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Do Traditional Marine "Reserves" Conserve? A View of Indonesian and New Guinean Evidence

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The concept of a "traditional marine conservation ethic" existing among coastal people has been suggested by work in the oceanic western Pacific. The idea is evaluated here by using available information on territorial fishing rights in Indonesia and Papua New Guinea. Relevant data are not overabundant, but are sufficient to begin to answer some basic questions regarding the origins of marine tenure and the relationship of this ownership to marine resource exploitation and management. It would appear that such tenure is not universal, and this patchiness may be determined by a general inclination of people to give greater attention to the land than to the sea in their subsistence patterns. When it did develop, tenure probably arose most commonly as a result of conflict over marine areas, and this competition was intensified, not diminished, when certain resources became economically valuable. Such disputes were bound to be influenced by a number of factors pertaining to marine exploitation directly, but also including social and political issues and problems not necessarily relating to marine biological resources. Overall, the strong impression given is that exclusive areas became established not because people wished to conserve resources, but rather because they tended to exploit more and eventually came up against neighboring people doing the same sorts of things. Traditional tenure is but one circumstance which might have enhanced any supposed natural *status quo* between man and resources existing in the past. It is especially hard to conclude that numbers of people were determined by marine resources alone when they lived on the land and typically found most of their food there. Traditional tenure also imposes adverse constraints on coastal zone development and management, and there are certainly many problems with which it cannot begin to cope. It is difficult to argue that traditional tenure systems could realistically stand up to modern threats to the coastal zone. It is true that without responsibility on the part of the fisherman management measures cannot be expected to work. But traditional ownership patterns can only be regarded as a very imperfect route to establishing that responsibility, because the ownership existed for gain and not for restraint.

INTRODUCTION

According to the traditional conservation ethic, the practises and attitudes of subsistence peoples have much that is relevant to conservation today. It is a view

which has been developed in the marine sphere in particular from assessment of the information available on small-island peoples of the western Pacific [JOHANNES 1978]. Few ideas could be more appealing in the attempt simultaneously to prevent both over-exploitation of natural resources and the decline of traditional cultures than one which suggests that people of old developed the means of controlling the human use of natural ecosystems, and that this experience is of value to modern management. For the concept to be widely of use, it is clearly important to show that it is indeed applicable to areas other than that for which it was proposed. For the supposition to be correct, it has to be demonstrated that traditional people were either aware of conservation as we now perceive it, or that their practises had conservation effects as a by-product, even if instigated for other reasons. There is also an assumption that the conditions for which traditional practises were appropriate in terms of conservation, are similar to those prevailing today.

I will begin to provide an answer to these questions by piecing together the data available specifically on protected area practises in the exploitation of coastal resources of Indonesia and Papua New Guinea. This paper is confined to systems of marine tenure because within a broad view of protected areas, traditional "reserves" are most closely identifiable, superficially at least, with their modern counterparts.

HOW WIDESPREAD ARE TRADITIONAL MARINE CONTROLLED AREAS?

At least at one time, fishing-grounds off Aceh, in northern Sumatra, were each supervised by a special individual, the *Panglima-laut*, who could arrange the times when fishing was permitted [ANON. 1910]. Schot [1883] reported how groups of Orang Laut on the eastern coast of Sumatra came to exploit separate areas through mutual agreement. In the Palembang area of southern Sumatra van Royen [1927] has given a broad account of how the use of coastal swamps was regulated by the communal system of the *marga*. Off Tuban, in Central Java, offshore fishing-grounds were identified by floating markers anchored to the bottom [ANON. 1921].

At Salayar Island, in the Flores Sea, Kriebel [1919] mentions how reef areas were tenured and passed from father to son. Around Tanimbar, Kolff [1840] refers to areas which were exclusively used by adjacent villages. In the Kei Islands of southern Maluku, van Hoëvell [1890a] describes reserves to which all members of a village had access, although recently Barraud [1979] reported that fishing areas were not owned in the part of the Keis in which she worked. Tenure of fishing grounds at the village level has been reported for the Galelarese of Halmahera, in northern Maluku [ANON. 1937].

Traditional reserves, mostly belonging to whole villages, have been reported several times from western New Guinea, especially for the northern coast and islands [VAN DER SANDE 1907; FEUILLETEAU DE BRUYN 1920; GALIS 1955, 1970]. There is more sparse evidence of ownership of marine areas along the southern coast as well [GEURTJENS 1929; POWWER 1970].

I have come across little evidence of well-developed traditional ownership of marine areas along the southern Papuan coast of Papua New Guinea. By contrast, there are several references to tenure for the northern coast and islands. Among these are reports by Malinowski [1918] from the Trobriand Islands, by Bell [1953–1954] on Tanga Island, off New Ireland, by Panoff [1969–1970] on New Britain and by Carrier [1981] on Ponam Island, off Manus. Although this summary suggests that ownership of marine areas has developed widely in the region, it hardly supports the notion that marine tenure is, or has been, universal.

That tentative conclusion must, however, be qualified by the recognition that coverage of maritime topics has been far from adequate for the region. So often observers have given elaborate descriptions of land tenure, but have scarcely dealt with patterns of water ownership. Evidence is commonly given that such tenure is known, but not enough detail is offered to provide the inference with any foundation. That this lack represents a certain bias in the reporting of maritime matters as a whole is supported by an apparent disinterest in marine exploitation. Frequently, one is informed that fishing is a significant activity for a particular group of people, but again the details of its performance are left to the imagination. This discrepancy has been noted elsewhere, the most comprehensive review being that of Emmerson [1980]. Anell [1955], among others, refers to the paucity of data on fishing in his historical review.

At the same time, however, it seems certain that either marine tenure never existed in certain areas, or, if it existed, it disappeared some time ago. I have yet to come across any mention of marine tenure for the western coast of Sumatra, for Kalimantan or mainland Sulawesi; there is surprisingly little information given on such ownership in Java. By contrast, there is sufficient evidence of marine tenure for the eastern coast of Sumatra, for parts of Maluku, and especially for the northern coasts and islands of New Guinea. This is not a distribution which I can explain in terms of the intensity of observations. If marine tenure is patchy in its occurrence, this should not be surprising in itself, because territoriality of natural areas is not invariably found in traditional societies [HARDESTY 1977], and this is true also of fishing rights [ACHESON 1981].

UNDER WHAT CONDITIONS HAS MARINE TENURE DEVELOPED?

Is there then anything special about the perceived distribution which might explain why tenure has developed in some areas and not in others? In general it can be expected that ownership of marine areas will develop where some benefit accrues to the people involved. The resources thus contained may be particularly valuable in some way, and, or alternatively, they may be especially easy to defend. Is tenure well-developed among those people for whom marine resources are especially important? Obvious candidates for this are the sea-gypsies, the Orang Laut of western Indonesia, and the Sama Bajau or Bajau Laut of eastern Indonesia, whose livelihood has long been almost exclusively dependent on marine gathering. I have mentioned

one recorded case of ownership amongst the Orang Laut of eastern Sumatra, but there seems to be no mention of such practises among the Bajau. Perhaps such people, leading a semi-nomadic life, were in fact disinclined to associate themselves with a particular area for long enough to want to claim it; certainly they have wandered widely in the archipelago. Lack of study of their case would not seem to be responsible, because a great deal has been written about them over the years [SOPHER 1965].

Has ownership developed among sedentary coastal residents in especially productive areas? Kriebel [1919] described a case where marine tenure was well-established on one side of an island, Bonea, which was productive, while the western, unproductive side was unclaimed. Productivity alone, however, can not explain the broader pattern, because otherwise areas such as Aru, in southern Maluku, long-renowned for its wealth in marine resources, could be expected to have a well-developed tenure system. But I have yet to come across any reference to marine ownership in that area. It is admittedly possible that this is a historical quirk, that tenure once existed, but has been lost, perhaps swamped by outside commercial interests [VAN HOËVELL 1890b]. A similar explanation, though here through intrinsic population growth, might be offered in the case of Java. According to an old report [ANON. 1930], marine tenure once existed around Enggano (off Sumatra), but was abolished in the last century by decree of the Resident; the reason given was that feuds were necessary to maintain territories, and the Dutch wished to prohibit fighting.

It would still seem that a broader explanation is needed for the inferred patchiness of marine tenure in this region, and I would like to suggest two possible causes. The first is primarily ecological, namely that as often as not more reliable means of human sustenance were available on land. The other suggested reason, although not necessarily unrelated to the first, is that where they are faced with the alternative of a land- or a sea-based livelihood, people seem in most cases more inclined to choose the former. Both ideas have been expressed by Bell [1946-1947: 326], in seeking thus to account for the insignificant role of fishing in the life of the Tanga Islanders:

"The explanation [for this lack of fishing] may lie in the supernatural background dread which these people have of the sea and all that comes from it, or in the abundant and well-balanced food supply which is always available to them in their gardens and their pig pens."

I have scarcely seen such an attitude toward the sea evinced for any other Papua New Guinean people, but the former theme does exist also in the Indonesian setting. Thus van der Kroef [1954] has described ways in which the sea is widely viewed as being symbolically opposed to the land. Such antithesis has been most evocatively described in the case of the Balinese, of whom Swellengrebel [cited in VAN DER KROEF 1954] felt that the land/sea opposition dominated human existence. To the Balinese it is the mountains which are pure: they provide water and are the seat of the gods. By contrast, the sea receives the filth of the land [COVARRUBIAS 1937; HOBART 1978]. Apparently as a reflection of such attitudes, the Balinese have not traditionally lived by the sea; coastal dwellers in Bali have long been of other ethnic groups, such as the

Buginese. Although this state of affairs has been most vividly described in the Balinese case, it is probably not exclusive to it. Lombard [1980], for example, has described how to the Javanese the sea is a wilderness beyond the control of human society and as such inspires a certain awe. Emmerson [1980] has expressed the opinion that fishermen and coastal dwellers in the same area are generally looked down on.

I suggest that this caution with respect to the sea may have been reinforced by natural phenomena, such as tidal waves, and also for anthropogenic reasons, such as slaving raids in former times. Piracy was certainly a risk of coastal living over large areas of Indonesia, into the last century.

The second factor, expressed above in the words of Bell, is that once simple methods for enhancing production on land had been developed this land provided a surer source of food than did the sea. It is true that Indonesia is the home of a diverse maritime technology, as is amply illustrated by works such as that of Hornell [1920] on the design of outriggers. But it is also surprising how commonly marine exploitation is reported to be unimportant. Such lack of development of marine resources may serve to explain how it is that a minority of people—groups such as the Bajau and Buginese—came to play such a central part in marine exploitation and trade in the Indonesian archipelago.

Among New Guinean coastal peoples the picture is one of a rather sporadic dependence on marine resources. Bell [1946–1947: 310] reported that fishing by the Tanga Islanders "...is, for the most part, not regarded as an occupation vital to the economic well-being of the community nor does it loom large in the ritual horizon." Of the people of south-west New Britain which he studied, Todd [1934–1935: 194] says that "...fish and reef products provide a rather inadequate flesh supply." Referring to the Wogeo Islanders, Hogbin [1967b: 52] informs us that "...fishing by one method or another is carried out at all times, but, except when the palolo worm is expected, sea food is never of such overwhelming importance that the gardens are neglected." Verschueren [1970: 45–46] observed that the Marind-Anim whom he studied evidently prefer the months which they spend hunting and fishing inland, but that during the wet season the abundance of mosquitoes drives them to coastal dune areas where they "content themselves with the yield of the sea." Writing of the Manam Islanders, Wedgewood [1934] gives the impression that fishing is most erratic in its results.

In contrast to the picture given by such views are reports, for example by Epstein [1963] and Malinowski [1918], of the importance of fishing in the economies of the Tolai of East New Britain and the Trobriand Islanders, respectively. Clearly, exploitation of marine resources is extensive among some coastal groups, but in others a more land-based livelihood has been pursued.

Such patchy development of marine exploitation can be contrasted with that prevailing in the oceanic Pacific. Reinman [1967: 194] in his review concludes that "Present evidence for the use of the marine environment seems to indicate an increasing usage of its products from South East Asia through the Melanesian area and into

Polynesia." Anell [1955] had already contrasted fishing techniques between Micronesia-Polynesia and Melanesia, and the general view from archeological evidence is that fish and fishing techniques are more in evidence in Polynesian sites [REINMAN 1967]. This relative importance might explain any prominence of marine tenure in the oceanic Pacific. Conversely, lack of indigenous marine exploitation may explain the absence of such ownership in some areas, as suggested for southern and eastern Kalimantan [ANON. 1926b].

There are other reasons why marine tenure might not have developed more extensively than it appears to have done. Returning again to the argument that areas will be defended only where such defense is feasible; there is often the suggestion in the literature on tenure as a whole that explicit ownership occurs most commonly where the resource being defended has involved some investment on the part of the owner. Thus Crocombe and Hide [1971] explain the absence of ownership of mangrove forest by the people of Marshall Lagoon by lack of expenditure of labor in establishing or improving mangroves as a valuable resource. The labor comes only in harvesting the resources and in preparing them after they have been gathered. Another example is afforded by tidal stone weirs which are constructed on reef flats to catch fish: at least on Aua Island [PITT-RIVERS 1925] and on Ponam Island [CARRIER 1981] to the west and north of Manus, respectively, these are owned.

A further condition for effective ownership may be demarcation. Crocombe and Hide [1971] suggest that ease of identification and boundary delimitation may determine the types of area which people are likely to own and protect. This, in addition to the notion of investment, may explain why agricultural areas are so often finely divided within and between communities, whereas tracts of open water and forest are rarely subject to the same patterns of intense subdivision and regulation. Open sea areas were demarcated on occasion [ANON. 1921], though I suggest that such boundaries would have needed constant maintenance.

In summary, marine tenure is found in some areas, but it does not occur all over. Two major explanations and some lesser ones are put forward as to why this might be so. For one thing, people in several areas tend, according to some accounts, to be averse to the sea. For another, perhaps not an unrelated reason, marine exploitation is not as developed as one might expect. A third possible cause is that marine areas may not be worth owning in many cases: the resources may not be valuable enough, there is in any case rarely a large personal investment in the way that there is in agricultural land, and the areas may be difficult to demarcate.

HOW DID TRADITIONAL RESERVES FORM?

There are records of conflicts between groups of coastal fishermen in Aceh, northern Sumatra [SNOUCK HURGRONJE 1906; ANON. 1910]. One report mentioned that marine tenure around Enggano, to the west of Sumatra, was maintained by continual battles [ANON. 1930]. Schot [1883] mentions disputes between Orang

Laut groups over fishing-grounds along the eastern coast of Sumatra, and that these led to people exploiting exclusive areas.

In 1913 a group of Kangean Islanders persuaded some North Madurans to fish elsewhere because they believed that the latter were depleting their reefs [ANON. 1931]. Disputes over the exploitation of reefs have been described on Salayar, in the Flores Sea [KRIEBEL 1919], on Tanimbar [KOLFF 1840; VAN HOËVELL 1890c], and around Aru [KOLFF 1840].

Malinowski [1918] mentions that disputes over village fishing grounds had occurred in the Trobriand Islands, and van der Sande [1907] records the same off the northern coast of western New Guinea. Bell [1946-1947] reports inter-clan fighting over fishing rights off Tanga.

The inference from such reports is that tenured areas have come into being as a means of resolving conflict between people. Disputes did not come entirely to a halt thereby, and Kolff's description of one confrontation [KOLFF 1840] shows how events other than those to do with the area involved could contribute to the escalation of a disagreement. Clearly, disputes did not arise unless people had something to fight over, and Kriebel's [1919] anecdote of how only the productive side of an island came to be tenured is instructive in this regard. A complication to the productivity story is Carrier's [1981] description of how, although only obviously productive areas are owned around part of the coast of Ponam Island, in another part even intervening relatively unproductive habitat is claimed.

If, as a whole, however, people only take the trouble to defend what is valuable, then tenure patterns may clearly change according to what is deemed worth owning. A third feature of disputes over traditional marine "reserves" involves an element of opportunism. Both Carrier [1981] and Johannes [1982] report how conflict over reefs evidently increased around Manus, to the north of mainland Papua New Guinea, when *Trochus* became a valuable commodity. In Carrier's case the disputes led to the breakdown of dominance by a single clan, although whether the multi-clan tenure which arose in its place was a reversion to some earlier pattern of ownership is unclear [CARRIER 1981]. It has been reported that around Marshall Lagoon, on the Papuan Coast, marine tenure was until recently poorly developed, if at all. It is only with the expansion of fish as a cash commodity that villages have started claiming exclusive rights to their adjacent waters [R. ALU, pers. comm. 1983]. Kolff [1840] described how a dispute arose between two villages over the harvest of *trepang* (bêche-de-mer), trade in which is thought to have greatly expanded in the latter part of the eighteenth century. Perhaps marine tenure there was a response to this valuable business. On Nila Island, in eastern Nusa Tenggara, the latter was not the case; tenure arose early on, but disputes evidently increased when pearl-shell became valuable [ANON. 1926a].

A further feature of disputes over rights to marine exploitation is that these were commonly influenced by such social factors as intergroup rivalry. A case relevant to this issue was related in Aroma, on the Papuan coast [K. RAVU, pers. comm. 1982]. Apparently a few decades ago (in the time of my informant's grandfather), a group

of fishermen, the Alukuni, settled near the mouth of Hood Lagoon, just to the west of Aroma. There was a long-standing disagreement over land rights between the Aromans and two pre-existing villages in Hood Lagoon, Keapara and Karawa, and it was the latter people who permitted the Alukuni to settle where they did, between them and their adversaries along the coast, in Aroma. Matters were aggravated when the Alukuni, non-agriculturalists and fishermen exclusively, began fishing in Aroma Bay and came to barter their catch for vegetable produce in Aroma. As a result of this affront the Aromans unilaterally fixed a boundary close to the Alukuni settlement, across which the latter were not permitted to venture. Particularly because the Aromans themselves were not keen fishermen and were primarily cultivators, the disputes were perhaps least of all over the marine issues overtly focussed on, more over land, and perhaps most of all over intergroup differences. Baines [1982], in attempting to explain how comparable villages on a Fijian island have come to own marine areas of very different size and location relative to the owning villages, suggests that these distributions are as much a result of historical factors, including the order of colonization, and fluctuations in local power, as a reflection of the equable dispersion of people and resources.

Having discussed these aspects of disputes in an attempt to understand the origins of marine tenure, I have nevertheless to admit that it is also arguable that some conflict may have arisen as much as a consequence of the instigation of tenure, as that tenure might have developed out of original conflict. Indeed, it often seems possible that the idea of laying claim to marine areas might have been introduced from outside rather than deduced autonomously from conditions prevailing within the area. This is a historical question which is not easily, if ever, going to be resolved for any one case.

HOW DO MARINE TERRITORIES RELATE TO THE RENEWABLE RESOURCES WITHIN THEM?

In giving a brief overview of the conditions under which tenure might have developed, I have already implied that ownership may be influenced by a number of factors. Although disputes, as indicators of the conditions leading to territoriality, seem often to have related to the exploitation of biological resources, conflict could also arise for other reasons. Thus van der Sande [1907] speaks of ownership being directed not only at fishing, but also at trade through the waters claimed by villages, and Panoff [1969–1970] relates how landing site rights can be involved in addition to those of fisheries in village reserves among the Maenge of New Britain. The case of the Alukuni and Aroma in Papua suggests, moreover, that where conflict developed overtly over fishing issues the prime mover may not have had anything directly to do with the sea. The resulting boundary would appear to have been quite arbitrarily placed, as far as habitats and resources are concerned.

It becomes evident that in many cases "social" issues may have been as much at stake as "resource" ones. Referring to the Trobriand Islanders, Malinowski [1918]

stated that with catches being abundant, there were no grounds for anyone to be mean in distributing the catch. Everyone received a share of the harvest, but the privilege of giving was highly valued and distribution had to proceed according to customary rules. An implication is that if people fought over marine areas [MALINOWSKI 1918], this was not for scarce resources, but rather for the status of being a giver. Both Baines [1982], writing of Fiji, and Bell [1946-1947], describing the Tanga Islanders, imply that power-play is as much involved in marine tenure as is an ecological allocation of resources. Comparable contentions for land tenure can be found in the works of Hogbin [1967a], Crocombe and Hide [1971] and the Papua New Guinea Commission of Inquiry into Land Matters [ANON. 1973]. Perhaps we should recognize, as Sahlins [1968] did, that both environment and culture are likely to be important in shaping the organization of people. This does not mean that ecological factors could not be of predominant importance in some cases, and one might argue that since it is exploitation which is primarily involved in the case of the sea, and not additional factors such as settlement, therefore such might be the case with marine tenure. In view of what I have said above, however, I believe that such an extreme stand is scarcely tenable.

Even if an ecological-determinist argument is pursued, it is not at all clear what might be the limiting resource which would determine the carrying capacity of people. With the widespread role of agriculture, and sporadic dependence on fishing, it would seem more likely that land resources are significant in this regard than marine ones. Perhaps this relationship depends on what influence agriculture had on patterns of marine exploitation, but from first principles either an increase or a decrease in the intensity of marine use could be argued. It depends rather on whether people became more or less likely to fish in the sea as advances in cultivation techniques occurred.

The impression given from several accounts is that tenured marine areas were simply a seaward extension of tenured lands. On the island of Nila, for example, only people owning land adjacent to the sea had rights to marine exploitation [ANON. 1926a]. The design of the traditional marine "reserves" would thus seem to be more dependent on those on land than *vice versa*. Fishing and agricultural coastal people therefore present a case that is particularly difficult to evaluate. Perhaps the marine picture would be far simpler if people lived on the sea, but then, as on land, additional factors would come into play. Vayda [1976] has presented a case for warfare among certain inland groups, among them the Highland Maring of Papua New Guinea, maintaining the population at carrying capacity. Eibl-Eibesfeldt [1979] argues more generally that this might be so, but there are problems with such a simple model. Fighting still occurs at low population density [VAYDA 1976], and also specifically where wild protein is more than ample for hunter-gatherers [CHAGNON and HAMES 1979].

In conclusion, although marine tenure exists in many areas, this ownership is likely often to relate to factors other than marine biological resources. Issues aside from fishing were often at stake, rivalry within and between groups was frequently important, and even in an ecological model marine resources were not necessarily

the factor determining the carrying capacity of people. It appears also that marine reserves were commonly a mere appendage of owned land, and that there was considerable opportunism in their establishment. Although some literature gives the impression that territoriality might have adjusted populations to the capacity of their environment to support them, it has to be recognized that this state of affairs, if indeed it did come about, arose most probably through the self-interest of groups. Carrying capacity was reached, if at all, because people tended constantly to expand their populations and their use of resources, not necessarily because there was any conscious effort to balance the man-resources equation. Similar views have been more eloquently expressed by Bulmer [1982] for inland people of Papua New Guinea, and by Carrier [1982] for the Ponam Islanders. This mechanism of boundaries established by "greed" rather than by self-restraint might help to explain the paradox of people being supposedly concerned about their environment and yet tending willingly to accept economic development which can massively change that environment [e.g., HAINES 1982]. They are concerned about their environment because it affords them their livelihood, but they will not readily reject something which clearly raises their meagre standard of living.

WHAT HAS CONSERVED RESOURCES?

Although it appears that on occasion people have locally depleted populations of certain marine species [e.g., BULMER 1982], it may be possible to say that, as a whole, exploitable populations have tended to be conserved. However, if people did not, in the final analysis, consciously conserve marine resources, what did the job for them? I have argued above that not only were disputes not necessarily related to resources, but that even if they were, these were not invariably marine resources. The case is debatable, but territoriality would not seem obviously to have been the factor responsible for "conservation." Explanations which are at least as plausible come readily to hand.

Foremost among these is the comparative lack of marine exploitation, for which, as implied above, several factors could be held responsible. People might simply not have had the maritime technical means, or if they did they were loathe to use them. In favor of the former point is Reinman's [1967] recognition of the relative lack of certain basic items of fishing gear, such as hooks, from Southeast Asian archeological sites. Conversely, even for the Polynesian outlier, Tikopia, Kirch and Yen [1982] observe that while inshore species dominate the remains of marine organisms in middens, this was not apparently due to any technical inability to exploit pelagic species. This brings us back to an earlier contention, that of the inclination of people to remain close to land where sufficient sustenance was afforded by so doing. Did coastal people tend not to exploit marine areas because they lacked the technology and, or alternatively, because they were averse to such a livelihood? As implied above, the answer is not clear-cut, but I think the point is adequately made that marine exploitation may have been limited by means other than territoriality.

It is also possible that a relative lack of trade and monetary exchange helped conserve marine resources in many localities, although both potential influences have been present in some form in many parts of the region for a long time. Up to a point commercial values for marine products may have increased, or even led to the initial establishment of, territoriality, but I doubt that this reduced the tendency of people to deplete marine resources. People instigated reserves not so that they could take less, but rather so that they should, on average, have exclusive access to more, if the arguments I have pursued are correct.

Alternatively, it may be that if marine technology and exchange systems were adequate for resources to be depleted that this resource decline did not happen because population, or exploitation activity, was kept in check by a factor other than the availability of those marine resources. I have suggested above that this factor was more likely to have been something related to land than anything marine. Disease, malnutrition or warfare are all factors which might have contributed to keeping numbers of people down.

WAS CONSERVATION AN INADVERTENT CONSEQUENCE OF TERRITORIALITY?

For territoriality to have conservation as a by-product, either people must take more care of what they have so delimited than would otherwise be the case, or the exclusion of others must have conservation effects. If people tended to establish territories for reasons other than conservation, it is not immediately obvious that they would have managed their resources better. Although regulations prohibiting the harvesting of depleted species have been reported elsewhere [JOHANNES 1978], I have seen little mention of such measures in the region with which we are concerned here. What has been indicated is that influential individuals often place a temporary taboo on certain areas, particularly before ceremonial feasts, so that just before the event a large catch is taken from the reserve. Having visited such an area myself, off the east coast of New Ireland, in the few weeks leading up to Christmas, I fail to see how this would have conserved anything. Presumably fish frightened out of actively fished areas tend to congregate in the protected one. The time-scale would have been too short for any population increase. It is possible that the harvest was greater thereby—no doubt for the people immediately involved, conceivably also for the overall stocks concerned. Some fisheries students at the University of Papua New Guinea have also suggested that controls within some northern coastal communities have recently been instigated.

Although I can find nothing relevant on the effect of village-type reserves, there is evidence that where rights of exploitation were rented out over-exploitation sometimes resulted. Luytjes [1923], for example, complained of mangrove degradation within concessions in Sumatra. Gramberg [1880] reports what appears to have been a marked decline in an estuarine clupeoid fishery of eastern Sumatra, access to which was given on payment of a fee. Once more I see self-interest more than a desire to

conserve, although I concede that limited-term access may have precluded any long-term concern for restraint.

The result of excluding outsiders would appear to depend on the level and origin of outside exploitation. Perhaps the best way to understand this is to imagine a coast with villages along it. In the absence of exclusive ownership, people from each village would tend to exploit stocks over a greater stretch of coast, but this would not of itself lead to heavier exploitation. Given disparities in each village's population size and adjacent area, it might even lead to a more desirable uniformity of exploitation. Only if people were more likely to take a greater harvest per head of overall population, or if exploitation by non-coastal people were more intense without reserves than with them, would the resources of the entire area be more likely to become depleted. It is difficult to see how the former case might have held but the latter might have been common where people could take larger catches and preserve them. This would seem to have been less the likelihood in areas such as New Guinea than in western Indonesia, for example, where fish have been salted and therefore the potential markets larger, and where wandering marine exploitation has been a livelihood, if only among a minority of people, for longer.

WHERE MIGHT TRADITIONAL RESERVES BE APPLIED TO MODERN MANAGEMENT PROBLEMS, AND WHAT MIGHT BE THE CONSEQUENCES?

In the preceding sections I have attempted to define some of the characteristics of traditional tenure of marine areas. To begin with, there are quite clearly several types of problem which a system of traditional limited entry areas would be able to help little in alleviating. Areas of limited entry may not be able to do much for the consequences of rapid population growth, whether from intrinsic increase or immigration; they may not stand up to sudden commercialization, where the tradeable value of a resource rapidly increases; they are going to be of little use in remote, sparsely-populated areas; and they are unlikely to be of any use for regulating the exploitation of migratory-species. It is, however, hard to conceive of any generalized type of significant coastal problem to which these areas might be of great use. Conceivably they might help protect relatively sedentary species of local subsistence value, but the pressures on such resources will probably be endogenous as much as external, and there is little evidence that the system can cope with the former.

It can be claimed that the social basis for these systems has something to offer the manager. Perhaps the basic message of the traditional conservation ethic in this context is that people obviously have to be involved in the development of their resources. If so my worry is whether most people are able to differentiate between "good" and "bad" development. Traditional ownership is, in fact, at least in Papua New Guinea, a major bane of fisheries officers [*e.g.*, HAINES 1982]. The radical conservationist might claim that this proves the point; people have evidently decided that they do not want development. I do not believe that such a conclusion would

be warranted. I have heard of cases in Papua New Guinea where people have entered with apparent willingness into fisheries development projects [e.g., the Sepik *solpis* program], or have accepted large revenue from development of a resource by others (e.g., the Kavieng tuna-bait fishery). Perhaps problems arise primarily where a number of owning groups and a valuable resource is involved: it becomes a matter of status how much is paid and to whom. The difficulty of developing and managing coastal resources in an inter-village cooperative way in Papua New Guinea would seem to be next-to-insurmountable. To be sure legal controls in management are useless without responsibility, and this may come about through ownership of some kind. To the extent that biological resource management is a compromise, between the need to generate further knowledge and the urgency to act now, such ownership could be expressed through traditional tenure systems. From my analysis, I believe that this conclusion is based on misconceptions about tenure, and it is certainly not without disadvantages to other beneficial activities, of which conservation is but one.

A further feature of ownership patterns is their flexibility. Of New Guinea tenure, Crocombe and Hide [1971] state:

In the short term, the lack of formal courts and rank hierarchies led to the settlement of disputes more in terms of current pressures than ideology, by negotiations or warfare. Flexibility is a distinctive characteristic of all tenure systems, and powerful individuals could select and manipulate those principles which would maximize their own advantage.

Haines [1982] warns specifically against formalizing tenure systems in Papua New Guinea fisheries. The Report of the Papua New Guinea Commission of Inquiry into Land Matters [ANON. 1973] also emphasized that not only is the demarcation of boundaries between groups difficult, it may in fact contradict inter-group relations. It also points out that membership of groups is such that to translate it into registered title is next to impossible. Even if the system could be rigidly imposed, the assumption would still be that people are "in balance" with the resources deemed most worthy of management. I have yet to see any support for this.

If traditional reserves do not typically promote conservation in any practical sense, if they often inhibit development which, it is claimed, should go hand-in-hand with conservation, and if we cannot codify their structure, what is there left? Perhaps we are left with a message that man and biological resources are intimately related, that any effect on one may have consequences for the other. I am not sure whether we have to preserve a tenure system specifically to remind us of this! I am not suggesting that the system be abolished—in countries such as Papua New Guinea this would, in any case, be impossible—but rather that, in this context, we cannot prop it up with spurious evidence of supposed roles in conservation.

My main concern, however, is whether these traditional systems can really mitigate the adverse effects of massive change. It is perhaps unreasonable to expect them to respond appropriately to novel developments far removed from the conditions under which they evolved, but such robustness is indeed necessary in the real world. If I end thus on a pessimistic note it is not for want of trying to understand

the context which I set myself at the start. Throughout, my attempt at analysis has been plagued by a lack of information. If I conclude that the traditional conservation ethic is somewhat ill-conceived in this setting I would nevertheless be among the first to admit that our knowledge of marine tenure in this region is derisively fragmentary. A great deal more should be done to elucidate the structure and functions of sea tenure systems before they are lost altogether, or to attempt to reconstruct information on those that may already have disappeared.

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