special expeditions or when resources on the regular fishing grounds ran low (e.g. 9, 53, 55). Fishing pressure around Woleai was controlled by limiting the number of traps that could be set in an area (3).

Fishing in inland lagoons was often allowed only during bad weather in order to maintain an easily harvested and readily available source of fish for times when it was not possible to fish in outside waters (Table 1).

Size restrictions on fin fish do not seem to have been employed in Oceania. This may be because Pacific islanders relish smaller fish for their superior flavor. However, size restrictions were sometimes placed on slow moving or sessile marine species that are particularly susceptible to overharvesting. Giant clams were thus protected in part of Palau, as were coconut crabs on Pukapuka and in the Marshall Islands (Table 1).

Gear restrictions, probably the oldest form of fisheries regulation in the West (74b), seem to be the rarest form of conservation practiced in Oceania. I know of only four examples and they are all of recent origin.<sup>1</sup> Because various reef fishes sleep at night and are exceptionally vulnerable to spearfishermen with lights, spearguns have recently been banned on Mokil. The giant bumphead parrotfish, *Bolbometapon muricatus*, is particularly vulnerable to this fishing method. As a consequence, a law banning night spearfishing has been enacted in one area in the New Hebrides at the request of the local people. The same species is overharvested in Palau by night spearfishing, according to fishermen (some of whom wish to see a similar law against such fishing enacted). Spearfishing was also recently banned on Satawal (M. McCoy, personal communication). A chief in one part of Western Samoa recently banned the use of imported trolling spoons by all but the elderly because he believed they enabled his people to catch too many jacks (W. Travis, personal communication).

Sea turtles have been protected in a number of ways. In response to a noticeable decline in numbers of turtles, the natives of Tobi decided that turtle eggs would no longer be eaten so that there would be more turtles to eat in the future. Nests were fenced for protection against cats. When the eggs hatched (which could be predicted rather accurately) the young turtles were caught and fed until they were thought big enough to have a good chance of survival in the open sea. Rather than releasing the young turtles on the beach where, beset by predatory birds and reef fish, they would face a very hazardous trip across the reef, the islanders ferried them by canoe to the open ocean (13). Similar practices occurred on Sonsorol (R. E. Johannes, unpublished). Restrictions were also placed on taking turtle eggs in the New Hebrides (42) and in a portion of Western Samoa (see below). In the Gilbert Islands it was forbidden to catch turtles while they were on the beach. The Enewetak islanders took only a portion of the turtles they sighted and maintained several uninhabited islands as turtle and seabird reserves (Table 1).

Seabirds were of value as food, and their feathers were used in the making of fishing lures, shipboard weather vanes, and personal adornments. But their greatest importance often lay in their being used to locate schools of large pelagic carnivores such as tuna, dolphinfish, and sharks. (Even today the great majority of schools of tuna harvested by commercial net or pole fishermen in the tropical Pacific are first spotted by observing birds feeding upon the small fish driven to the surface by feeding tuna.) For these reasons the taking of seabirds or their eggs was controlled in some areas (Table 1).

<sup>1</sup>It is not surprising that restrictions on efficient fishing gear were not used traditionally in Oceania. The banning of certain types of fishing equipment was devised as a conservation measure in Western countries where unlimited entry to the fishery and the resulting competition for fish encouraged fishermen to catch all they could regardless of the effect on future yields. But as Crutchfield (25) said, "the achievement of a desired level of fishing mortality by deliberate proscription of efficient harvesting methods is wasteful, self-defeating and devastating in its effects on technological progress." Traditional Pacific island fishermen would probably have been incredulous to learn that in some parts of the world efficient fishing devices were forbidden. In their cultures better fishing gear was developed primarily in order to reduce the effort involved in catching fish rather than to catch more fish.

All this should not be taken to mean that Pacific islanders enjoyed a perfect relationship with nature and that all their actions were governed by environmental wisdom and restraint. Solomon islanders harvested porpoises primarily for their teeth, letting much of the meat rot (28). Poisons, which were used in fishing throughout Oceania (e.g. 33), killed fry indiscriminately along with eating-sized fish, and sometimes killed so many of the latter that the natives did not bother to pick them all up (e.g. 16, 20). The Trobriand islanders often caught so many fish that some had to be thrown away (64). Although Hawaiians declared a closed season to conserve tuna (Table 1), they nonetheless sometimes caught so many during the open season that "most of them rotted" (50). The natives of Satawal expressed no concern over the uncontrolled harvest of turtle eggs (61). A traditional method of fishing in Tonga involves encircling a coral head with a net and then systematically breaking up the coral, thereby destroying fish habitat in order to extract the fish (84). "Horrible waste" was sometimes committed by Tahitian royalty at their feasts (86). In short, environmentally destructive practices coexisted, as in most societies, with efforts to conserve natural resources. But the existence of the former does not diminish the significance of the latter.

#### WERE THESE CONSERVATION MEASURES EFFECTIVE?

The value of reef and lagoon tenure was discussed above. In estimating the value of other traditional marine conservation measures in Oceania, it is useful to differentiate between "recruitment overfishing" and "growth overfishing."

Recruitment overfishing occurs when fishermen leave too few fish to sustain the fishery at its optimum level (e.g. 26). Contrary to the intuition of early marine biologists and Pacific island fishermen alike, recruitment has sometimes been found to be independent of population size over a wide range of population sizes (e.g. 26). That is, roughly the same number of young fish may survive and recruit to the fishery whether (let us say) 2,000 individuals or 20,000 individuals spawn; it may be only when the spawning population drops to, say, 1,000 individuals that some reduction in the numbers of successful future offspring will occur. Thus, among fishes to which this relationship applies, no conservation measure will assist recruitment until the spawning population drops to a particularly low level. We do not know enough about the dynamics of any reef fish populations to predict the levels below which recruitment will begin to drop. Thus we cannot reliably predict the effectiveness of any conservation measure in controlling recruitment overfishing in the Pacific islands.

When growth overfishing occurs, the fish are caught before they achieve their optimum growth (26). This form of overfishing manifests itself in the form of a significant decrease in the mean size of the fish being landed. Growth overfishing appears to be widespread in Oceania today. Restricting the harvest of reef fish by means of closed areas, closed seasons, etc would clearly be useful under such circumstances. It is doubtful, however, that traditional controls on the harvesting of pelagic species such as tuna, akule (40, 65), or flying fish (R. E. Johannes, unpublished) have been significant. In most cases the fish population sizes have been



so large in relation to the numbers that could be harvested close to shore by islanders that catch restrictions have served no conservation function.

Populations of sea birds and turtles spread out over thousands of square miles converge to nest in a small number of limited areas, rendering them extremely vulnerable to overharvesting at nesting time. Restrictions on the harvesting of eggs and of nesting individuals have thus undoubtedly been useful. Similarly, restrictions on the harvesting of slow-growing sessile animals such as giant clams have been of obvious value. Since these large shallow water species are easy to count, it is a relatively simple matter to determine when harvesting pressure is in need of control.

In short, then, most Pacific island marine conservation measures, when applied judiciously, serve the purposes for which they were designed.

## THE IMPACT OF WESTERNIZATION

If there is an island somewhere in Oceania where marine resources are conserved more effectively today than they were before European contact, I have not heard of it. But islands are legion where traditional conservation laws have weakened, failed, or been forcibly abolished. More or less concurrently the marine resources around many of these islands have dwindled.

Accounts of overharvested reef fin-fisheries are far too numerous to list. Green and hawksbill turtles and the dugong, important staples in parts of Oceania less than fifty years ago, are now on the endangered or threatened species list. Seabird rookeries have dwindled and sometimes vanished. Giant clam populations have disappeared in some areas. Mother-of-pearl-bearing oyster populations, once a major resource in French Polynesia, have been drastically depleted.

It is not my purpose here to describe this degradation in detail, but rather to discuss the causes of the breakdown of the traditional conservation systems that helped minimize such problems in the past. There are at least three interrelated causes: (a) the introduction of money economies, (b) the breakdown of traditional authority, and (c) the imposition of new laws and practices by colonial powers.

Prior to Western contact it was customary in most of Oceania to share one's catch with one's fellow villagers and to receive products of their labor in return. It is difficult to convey the fundamental importance of this custom to Westerners whose most basic assumptions about the distribution of goods and services are firmly rooted in a money economy. The introduction by Westerners of this money economy, the development of distant markets (i.e. district centers, foreign countries), and the consequent growth of the profit motive started the process of environmental decay around many Pacific islands.

Under this fundamentally new economic order goods are bought and sold, not shared; the fisherman finds himself competing for money, and therefore for fish. In order to compete effectively he must buy better equipment and fish harder. This process is self-reinforcing. The need to spend more money to get more efficient gear to harvest more intensively increases as the numbers of fish decrease. As equipment becomes more sophisticated, its price ultimately rises beyond the means of the



average fisherman. A new profession, moneylending, arises. The fisherman borrows to finance his purchases, and he often falls into debt. Employment opportunities diminish as more efficient modern boats drive out native craft.<sup>2</sup> The fisherman becomes further impoverished, and profits, such as they are, end up largely in the pockets of a few entrepreneurs. This pattern is all too familiar in tropical artisanal fisheries (e.g. 2, 22, 23, 37, 68). It is part of the oft-repeated sequence of events whereby self-sufficient, internally regulated subsistence economies are converted to money-based economies, governed ultimately by decisions made in market centers thousands of miles away.

Under such conditions a conservation ethic cannot thrive. Conservation customs practiced voluntarily by the individual erode first. No longer will a fisherman let some of the fish in his nets go, or refrain from catching all the turtles he sights. His income is now proportional to his catch. Restraint on the fishing grounds is now equivalent to self-denial. The spawning aggregations discussed above are harvested with growing intensity and "efficiency." At first much wastage occurs because of periodic glutting of the market. Eventually the stocks dwindle, and there comes a time when the fish on the reef are too few to satisfy even local needs.

Pressure is put on traditional leaders, both by their own people and by colonial governments<sup>3</sup>, to relax or abandon traditional conservation laws in the name of increased profits. Some leaders abandon these traditions willingly, unaware of the dark side of the new economic order, unable to perceive the effects of a system imported from beyond the limits of their cultural experience. Others defend their traditional laws, but with diminishing success as colonial governments usurp their power and prestige.

What has happened in Palau in the past two decades serves as an example. Possessing fish stocks surplus to their own needs, the Palauans developed an export market to Guam. In a flush of enthusiasm over the wealth their fish appeared to afford them, and supplied with government loans to purchase bigger boats, the fishermen in some areas quickly depleted their fishing grounds. By the time it became apparent that fishing pressure was excessive the fishermen were trapped into continuing to overharvest in order to continue making payments on their boats. The

<sup>2</sup>This should not be taken to imply that all attempts to modernize artisanal fisheries should be abandoned, but rather that they should take into account the context in which the fishermen live and work, and not just the narrow goal of "production efficiency." For example, around islands where traditional sailing craft are restricted in calm weather to heavily fished shallow reef waters, the introduction of motorized vessels enables fishermen to seek pelagic species beyond the reef thereby expanding their resource base and sparing inshore resources.

<sup>3</sup>Colonial governments did all they could to encourage the profit motive among the islanders, for in its absence the natives could not be induced to work on colonial plantations, nor, as a consequence, did they possess the cash to purchase imported goods from colonial traders. One prominent fisheries biologist whose sympathies were clearly with the natives, nonetheless echoed the conventional wisdom of the day: "until they (Fijians) come to value money as a means to the attainment of wants at present not desired, we cannot expect them to awaken from their present apathy and indifference to the riches which the sea offers to their grasp at the expense of regular and sustained effort" (46).

people of one municipality, in an effort to keep up the payments on the diesel boat they had purchased to increase their fishing efficiency, fished their reefs down to a catch level at which it no longer paid to keep the boat in operation; they had to forfeit it. They have all but exhausted their rich fishing grounds and have nothing to show for it but unpaid bills. Their leaders now covet the adjacent fishing grounds of their less aggressive neighbors. They cannot exploit them because of traditional reef and lagoon tenure laws. However, efforts have been made (unsuccessful so far) to pass legislation that would destroy these laws. If this happens the depletion will spread.

Reef and lagoon tenure systems have already been weakened or destroyed in many Pacific island areas. In the past century the system has eroded in the Marshall Islands (74, 78); Samoa (19); Tonga (34); the Caroline Islands (47); the Tokelau Islands (62); Nauru (51); Huahine, Society Islands (82) and Tanga (Tanna), New Hebrides (10). It has been destroyed in Hawaii (54), the Gilbert Islands (58), and the Cook Islands (24). This list is undoubtedly incomplete since little has been written on the subject.

The value of marine tenure was not generally appreciated by Western colonizers. It not only ran counter to the Western tradition of "freedom of the seas," which they assumed to have universal validity, but it also interfered with their desire to exploit the islands' marine resources—a right they tended to take for granted as soon as they planted their flags.<sup>4</sup> Colonial governments often passed laws that weakened or abolished marine tenure (e.g. 24, 54, 71).

The steps that led to the loss of some marine tenure systems have gone unrecorded, particularly where it happened more than a few decades ago (e.g. 10). But it appears that in some cases the islanders abandoned the system voluntarily. This probably occurred in response to the widespread depopulation that followed European contact (e.g. 60). Population densities became so low on some islands that the defense of marine boundaries became pointless; no purpose would have been served by hoarding superabundant fish.

Populations have since rebounded however, often reaching higher levels than existed prior to Western contact (e.g. 60). It might be expected that tenure laws would be reinstated when the benefits of maintaining fishing rights once again justified the effort (e.g. 6). This has not been the case. In addition to the resistance of some colonial governments to the institution or reinstatement of such laws, the islanders themselves are sometimes unsympathetic to such a move. Now accustomed to unlimited entry on the fishing grounds and motivated in their patterns of

<sup>4</sup>The judgment in the case of *Hanasiki v. O. J. Symes*, High Court of the Western Pacific, Honiara (1951) contains an illustrative passage. "In this case . . . the defendant (a European) has throughout contended that he is entitled to fish for trochus shell on any reef he chooses. Indeed I do not think that I am being unfair to him in stating that he has evinced, while conducting his case, the attitude that the law cannot be so absurd as to recognize the right of any native to say to him or anyone else yea or nay in respect of taking trochus shell from any reef." Of the reef and lagoon tenure system in Hawaii one Attorney General stated, "the entire system is un-American and one toward the correction of which we should all cooperate," *Honolulu Advertiser July 28, 1931*.

resource use by a money economy, many fishermen fear the short-term inconvenience and economic dislocation attending the reintroduction of reef and lagoon tenure. And the diminished authority of the traditional leaders often prevents them from making laws that run counter to these sentiments in order to reestablish rational patterns of exploitation.

A case in point occurred on Lukunor, Truk District, after World War II. Before the war the Japanese administration declared all areas below the high tide mark to be state property. According to Tolerton & Rauch (80),

at the beginning of the American administration the chief attempted to restore the trapping and reef areas to those who had formerly controlled them. This was not popular with the people, who in the last generation had become accustomed to considerable freedom in the use of the lagoon, and particularly the reef area adjacent to the islands. . . . The order was particularly resented because the area is that utilized most intensively by the women and boys whose contribution was important during the scarcity induced by wartime dynamiting (of fish) and people wished no restriction on gleaning. Yet this was precisely the reason, and undoubtedly a just one, given by the chief for the order restoring the ownership pattern, for he felt the young men particularly were not giving the fish a chance to rest and multiply, and that they and the women were taking too many of the shellfish.

These authors went on to say that since the chiefs traditionally controlled these resources, "it hurt to see them abused by careless people."

The reason often given by both fishermen and government officials for preferring unlimited entry to traditional marine tenure systems is the belief that opening up the fishing grounds to all comers will speed up economic development. And indeed it often will—but only temporarily. In the absence of reef and lagoon tenure, people crowd onto productive fishing grounds. The catch and the profits increase up to a point. But overfishing soon occurs (reef fisheries are notoriously easy to overharvest for reasons that are not well-understood). And, even before the fish stocks are seriously depleted, profits decrease markedly as the catch is divided by increasing numbers of fishermen. The combined investment in boats and gear grows to become much greater than is needed to harvest the stocks efficiently, and eventually the point is reached where the fishermen's incomes do little more than cover their operating expenses. As Marr (66) states, "overcapitalization and thus economic waste are inevitable in a fishery where there is unlimited entry."

## CONCLUSIONS

As long as capitalist economies dominate Pacific island commerce and marine tenure laws are weak or nonexistent, the traditional island conservation ethic will continue to erode. Conservation through education and admonition alone cannot work under the competitive conditions that exist on the fishing grounds. Some form of government control therefore seems necessary. Attempts have been made by many Pacific island governments to regulate marine resource use but these have generally proven ineffective. Sufficient money and trained personnel have not been

available to obtain the necessary information on the biology of the species involved nor on their catch rates to manage them adequately. And even if such information were available, species-by-species management programs such as those used in the temperate zone would cost more than the benefits derived; there are far more species involved than in typical temperate fisheries, and no one or two species dominate the catch. (Certain particularly valuable species such as lobsters or turtles may sometimes be managed separately, however.) To date, as a consequence, there are no established general scientific management principles designed for reef and lagoon fin-fisheries.<sup>5</sup>

Since current governmental fisheries-management schemes in Oceania are thus generally not very effective, and since many traditional island conservation customs appear sound, Pacific island governments should make greater efforts to understand and support the best of these customs. One advantage of legislation patterned after local custom is that it is likely to gain greater public support and thus be easier to enforce. [As Kesteven (52) has said, "the fisherman must not be able to continue to regard regulations as some alien restraint imposed upon him for purposes he does not recognize."]

Legislation that strengthens traditional marine tenure laws where they still exist will strengthen the ability of the owners to police their resources—something they often do voluntarily if their rights are secure. Legislation that weakens or nullifies marine tenure laws increases the government's regulatory responsibilities and places additional burdens on typically understaffed and underfunded fisheries departments. The government thus disposes of a service it gets free and assumes responsibilities it is ill-equipped to handle.

(Where the original controllers of a tenured area are joined by significant numbers of immigrants, the problems of maintaining reef and lagoon tenure increase—particularly if the newcomers are of a different culture. The immigrants naturally want to fish too, and are often intolerant of local customs. The behavior of non-Polynesians in Hawaii, described by Kosaki (54), provides one example. In cases where the immigrants outnumber the original inhabitants, as in Hawaii, the problems of maintaining traditional reef and lagoon tenure systems may prove overwhelming.)

Whereas local custom may prohibit the introduction of a conservation regulation patterned after Western custom, a modified version of it, tailored to better fit local sentiment, may succeed. For example, one Samoan chief who was concerned about the overharvesting of turtle eggs in his district knew that an outright ban on harvesting would not be tolerated by his people. So he devised an indirect approach to the problem that would never have occurred to an outsider. He declared a certain rock outcrop on the turtle's nesting beach taboo. The digging of turtle eggs is a social activity in Samoa, and the tabooed rocks provided the only shade on the beach in which to sit and talk. Deprived of the social incentives to dig turtle eggs, the islanders removed far fewer than before (W. Travis, personal communication).

<sup>5</sup>Elsewhere I am proposing a reef fishery management scheme based on the traditional Pacific island custom of restricting fishing during spawning periods (49).

A number of island governments legally sanction traditional reef and lagoon tenure laws (e.g. Fiji, New Hebrides, Solomon Islands, Trust Territory of the Pacific Islands, Papua New Guinea). But no fishing rights are generally recognized unless it can be demonstrated that they existed prior to the introduction of Western law and, in the case of the Solomon Islands (5), unless the custom has been maintained continuously. I believe that this is unfortunate. Laws that freeze traditional customs prevent the evolution of tenure systems to fit contemporary needs. If a valuable new fishery develops in an area where marine tenure has not been exercised, it is only natural that people who customarily use this area will want to control the fishery. And, for reasons discussed above, the resource is more liable to be harvested in moderation if this right is available to them.

Some consideration should thus be given to making Western the laws sanctioning traditional marine tenure systems more flexible with regard to contemporary claims. This would make them more effective in protecting native rights—the expressed reason for their existence. Otherwise it is too easy for outsiders to capitalize unilaterally on new fisheries and deplete them. Melanesian natives who petitioned for recognition of fishing rights, for example, were denied them by European administrators on the grounds that they were not traditional. This enabled Europeans and other outsiders to develop trochus and sea-cucumber harvesting industries without compensating local natives (11).

### *Return to Self-Sufficiency*

Economic development is the focus of much planning and research throughout Oceania today. This is a natural response to the rising influx of capital and tourists during the past decade. But if rapid world inflation continues and energy costs escalate as rapidly as many predict, then the people of Oceania must plan for a different kind of future—one that involves retrenchment. They are at the end of a long and expensive supply line—not only for manufactured goods, but also, today, for much of their food. Many island economies are also dominated by depression-sensitive tourist industries. They are thus among the first to feel the pinch of constricting world economic conditions. When the world economy sneezes, Oceania catches a cold.

In addition, the declaration of 200 mile exclusive economic zones by many coastal states has potentially serious consequences for Oceania. Pacific islanders import tens of millions of dollars worth of fish annually, and the single most important source of animal protein in many district centers is canned mackerel from Japan. This fish is caught in what have traditionally been regarded as international waters and processed with an economy of scale such that it can be exported to the tropical Pacific and sold at lower prices than those of most fish caught locally. Jurisdiction over these waters by the countries nearest them is expected to result in a marked increase in the cost of mackerel, putting the product out of reach of many islanders who have come to depend on it. This development could create a drastic, rapid increase in fishing pressure on local island fish stocks.

Pacific islanders may thus be faced with an involuntary return to much greater economic and nutritional self-sufficiency. The success of such a transition would

hinge largely on the extent to which traditional customs of resource use—customs designed specifically to foster self-sufficiency—were reestablished. Undoubtedly there are many other areas of the world where efforts to shore up traditional patterns of resource management would help to minimize suffering in the event of a long-term depression.

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