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Government-supported, village-based management of marine resources in Vanuatu

R.E. Johannes*

R.E. Johannes Pty Ltd, 8 Tyndall Court, Bonnet Hill, Tasmania, 7053, Australia

Abstract

The Fisheries Department of Vanuatu catalyzed a striking upsurge in tradition-based marine resource management in fishing villages in the early 1990s. Of 26 villages surveyed, only one had not introduced new village-based marine resource management measures between 1990 and late 1993. Although government assistance and advice in this connection covered only one species, trochus, the success of conservation measures for it prompted villagers to introduce controls over fishing for many other species of fish and invertebrates. Vanuatu's experience yields many lessons for initiating effective, inexpensive, government-assisted, village-based marine resource management. It also reveals how a local shoestring operation can have much greater success than a fisheries development project costing tens of millions of dollars. © 1998 Elsevier Science Ltd. All rights reserved.

1. Introduction

Effectively monitoring and managing small multi-species and multi-gear near-shore fisheries using conventional Western methods has generally failed in developing countries, including those in Oceania [1]. Despite several decades of effort, it has been widely concluded that there are few, if any, Pacific Island inshore fisheries which are currently managed [2].

It is true that few Pacific Island in-shore fisheries are currently being managed by *government personnel*. But it would be wrong to conclude that they are not being managed at all. If management means regulating who may fish, when and where they may fish, what methods they may use, and/or what they may catch, then fisheries management by villagers themselves has been widespread in Oceania for centuries. It is now apparent that far more has been going on in terms of local marine resource

* Tel.: 00 61 3 6229 8064; fax: 00 61 3 6229 8066; e-mail: bobjoh@netspace.net.au.

management in the region than some national authorities or fisheries administrators have been aware of until recently. Moreover, such local management activities are increasing in some countries in the region, including Vanuatu.

However, it cannot be assumed that Pacific Island marine resources are necessarily being managed well. Management of marine resources by traditional villagers does not guarantee their sound use. There are several reasons for this. One is that colonial governments, often ignorant of pre-existing management structures and institutions, introduced various types of ineffective centralized natural resource management policies that persist today and often greatly weaken local authority [3]. Another important reason is that villagers usually lack adequate scientific information on which to base management decisions. Toloa et al. identify the issue [4]. "The people of Tokelau feel that the traditional conservation system has served them well over the centuries. They are also aware, however, of the need for modification of the system to reflect recent changes. ... Although the output from [marine biological research in Tokelau] has been utilized to some extent, a mechanism should be established so that the results are more fully incorporated into the Council of Elders' management plans."

Villagers may not understand the need for certain types of management. Or, if they do, they may not know how to formulate management plans to address those needs effectively. The introduction of commercial fishing, the rise of trochus (*Trochus niloticus*), giant clams (*Tridacna* spp.), bêche-de-mer (Class Holothuroidea), green snail (*Turbo marmoratus*), rock lobsters (*Panulirus* spp.) and pearl shell (*Pinctada* spp.) as important exportable resources, and the introduction of new fishing gears and faster boats have all brought new management challenges with which traditional arrangements were not designed to cope.

In common with fisheries departments of other Pacific Island nations, that of Vanuatu now realizes that managing most of its coastal fisheries from Port Vila is impossible [5]. The costs of research, monitoring and enforcement in the multitude of small fisheries associated with the nation's several hundred coastal villages would greatly outweigh the benefits. But the Department is beginning to play a vital indirect role in management by working in the villages to help combine local knowledge with modern research-based knowledge, to improve village-based marine resource management.

This type of "cooperative management" began modestly in Vanuatu in 1990, when Moses Amos, a trochus specialist in the Fisheries Department, announced over Radio Vanuatu that the Department would provide advice on trochus management to fishing rights owners who requested it. Response was enthusiastic, and Mr. Amos and his team began to carry out trochus surveys on village fishing grounds. They also gave the villagers basic information on trochus life history and advice on such things as why minimum size limits on trochus are desirable, where trochus refuges might best be situated, and for how long their trochus fishery should be closed in order to rebuild stocks. The approach was deliberately informal: "Every evening, after each day's diving, the Research Officers arrange for further informal discussions with resource owners and fishermen, about the importance of harvesting only legal size shells. (These discussions are usually held around bowls of kava)" [5, p. 16].

Mr. Amos ensured that information flowed in both directions. For example, learning from villagers about temporal trends in their trochus populations provided information useful in formulating management strategies. Fisher's information on local near-shore currents helped him decide if and where to suggest setting aside a trochus breeding preserve.

Villagers were not forced to adopt rigid management plans based exclusively on biological considerations. Rather, final decisions were left to local people who need to balance biological considerations with local social and economic concerns. In choosing the length of a ban on trochus harvesting, for example, villagers may wish to opt for a shorter period than would be ideal biologically, to obtain cash for a planned community project or to rebuild after a cyclone.

Of necessity the Department's work had so far been limited mainly to trochus fisheries. But clearly it offered a basic general approach to cooperative management that could be applied both over a wider range of species as well as elsewhere in Oceania.

In this article I describe the results of three weeks of interviews carried out in Vanuatu in November 1993 to examine the strengths and weaknesses of this cooperative management approach and its potential for wider application. A detailed quantitative study would have required much more time and money than was available. A brief, largely qualitative survey seemed to be a practical alternative. The main questions addressed by the survey were:

- How widespread is the demand by villagers for technical advice on management of marine resources?
- How well has this advice been received and what have been the practical consequences in terms of improved management?
- What is the scope for extending this approach to other marine resources?
- What are some of the features of customary marine tenure (CMT) that affect the effectiveness of marine resource management by the community?
- What lessons can be learned from the experience of Vanuatu that could be useful to other countries?
- Do the laws of Vanuatu adequately protect CMT and villagers' rights to manage their marine resources?

2. The interviews

I carried out interviews in most of the coastal villages on the Islands of Efate and Emai as well as in a number of villages in the area of Southeast Malekula. I was assisted in these interviews by Moses Amos on Malekula and Emai and, in most cases, by William Naviti on Efate. Mr. Naviti also carried out interviews for me in two fishing villages on Ancityum. To expand the areal coverage I also interviewed several people in the capital, Port Vila, who were familiar with village marine resource management regulations in their home villages on other islands.

I sought out chiefs, as well as elders who had reputations as being especially knowledgeable about fishing. Chiefs (who were sometimes also knowledgeable fishers)

were interviewed not only as a sign of respect for their authority, but also because it is they who are usually most centrally involved in making management decisions concerning the villages' marine resources.

I ensured always to include certain basic questions in my interviews. But I made the interviews informal and unstructured rather than adhering to a standardized survey-style format, so as to pursue unanticipated local issues or local marine knowledge that emerged during the course of the interviews [6].

In some cases I was asked to explain my interests to the villagers as a group. Since the villages in question were small, I used these opportunities to interview the entire gathering. At other times just one or two people were interviewed.

Each village of Vanuatu has for centuries claimed the exclusive right to harvest marine resources from the adjacent shallow waters, through its chief or its constituent clans or families under a CMT system [7]. All reef flats are thus owned, and the national Constitution upholds these traditional rights [5]. Within the framework of CMT, I concentrated on determining how and when recent local fishing regulations or "taboos" had been designed and implemented, the problems encountered, and the attitudes of village leaders toward the continuing use of this approach to marine resource management.

In addition, I tried to determine how villagers regarded government assistance, both from the Fisheries Division in designing and implementing local management regulations and from the courts in enforcing those regulations.

3. Results

3.1. Village-based conservation measures

All but one of the 27 villages surveyed employed some form of explicitly conservation-based taboos on their fishing grounds, and all asserted their right to exclude outsiders from their fishing grounds. This last measure, although not always employed with conservation in mind, reduces harvesting pressure and thus serves the purpose of conservation in waters where resources are limited relative to demand.

The interviews revealed that village-based marine conservation has experienced a remarkable upsurge in Vanuatu since 1990. In most of the 27 villages surveyed, explicitly conservation-based fishing taboos had been applied for the first time in living memory only within the previous 3.5 years. In several other villages some such taboos had been employed prior to 1990 (e.g. Analgawat, Mangaliilu, Marae, Ebau, Tongamea), sometimes for as long as anyone could remember. In earlier times these taboos usually focussed on trochus and green snails (although at Marae a 1–2 year ban on taking of octopus was used periodically to rebuild stocks). In most of these villages, however, these controls had been diversified since 1990 to cover other marine resources.

The only published descriptions of CMT in parts of Vanuatu [7, 8] do not prepare the researcher for the exceptional variety of ways in which marine conservation

measures have developed recently within its framework. No two villages surveyed in the present study were identical in this regard (Table 1).

Queries concerning the cause of this sudden, widespread flowering of marine conservation revealed that the educational efforts of the Fisheries Department, along with those of the government Conservation Unit played a major role. Education in the villages by the Fisheries Department has focussed largely on trochus conservation. But since these efforts began, less than four years earlier, villagers have perceived that what works to conserve trochus can be adapted to other species. Accordingly, they have introduced regulations controlling the harvest of many other species. In short, the Department's efforts have been favored by a prodigious multiplier effect.

Village-based fishery closures can be divided into those that involved the total closure of fishing grounds and those that were species or species-group-specific. An example of the former are the closures for trochus and green snail harvesting.

The Fisheries Department usually advises villages to implement trochus closures for a period of two to three years. Three years are required from larval settling to the attainment of legal harvestable size. Regulations in Vanuatu stipulate a minimum harvestable size of 90 mm across the base of the shell. Bour and Granperrin [9] report that trochus in Vanuatu achieve an average size of 94 mm three years after settlement. For green snails, this period is thought to be similar or only slightly longer [10]. Thus, for the present at least, it seems appropriate to combine trochus and green snail harvest closures, as has already done in several villages surveyed.

Closure periods for trochus ranged from one to five years (Table 1). Where one-year periods have been adopted, the decision was based at least in part on villagers' unwillingness to be deprived of trochus income for longer periods. Four and five year closures seemed to be based on reasoning that if two- or three-year bans are good, then longer bans should be even better. Adherence to the government size limits on trochus shell was said to be rigorous in some villages but not in others.

Only two villages employed *bêche-de-mer* harvesting closures. One reason is that stocks in Vanuatu are naturally rather limited [11] and so are of minor economic importance in most villages. Further, several species of differing sizes are involved, and the biological information necessary for designing optimal management strategies with which the Division could supply villagers is very limited. Leaders in one village attempted to impose a closed season on *bêche-de-mer*, but it broke down because of understandable arguments over just what constituted an appropriate closure period. One village had imposed a total taboo on *bêche-de-mer* harvesting because of a concern over its possible impact on the reef community as a whole. This was based on an apparent misunderstanding concerning the biology of *bêche-de-mer*. (Two villages had size restrictions on *bêche-de-mer* but I did not have time to investigate the details.)

Rock lobsters are an important commercial resource in some villages. To complement government size limits and its prohibition on taking berried females, two villages had imposed closed periods on their lobster fisheries.

Regulations exist for other species. Octopus were often said to be important components of the village catch. Three of the villages surveyed had specific closure periods for octopus (Table 1). Other marine animals for which specific closure periods

Table 1
Village-based fishing restrictions

1. *Species tabooed*^a

All species – Marae, Lamén, Emua, Ebau, Pelong, Uri, Litslits, Uripí, Tongamea, Tabakoro^b, Analgawat, Lamap^c
Trochus or trochus and green snail – Lamén, Erakor, Eton, Mangaliilu, Seviri, Pelong, Lutes, Marae, Tabakoro, Utche, Analgawat
Trochus, green snail and bêche-de-mer – Tongamea
Trochus, green snail and lobster – Aneitcho (Port Patrick)
Octopus – Sangava, Marae, Pescarus
Bêche-de-mer – Mangaliilu^d, Emua
All shellfish – Marae
Mangrove crabs – Uri
Shore crabs, limpets, parrotfish and rudderfish – Anawanjei
Rock lobsters – Analgawat

2. *Methods tabooed*

(a) *During closures that involve species other than molluscs*^e

All methods – Lamén, Marae, Emua, Ebau, Pelong^f, Uri^g, Uripí, Litslits, Tabakoro, Tongamea, Pescarus
Night spearfishing – Pelong, Uri
Gillnetting – Pelong, Tabakoro, Utche, Uri
Dropline fishing – Tabakoro
All methods except bow and arrow or throwing spear – Lamap
All methods except line fishing and daytime spearfishing – Pelong

(b) *At all times*^h

Breaking coral or not replacing rocks properly while reef gleaning – Erakor, Marae
Gillnetting – Utche
Commercial gillnetting – Uripí
Spearfishing – Utche
Night spearfishing – Mangaliilu

3. *Extent of Areas Affected by Closure*

All village fishing grounds – Mangaliilu, Erakor, Lamén, Emua, Paunangisu, Uri, Norsup, Tautu, Tabakoro, Aneitcho (Port Patrick)
About half the village's fishing ground – Marae, Ebau, Litslits, Sangavaⁱ
Smaller portion – Uri^j, Pelong^g, Tabakoro, Tongamea
Individual subdivisions of fishing ground owned by different descent groups, i.e. clans or families^f – Lamén, Uripí, Pescarus, Pelong, Lamap, Lutes, Tautu, Marae, Analgawat

4. *Duration of closures initiated during the past three years*^k

None – Taniau
One month – Sangava
Three months – Uri
Six months – Uri
Seven months – Uri
One year – Erakor, Mangaliilu, Paunangisu, Ebau, Pelong, Lamap, Norsup, Tautu, Tabakoro, Marae, Pescarus, Analgawat, Anawanjei
Two years – Lamap, Uripí, Pelong, Sangava^l, Analgawat (1.5–2 years)
Three years – Marae, Lamap, Tabakoro (2–3 years)
Five years – Uri^g, Pelong^f, Seviri, Pescarus (4–5 years), Aneitcho (Port Patrick)
“Until it is decided that the area is ready.” – Tongamea
Indefinitely – Mangaliilu^d, Emua^m

Table 1 (continued)

5. *Size restrictions*ⁿ

Mangrove crabs – Uri
Bêche-de-mer – Uri, Sangava

6. *Villages in which reef taboos were traditionally related to*

(a) A chief's death or initiation – Marae, Lamén, Erakor, Mangaliilu, Emua, Ebau, Uripí, Analgawat
(b) Any family member's death – Lamén
(c) Circumcision ceremony – Uripí

7. *Villages where the custom(s) described in item 6 have been abandoned*

Marae, Erakor, Mangaliilu, Emua, Ebau, Uripí, Analgawat

8. *Villages in which conservation-based fishing taboos have recently been, or are soon expected to be abandoned.*

Erakor, Uripí, Mele

9. *Villages no longer asserting exclusionary rights to their fishing grounds*

None of the villages surveyed

^aVillages are often listed more than once here because they ban the taking of different species or species-groups at different times and places.

^bFishing for special community occasions allowed.

^cFishing with hand spears and bow and arrow allowed.

^dThis closure has recently been abandoned. See text.

^eVillages are often listed more than once here because they ban different methods at different times and places.

^fSome of the other villages with fishing grounds split between several different owners, but these fishing grounds were nevertheless currently being managed collectively as a single unit for conservation purposes (see text).

^gA clam preserve of about 150 by 150 m.

^hIn addition village authorities also often emphasize the importance of observing government marine conservation laws (see text).

ⁱProposed for 1994.

^jA special preserve of 100 ha.

^kOpenings may be for much shorter periods than closures, especially in the case of trochus and green snail, for which the reef may be opened for as little as one week.

^lNight spearfishing

^mBêche-de-mer

ⁿIn addition to the government's size restrictions trochus, green snail etc, size restrictions are sometimes also imposed by buyers of bêche-de-mer and other commercial species.

were reported were limpets, parrotfish, shore crabs and rudderfish (all on a single family's fishing grounds at Anawanjei) and mangrove crabs (at Uri).

Restrictions are also imposed on specific methods of fishing. Gillnetting is prohibited in some villages. The explanations given were uniform: “it catches too many fish”. (Indeed, uncontrolled gillnetting has devastated certain reef fish stocks in a number of other Pacific Islands [12], and villagers elsewhere in Oceania have similarly banned the use of gillnets [12, 13]. Night spearfishing using flashlights is banned in some villages because it enables fishers to deplete stocks of certain fish, especially large parrotfish.

3.2. *The experimental and rapidly evolving nature of village-based marine conservation*

Although a basic awareness of the relationship between excessive fishing pressure and declining stocks is lacking in villages in some Pacific island areas [14], such awareness was clearly manifest in many villages I visited in Vanuatu. In some, it apparently has traditional roots. For example, some villages had employed explicitly conservation-based fishing closures for periods ranging from several decades to as long as anyone could remember. But it was also clear that the recent dramatic upsurge in villagers' interest in marine conservation is largely the result of the educational efforts of the Fisheries Department.

Many villagers are convinced of the benefits of the recent regulations on fishing, judging not only by their enthusiastic comments, but also by the ways these regulations are evolving. A number of villages decided on the basis of their initial experiences to extend the length of closures. For example, the period of total closure of fishing grounds at Uri, has been successively increased from three months to seven months, then to a year, and in Seviru the trochus closure has been extended from 2 to 5 years.

In only three of the 27 villages surveyed was regulation being abandoned. In each case the basic reason given was lack of community unity. Termination of local management efforts was brought about in one village by complex, long-running, initially land-based disputes among land and reef owners. In none of the three cases was cessation reportedly due to any disillusionment concerning the conservation benefits of the regulations.

Two village leaders told of experiences that have caused them to modify the way in which a fishing taboo is formally declared. When fishing taboos were merely announced without fanfare, observance was unsatisfactory. Now, in these villages, closures are announced with substantial traditional ceremony. Pigs are killed, a feast is held and church leaders are asked to bless the taboo. By thus impressing villagers with the seriousness of these taboos, their observance, according to these leaders, is now much improved.

In the old days curses were put on the reef so that anyone breaking the taboo was threatened with supernatural retribution as well as fines. Such curses remain in use in certain villages today and are reportedly taken seriously. One man in a village on Emai collapsed and died while poaching on such a reef and this "lesson" has reportedly been taken to heart by the rest of the community.

Another chief said that the fine associated with breaking the taboo on trochus harvesting in his village was specified at the outset, but for poaching in waters closed to harvesting of all species, village leaders had simply mentioned an unspecified fine. The former taboo was well observed, the latter was not. The lesson taken from this, he said, is to announce specific fines firmly at the beginning of any closure period. Fines are typically stipulated in pigs, cattle or cash, or both livestock and cash. Some are also being levied in terms of labor on community projects or kava. Fines ranged from the local currency equivalent of USD50 to 130 and/or up to 3 pigs, depending on the village and the perceived seriousness of the transgression. Since a full-size pig may be worth more than USD100, and since the per capita GNP is less than ten times that amount [8], it can be seen that these fines are stiff.

The relinquishing of control by village sub-groups over their sections of village fishing grounds was a trend commented on favorably by village leaders. Unfavorable comments were elicited by the opposite trend, i.e., where subgroups are increasingly assertive concerning their individual rights and uncooperative with other fishing rights owners in the village. One or other of these opposite trends was reported from each of several villages surveyed.

Villagers were asked how they adapted to the temporary loss of animal protein from their fishing grounds during total closures. The six main responses were by

- greater reliance on land-based sources of animal protein;
- fishing with negotiated permission, and often some form of payment, in nearby waters of other villages;
- purchasing more local seafood from a nearby market or village;
- purchasing more canned fish or meat;
- greater reliance on fish caught outside the reef in untenured waters; and
- reducing consumption.

3.3. *Customary marine tenure (CMT)*

Little has been published on customary marine tenure in Vanuatu. The details of the system vary regionally, and even locally. Rights to waters contiguous to traditional land holdings are owned by the chiefs, clans, or villages that own the land. Rights may be subdivided and allocated to individual heads of families. Traditionally, a fishing ground that is closed to fishing by the owners is signified by the leaves or branches of certain trees (species vary with locality) fixed to or placed near boundary stakes on the beach or in the water. In earlier times those violating such taboos were killed or fined in pigs. Today punishment may be in the form of monetary fines.

Primary tenure rights are transferred via inheritance, which may be patrilineal or matrilineal. These systems are flexible enough to make allowances for such things as the settlement in the community of people from outside. Traditional fishing rights are rarely alienated. Secondary rights may be possessed by those related to the primary rights holders by marriage or adoption. Fishing rights typically extend from shore to the outer reef slope, but in some cases may also encompass deeper offshore waters or shallow offshore banks. Means of resolving traditional fishing rights disputes are described below.

There is no single body of custom relating to marine tenure in Vanuatu; there are over 100 different village language groups with differing resource tenure customs. In many places land and sea tenure rights are inherited through men, but in some it passes down through women. This survey revealed that even within single language groups details of the marine tenure system might vary between neighboring villages.

Customary marine tenure not only survives throughout Vanuatu, but is going through a period where exercising the right to exclude outsiders and regulate one's own groups' activities on the fishing grounds is intensifying.

Ownership of marine resources creates opportunities not only for resource management, but also for dispute. Considerable population movement in Vanuatu over the

past century was associated with coastal land alienation for plantations, etc., and by church settlements. Since custom laws were never written down, this resulted in poorly remembered histories of traditional ownership of land and associated fishing grounds in some areas, and when ni-Vanuatu reclaimed these alienated areas after independence, disputes developed. As Nalo et al. state [15]: "Sometimes a request for identification of custom owners can stir up old disputes that have been sleeping for many years, or the desire for money can lead to claims which have little foundation in true custom."

One such claim, said to be made by a number of villages, is that their traditional fishing rights extended well beyond the outer reef edge and sometimes all the way to the horizon. Such claims are often viewed with skepticism, especially in cases where neighboring villages make no such claims. Ni-Vanuatu refer with conscious irony to such apparently spurious claims as "new history".

There are typically six levels of dispute resolution available to a fishing rights owner within a clan. Dispute resolution between clans or between villages also begins at the appropriate level in the following sequence:

- First, the dispute is referred to the heads of families within the clan(s). If this fails it can be taken to the council of the subchiefs of the village, subsequently to the head chief, and then it may be referred to the council of chiefs of the area.
- In the event that this still proves unsatisfactory, a dispute can be taken to an Island Court (Island Courts Act {Cap. 167}). These are local courts staffed by justices who are local chiefs knowledgeable in custom. Decisions in Island Courts, while judged in accordance with custom, are nevertheless enforceable by law. (Not all of the 11 rural regions had established operational Island Courts in late-1993).
- Appeals from an Island Court decision on customary tenure go to the Supreme Court (cf. Island Courts Act). There, the chief justice sits with assessors knowledgeable concerning the traditions of the area where the dispute has arisen. The Supreme Court's decision on custom tenure questions is final. Although the Supreme Court has heard hundreds of land disputes, so far very few fishing rights disputes have reached it. I learned of only two.

According to villagers, however, sea rights disputes have been increasing in the past several years. This was said to be due to the increasing economic value of trochus and the growing significance of the cash economy in village life, and because of disagreements over traditional boundaries and the nature and allocation of rights within those boundaries.

3.4. CMT and the law

In Vanuatu, as in many Pacific island countries, land tenure is the most contentious and widespread legal issue [16]. In formally identifying custom owners and determining their traditional rights the government gives priority to land that is the subject of dealings under law (for example, leases, logging contracts, declarations of public land). The legal framework for dealing with these problems remains inadequate [16]. And since near-shore marine resources have seldom been subject to such dealings, the

development of formal government procedures for dealing with customary marine tenure has lagged behind those dealing with land tenure.

Chapter 12, Article 71 of the Constitution of Vanuatu establishes that "all land in the Republic belongs to the indigenous custom owners and their descendants." And "land" includes "land extending to the seaside of any foreshore reef but no further" under the Land Reform Act (Cap. 123).

Thus, government laws concerning land in Vanuatu often pertain to tenured marine areas. According to Nalo et al., [15] however, the Land Leases Act stipulates that customary owners cannot lease their reefs as they can their land. (Other types of arrangements can be made whereby reef tenure holders can rent their use rights to other interested parties. Disputes concerning such arrangements would be settled under contract law, not the Land Leases Act [17].) The confusion this produces is illustrated by a current dispute which involves fishing grounds contiguous to a piece of land owned by a chief but leased to another individual on Emae. The fishing grounds in question are part of those belonging to the chief's village and controlled in the village's behalf by the chief. The latter placed a taboo on fishing on the village fishing grounds. The lessee complained that since the accepted tradition is that coastal land owners also own the fishing rights to contiguous shallow waters, he should have the right to use the fishing grounds associated with his lease as he sees fit and not be subject to the taboo. But the accepted tradition that the lessee speaks of may only be relevant to land *ownership*. As mentioned above, the law says that land *leases* may extend only as far as the high tide mark.

Judgement in the dispute was pending in the Supreme Court in late-1993. The case highlights the confusion that exists because of a failure of the law to deal clearly with CMT. The decision in this case appears to have considerable potential influence on the operation of future leases in Vanuatu's coastal zone.

In another case on Malekula, the local police chief was reportedly told by a member of the National Government to instruct a village chief to desist in his attempts to impose a taboo on fishing against the wishes of a subordinate chief. Here people are perplexed as to who is really in charge in this situation: the village chief, as indicated in the Constitution, or the government official?

Many custom reef owners commented that their disputes should and would be settled in due course by customary procedures, and that government involvement would accomplish little other than further complicating the issues. If serious crimes, like acts of violence, were committed as a result of such disputes, then the government should act to punish the offending individuals. Even then, however, they stressed it should not get involved in the dispute that occasioned the violence. That should be handled locally and according to traditional dispute resolution procedures.

This feeling was not universal, however. At Port Patrick, on Aneityum, local reef owners, unsatisfied with local dispute-resolution procedures, successfully petitioned the Minister of Fisheries to pass a regulation (Fisheries [Management and Conservation Measures] Regulation No. 35, of 1993) specifically recognizing their rights to close their fishing grounds to the harvesting of trochus, green snails and rock lobsters for five years.

4. Discussion

Lindley, 1993 [18] states that “there is no great pressure on shallow reef resources anywhere in the country outside of areas with commercial access to Vila and Luganville”, and that, “it is unlikely that overfishing of the shallow reef will occur in most rural areas for a long time to come”. It would be interesting to know how these conclusions were reached since there are no data for such areas. Moreover, fishers in most villages surveyed said they had imposed fishing closures because their reef resources were seriously depleted. Some said catches were insufficient to supply the needs of the village, let alone products for sale outside.

Around some islands there are long stretches of uninhabited coastline. These may be underfished. But this is of little practical consequence to village fishers who lack either the mobility or, often, the traditional right to exploit these resources, and who therefore must rely on dwindling local stocks.

The rapid expansion of village-based marine resource management in Vanuatu has occurred at a time when villagers’ already-limited incomes have been further reduced since the mid-1980s by a prolonged drop in the price of copra (once the main source of village income, but now fetching only about 25% of its post-WWII high value) and cacao. The problem was exacerbated by cyclones that had badly damaged many plantations. The need for money was thus reportedly acute in many villages. Yet villagers were widely putting aside opportunities to earn quick cash from their marine resources, in exchange for the greater long-term benefits of conserving them. Trochus sales have reportedly declined compared with a few years ago, apparently partly because of the increased number of villages that have tabooed their harvest [19].

It is too early to evaluate the quantitative significance of these new management strategies. The importance of making such evaluations will be discussed below. In the absence of quantitative data, the enthusiasm of villagers concerning the perceived benefits of their new management strategies is encouraging; not only in terms of the apparent improvement in resource productivity, but also because it makes it more likely that the recent flurry of such initiatives will not be short-lived.

4.1. Improving government support for village-based management

At present villagers are exploring controls over a wide variety of marine resources in the absence of technical advice. Trochus management through periodic closures is now taking place in many villages without the direct involvement of the Fisheries Department, encouraged by the results they have heard about from villages that have been motivated by the Department’s team. For similar reasons, closures are being implemented for other species, species-groups, or entire sections of shallow water fishing grounds.

This is not a bad thing. Village fishers are well placed and highly motivated to evaluate the effects of their closures. And, as the survey revealed, they are quite capable of modifying management as their knowledge of its effects improve.

But some relevant aspects of the life histories of target organisms are unknown to fishers. For example, before Mr. Amos advised them that trochus took three years to

grow from settlement to commercial size, villagers had little idea of how fast this species grew, and thus had rather hazy notions of how long a closure would be effective as a conservation measure. In addition, some principles of fisheries management cannot easily be learned simply through experience on the fishing grounds. For example, unless it is explained to them, fishers are unlikely to be aware that decreases in catch per unit effort or the mean size of individuals in the catch are not necessarily signs of overfishing.

Clearly, villagers could benefit from much more advice on a much wider range of subjects than is available at present. How can the government lend further support to efforts that are clearly in the best interests not only of villagers, but also the national economy as a whole?

Expanded Fisheries Department support for village-based marine resource management appears to hold great potential. It seems likely that it would be widely welcomed. Such support can be divided into research and extension services.

4.2. Expanded research

The value of research on the effects of experimental management on marine resources is widely recognized [20–22]. But opportunities for it are very limited in most tropical areas (as well as much of the rest of the world) because of the general lack of suitable controls. The village marine resource management systems of Vanuatu appear to provide opportunities, unparalleled in number and variety, for research to quantify the benefits of such management.

Villagers already seem convinced of the benefits of such management. But politicians and aid agencies may only be convinced – and thus persuaded to support expanded activities in this area – if they see hard data. Such data would also be of great interest to marine resource managers and researchers in other tropical coastal regions.

Research on the effects of closures of varying lengths on finfishes, trochus, rock lobsters, mangrove crabs, green snails, giant clams, various species of *bêche-de-mer* and other species that are important economically in large areas of the tropical Indo-Pacific would also be of great interest and value. Management systems in certain villages even offer researchers useful spatial as well as temporal controls; i.e., when one-half of the village’s fishing ground is closed, and the other half is open.

Monitoring the impact of closures on some trochus populations deserves highest priority for both economic and historical reasons. Mr. Amos and his group have already gathered systematic quantitative data on trochus size distribution and abundance on several hundred transects on various village fishing grounds prior to their closure.

Nash, 1993 [23] observes that, because of the short pelagic stage and consequently limited dispersal capacity of trochus larvae, “the unit of stock is probably of the order of 10 km in linear dimension” a circumstance, he points out, that makes the species well adapted to experimental management. Since tenured fishing grounds in Vanuatu are often of similar dimension, the opportunity of using them in experimental management research on trochus seems particularly promising.

These management systems appear to offer so many opportunities for valuable research that overseas as well as local researchers should be made aware of them. Indeed, such overseas research would have to be encouraged if full use is to be made of the opportunities afforded by these systems to help design optimal management strategies for tropical marine resources. Foreign-based research would, of course, have to be designed and carried out with the best interests of Vanuatu in mind, and with the approval of appropriate authorities at both national and village levels. Direct personal contact between village authorities and prospective overseas researchers would be more desirable in this connection than trying to arrange village-based research projects through intermediaries.¹

As described above, management in the villages is evolving rapidly. This is another reason that visits to prospective sites would be desirable before final research plans were made by overseas researchers. Another reason is that Vanuatu's shallow-water marine resources are legally owned and controlled by villagers and any research to be done on them depends upon their understanding and support. Their active participation, as well as some training, especially in appropriate monitoring methodology would also be highly desirable.

One way of identifying good sites for particular research projects relatively quickly would be to solicit the interest of villages with appropriate management plans, as the Fisheries Division has done in the past.

4.3. Expanded fisheries extension support

In Vanuatu, as elsewhere throughout the developing world, fisheries extension work has focussed largely on fisheries development. But where cooperative management is operating in artisanal fisheries, a supportive extension program needs to incorporate a new set of skills and knowledge. Extension workers must obtain information on village marine management strategies and on local knowledge concerning marine resources. They must also provide the complementary scientific knowledge and education that villagers need to manage their resources better.

Villagers do not want to be *told* how to manage their fisheries. What they do want is education concerning practical management alternatives. They need answers to such questions such as "what management measures are there for us to choose from, and where, when and for how long should they be applied?"

Learning how to carry out the appropriate interviews, discussions and other activities with fishers requires training that is not normally a part of a fisheries biologist's curriculum. This training lies partly in the realm of social science research methodology. Such training should be made available to those supervising extension officers in the Fisheries Department and, through them, the extension officers themselves.²

¹ For an excellent discussion of why dealing with village fisheries through intermediaries works badly in another Melanesian fishing culture, see Ref. [13] pp. 359–60 and elsewhere.

² Since this survey was conducted, this has happened in Vanuatu (Frances Hickey, pers. comm.).

4.4. Features of customary marine tenure systems that influence their value in supporting fisheries management

Social indices of the potential effectiveness of a CMT system in relation to fisheries conservation include the degree of

- the owners' commitment to management,
- community cohesiveness, and
- respect for village authority.

Where one or more of these is low, as in villages near Port Vila, and, reportedly on Aneityum, village-based management may be beset with problems.

It appears that villages are likely to be more successful in designing effective marine conservation programs where individual reef-owning descent groups (clans or families) are willing to subordinate their rights to those of the community as a whole. One example of this is where individual owning groups stagger their closures systematically, and allow other units from the same village to use their fishing area when it is open in exchange for the reciprocal rights when their area is closed. This means that some fishing area is always accessible to the entire village. Another approach in some villages is for families and clans to relinquish entirely their special rights over fishing grounds, entrusting them to the community as a whole, and participating in a community-wide management plan in which everyone's grounds are managed collectively as a single unit.

Geographically, Vanuatu's shallow waters areas favor the efficient operation of customary marine tenure because the reefs and lagoons are typically rather narrow. This makes surveillance relatively easy compared with conditions in some other countries.

4.5. Management options

Village fishers need to know what options are available to them to improve their management systems. For example, regulations in some villages might be more specifically targeted than they are at present, so as to protect vulnerable stocks without completely closing the fishing grounds. This would undoubtedly appeal to villagers for whom total closure means hardship. This is already being done in the case of bans on harvesting of trochus, green snail and lobster, which do not prevent fishing for other species. But the principle could be extended. Local knowledge could help provide the basic information required to decide on appropriate strategies.

One such strategy is the banning of fishing on seasonal migrations or seasonal spawning aggregations. This approach to management was seldom mentioned in the villages of Vanuatu. Nevertheless, fishers are often familiar with the location and seasonal timing of migrations and spawning aggregations of a number of species that are important in their fisheries. These are the times when such fish are usually at their most vulnerable to overfishing because of their dense concentrations and, frequently, their spawning stupor [24], which makes them unusually easy to catch in large numbers.

Elsewhere in the tropics local stocks have been completely eliminated from some areas through overexploitation of such migrations/spawning aggregations [25, 26, 6]. Fishers in several Vanuatu villages said they believed that overfishing at such times was responsible for the observed decline or disappearance of mullet, rabbitfish or mackerel in migrations or spawning aggregations in their areas.

4.6. Justification for expanded support for fisheries work in aid of village-based management

The Fisheries Department's achievements in providing relevant advice and motivation for village-based fisheries management have been outstanding. Villagers, too, also deserve a great deal of credit for this achievement. However, it is unlikely that they would have carried it out with such energy and speed without the encouragement and advice of Fisheries Department.

Throughout much of the developing world, however, politicians and foreign aid donors alike have focussed on conventional development so single-mindedly that they have perceived only dimly, or not at all, the economic benefits of increasing domestic production through conservation. And for Vanuatu, according to David and Cillaurren (1992, p. 44) [27], "in the opinion of the authorities, small-scale unstructured village fishing is incapable of generating a reliable increase in seafood production".

In the light of the past emphasis in Vanuatu on fisheries development over fisheries management, it is instructive to contrast the accomplishments of the Fisheries Department's shoestring cooperative management efforts, with those of the lavishly funded Village Fisheries Development Programme (VFDP), focussed on deep water fishing in Vanuatu. The VFDP concentrated on developing deep dropline fishing for high-value species. By 1987 it had received aid totally in excess of USD15 million from Australia, Canada, France, Japan, New Zealand, West Germany, FAO, the UK and the EEC [27, 28].³

The program failed signally to fulfil its stated goals. The reasons for the failure of the VFDP are discussed by Rodman and David and Cillaurren [27, 29]. The mean total annual catch from this fishery has amounted to a mere 5–8% of the catch from small-scale unstructured village fisheries. In addition, the bulk of the fish caught in VFDP-generated fisheries are too expensive for the poorer Melanesian families who need them most. In rural areas, "consumption of fish from village (VFDP-supported) fishing associations remains marginal, and can in no way be seen as a viable substitute for imported tinned fish" [27]. Moreover, because of the costs of importing the requisite equipment and supplies, VFDP-stimulated fishing for urban markets in Vanuatu is actually increasing the balance of trade deficit in those islands of Vanuatu which had VFDP fishing associations [27].

Although tens of millions of dollars of foreign aid money have been spent on the VFDP and the subsequent Extension Program evolving from it, a comparative

³ Later figures suggest much higher amounts have been spent. See, for example, [27].

pittance has been given to the "small-scale, unstructured fisheries" David and Cillaurren (1992) that are the target of the Fisheries Department's conservation efforts [27]. Yet these fisheries are of far greater sustainable value to Vanuatu, both in economic and nutritional terms, than the VFDP fisheries.

David and Cillaurren (1992) [27] calculated that in 1984 "the added imports of tinned fish that would have been required without the existence of the small-scale unstructured fisheries ... would have driven the cost of food imports up by 13.5 to 15.5%." Using these 1984 figures (the most recent available) it can be calculated that a 25% increase of village fish production for consumption by the local population, as might be achieved by conservation measures, would have saved the country about USD 0.4 million annually. In February 1994 prices for canned fish were roughly 45% higher than the 1984 prices given by David and Cillaurren (1992). Thus the savings today provided by a 25% increase over 1984 catch levels would amount to about USD 0.5 million annually.

The potential direct foreign exchange earnings of village-based management are not trivial either. For example, if village-based conservation of trochus stocks were to result in a sustained 25% increase in trochus production, this would mean additional foreign exchange earnings of almost USD 1 million, based on Vanuatu's 1992 trochus export figures of 193 t [30]. Added to this would be the foreign exchange earnings from increased production of green snail and bêche-de-mer.

Compared with the cost in foreign exchange of deep-water fishing, costs in these shallow water fisheries are minuscule. Most such fishing is done on foot or in unmotorized dugout canoes using implements of local manufacture or of minimal cost. Surveillance and enforcement cost the government almost nothing, since the villagers themselves perform them willingly and without pay. And their efforts are, of course, much more effective than those of any central government enforcement could be.

After acknowledging the failure of the VFDP Lindley (1993) [18, p. 34] stated, "The major problem now facing the department is in which direction future development efforts in the coastal fishery in rural areas must be directed. ... The only way forward seems to be diversifying the fishery so as to create more surplus ...".

A promising alternative does exist, however; greater emphasis on increased production of nearshore marine resources by means of village-based management. Increasing production through better management is, in the long run, the most sustainable form of development of natural resources there is. Moreover, it does not require the extravagant infusions of foreign aid that characterized the VFDP. This might appear to be a virtue. Inevitably, however, it will be judged as quite the opposite by many politicians and some aid donors.

5. Fishing rights disputes

Only a few disputes over tenured fishing grounds have reached the courts. The rest have been settled or are being settled at the grass roots level. This attests to one of the enduring values of the traditional system. But Vanuatu's shallow water marine

resources will almost certainly be subject to increasing dispute as economic development and the country's population continue to expand and place additional pressure on them. It seems likely, therefore, that the number of nearshore fishery disputes reaching the courts will increase.

In other parts of Oceania the biggest problems typically occur in and near district centers. Here, rapid population increase and the influx of outsiders and imported ideas have weakened local traditional authority and the ability to achieve the community consensus needed to agree upon and enforce effective management regulations. The same thing is happening in Vanuatu.

The significance of these problems for village fisheries management should be understood but not exaggerated. Fisheries disputes make news in Vanuatu, as elsewhere. Lack of dispute attracts no attention. The areas of reef and lagoon in the vicinity of the two urban centers of Vanuatu, Port Vila and Luganville, that are affected by such disputes, account for but a small percentage of the nation's coastal waters.

Nevertheless, if the power of local authority is allowed to continue eroding, this problem is liable to spread gradually. As elsewhere in the Pacific Islands, even remote areas will be affected [18, p. 34]. It seems vital that Vanuatu devise means to keep traditional authority strong. Where it weakens, the regulatory capacity of the traditional system also weakens, and no central government can expect to replace it effectively.

One element of the problem is that educated young people returning to their villages sometimes show little respect for village elders because of the latter's frequent lack of formal education or sophistication in outside matters. But it is the young people who are often uneducated when it comes to the importance of maintaining local systems of natural resource management. Aneityum, although not close to any urban center, is said to be especially troubled by this problem.

5.1. *The coordination of national law and customary marine tenure*

One of the virtues of customary tenure is its flexibility. Allowances are made, for example, for circumstances such as adoption, or the settlement in the community of people from elsewhere. This flexibility is also apparent today in the changes in village marine resource management practices that occur as resources become valued monetarily.

It has been widely observed that when such local customs and laws are precisely defined and fixed legally they tend to freeze tradition, leaving villagers less flexible in their responses to demographic changes, changes in technology, or other developments that require adjustments in local resource use patterns [12, 13]. For a different opinion see [32]. In some Pacific Island countries this problem has been addressed through legislation that guarantees the protection of traditional customs without specifying those customs in detail. Legal definition of the latter are arrived at on a case-by-case basis and only as a last resort when the need arises for detailed, locale-specific information during court-mediated disputes. Local leaders have generally tried to prevent this from happening by resolving disputes locally, whenever possible.

In the time available I was unable to obtain detailed information on the local fishing rights disputes described above in which the government has involved itself. But it seems superfluous and confusing to enact a government regulation asserting a traditional right already guaranteed by the Constitution (as in the Aneityum case, mentioned above), or for a member of the national government to try to direct a chief's decision in what appears to be local matter under the latter's jurisdiction, according to the Constitution (as in the Malekula case).

Moreover, these interventions set precedents that appear to offer an implicit invitation to all traditional fishing rights owners to petition the government directly to get similarly involved in their dispute. This may create endless and largely unnecessary headaches for the courts.

Such government actions will tend in the long run not to strengthen traditional authority, as was apparently intended in the Aneityum case, but rather to weaken it by creating confusion among villagers concerning just who controls these matters, traditional village leaders or the national government. Such uncertainty inevitably undermines local authority because of the ammunition it gives those who disagree with it. And the less secure the property rights villagers or their leaders perceive they hold over their fishing grounds, the less incentive they have to invest time and energy in managing them.

6. Summary and conclusions

The introduction of tradition-based controls on fishing for the purpose of marine resource management had occurred between 1990 and late-1993 in all but one of 27 coastal Vanuatu villages surveyed. The Fisheries Department set this trend in motion by assisting villages with their trochus management. The efforts of the Department and the benefits of closures are now widely appreciated by villagers, who have extended such controls to other species.

The example of Vanuatu suggests some strategies and conditions that would favor the success of government-supported, village-based management of tropical small-scale fisheries elsewhere. These include:

- Publicize in fishing communities the government's willingness to collaborate with villagers on management issues, and invite requests for assistance from interested villages.
- Start small, and not with a comprehensive plan to address many types of fisheries or many villages.
- Concentrate initially on villages where local marine tenure, local authority and community cohesion are strong.
- Concentrate initially on villages where fishing ground geography facilitates effective village surveillance.
- Focus initially on a single type or limited number of fisheries, preferably those that are
 - commercially important, and

- where useful management information is relatively easy to obtain (for example, benthic invertebrate species that are comparatively simple to census and monitor, such as molluscs (e.g. trochus, green snail, clams, pearl shell), or echinoderms (e.g. bêche-de-mer, sea urchins).
- Work towards ensuring that national law supports local authorities in their regulation of fishing by means of village-based prohibitions and enforcement mechanisms, but does not define these procedures too narrowly.
- Provide formal legal assistance in disputes only where local dispute resolution or enforcement has clearly failed.
- Train fisheries extension personnel in the skills necessary to help the community effectively combine local customs and knowledge with scientific knowledge for the purpose of marine resource management, by
 - studying local management procedures and relevant local knowledge concerning marine resources; and
 - obtaining relevant literature and research-based management information and disseminating it in forms that can be readily understood by the community.
- Leave final management decisions and enforcement to village authorities.

An additional factor favoring effective CMT-based enforcement of village regulations in Vanuatu is that only about 13% of the country's boats are motorized. This makes abuse of regulations more difficult than in some other Pacific Island countries, where poachers in high-powered boats can more easily evade apprehension.

Finally, given the lofty objectives of fisheries management as portrayed in most textbooks, it seems appropriate to conclude by providing those who still have faith in these techno-nostrums with some justification for management measures that have little quantitative foundation, such as many of those being used in Vanuatu villages today.

As noted earlier, the data necessary to provide such a foundation are quite beyond reach in small-scale, multi-species tropical fisheries, except, occasionally, for a few high-value benthic invertebrates whose populations are relatively easy to monitor. The consequent reluctance among fisheries biologists to impose regulations is one of the reasons for the dearth of effective government management initiatives in Oceania, despite decades of fisheries research. Marine resources, meanwhile, have been very seriously depleted in many areas. In such circumstances a fisheries manager should not aim for some management ideal, like optimum or maximum sustained yield, but neither should the manager give up. More realistic, but still invaluable objectives are simply to

- prevent serious overfishing;
- ensure a reasonably satisfactory allocation of resources; and
- to minimize conflict.

To achieve even two out of three of these objectives can be looked upon as a major accomplishment in any fishery.

In the opinion of some village fishers in Vanuatu, all three such objectives are being accomplished with the assistance of the Fisheries Department. It seems appropriate then, to ask the skeptics, when was the last time *they* met fishers who were that satisfied with the management of their fisheries?

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References

- [1] Smith A. Using customary practices in marine resource and coastal management in Yap State, Federated States of Micronesia. In *People, society and Pacific islands fisheries development and management*. Nouméa, New Caledonia: South Pacific Commission, 1991:15–22.
- [2] South Pacific Commission. Workshop on Pacific Inshore Fishery Resources. Nouméa, New Caledonia, 14–25 March 1988. South Pacific Commission, Nouméa, New Caledonia, 1988.
- [3] Dashwood J. Conflict resolution in the development of the Cook Islands pearl shell industry. In *People, society and Pacific islands fisheries development and management*. Nouméa, New Caledonia: South Pacific Commission, 1991:9–10.
- [4] Toloa F, Gillett R, Pelasio M. Traditional marine conservation in Tokelau. Can it be adapted to meet today's situation? Working Paper No. 7, South Pacific Commission 23rd Technical Meeting on Fisheries. Nouméa, New Caledonia, 1991.
- [5] Amos M. Traditionally based marine management systems in Vanuatu. *Traditional Marine Resource Management and Knowledge Information Bulletin* 1993;2:14–17.
- [6] Johannes RE. The plight of the Oshfish, or why quantitative sophistication is no substitute for asking the rights questions. *Naga*, 1993;16(1):4–5.
- [7] Taurakoto P. Customary rights to reefs and landings. In: Larmour P, editor. *Land tenure in Vanuatu*. Suva, Fiji: USP Institute of Pacific Studies, 1984:14–16.
- [8] Fairbairn TJ. Traditional reef and lagoon tenure in Western Samoa and its implications for giant clam mariculture. In: Tisdell C, editor. *Giant clams in the sustainable development of the South Pacific*. Canberra, Australia: Australian Centre for International Agriculture Research, 1992:169–189.
- [9] Bour W, Grandperrin R. Croissance des trocas à Vanuatu. Notes Doc. d'Océanogr., ORSTOM, Port Vila, Vanuatu. 1985.
- [10] Yamaguchi M. Green snail. In: Wright A, Hill L, editors. *Nearshore Marine Resources of the South Pacific*. Honiara, Solomon Islands and Suva, Fiji: Forum Fisheries Agency and Institute of Pacific Studies, 1993:497–511.
- [11] Chambers MR. Bêche-de-mer. In: Done TJ, Navin KF, editors. *Vanuatu Marine Resources: Report of a Survey*. Townsville, Australia: Australian Institute of Marine Science, 1992:86–91.
- [12] Johannes RE. Implications of traditional marine resources use for coastal fisheries development in Papua New Guinea, with emphasis of Manus. In: Pernetta J, Heaney W, editors. *L. Morauta, Traditional conservation in Papua New Guinea: Implications for today*. Port Moresby, Papua New Guinea: Institute of Applied Social and Economic Research, 1982:239–249.

- [13] Hviding E. Guardians of Marovo Lagoon: Practice, Place and politics in Maritime Melanesia. Pacific Islands Monograph Series; no. 14. Honolulu, USA: University of Hawaii Press, 1996:473.
- [14] Johannes RE, MacFarlane W. Traditional fishing in the Torres Strait Islands. Hobart, Australia: Commonwealth Scientific and Industrial Research Organization, 1991:268.
- [15] Nalo C, Hunt L, Boote E. Land tenure in Vanuatu today. In: Chambers MR, Bani E, editors. Resources development and environment. Port Vila, Vanuatu: ESCAP Pacific Operations Centre, 1988:78-92.
- [16] Weisbrot D. Custom, pluralism and realism in Vanuatu: legal development and the role of customary law. Pacific Studies 1989;13(1):65-97.
- [17] G. Tambe, pers. comm.
- [18] Lindley RH. End of contract report (of Vanuatu Fisheries Department Principal Fisheries Extension Adviser). Fisheries Department, Port Vila, Vanuatu, 1993, Unpublished manuscript.
- [19] M. Amos, (pers. comm.)
- [20] Sainsbury KJ. The ecological basis of tropical fisheries management. In: Pauly D, Murphy GI, editors. Theory and Management of Tropical Fisheries. ICLARM Conference Proceedings 9, International Center for Living Aquatic Resources Management, Manila, Philippines and Division of Fisheries Research, Commonwealth Scientific and Industrial Research Organisation, Cronulla, Australia, 1982:167-94.
- [21] Alcalá AC, Russ GR. A direct test of the effects of protective management on abundance and yield of tropical marine resources. J. Cons. int. Explor. Mer. 1990;46:40-7.
- [22] Hilborn R, Walters CJ. Quantitative fisheries stock assessment. New York, USA: Chapman & Hall, 1992:570.
- [23] Nash W. Trochus. In: Wright A, Hill L, editors. Nearshore Marine Resources of the South Pacific. Honiara, Solomon Islands, and Suva, Fiji: Forum Fisheries Agency and Institute of Pacific Studies, 1993:451-95.
- [24] Johannes RE. Words of the lagoon: Fishing and Marine Lore in the Palau district of Micronesia. Berkeley, USA: University of California Press, 1981:245.
- [25] Johannes RE. A spawning aggregation of the grouper, *Plectropomus areolatus* (Rüppel) in the Solomon Islands. In: Choat JH, Barnes DJ, Borowitzka MA, Coll JC, Davies PJ, Flood P, Hatcher BG, Hopley D, Hutchings PA, Kinsey D, Orme GR, Pichon M, Sale PF, Sammarco PW, Wallace CC, Wilkinson CR, Wolanski E, Bellwood O, editors. Proceedings of Sixth International Coral Reef Symposium. Townsville, Australia, 1989:751-55.
- [26] Johannes RE. Some suggested management initiatives in Palau's nearshore fisheries, and the relevance of traditional management. Palau Marine Resources Division Tech. Rept. 91.14., 1991:39. 1993 [6].
- [27] David G, Cillaurren E. National fisheries development policy for coastal waters, small-scale village fishing, and food self-reliance in Vanuatu. Man and Culture in Oceania, 1992;8:35-58.
- [28] Schaan O, Carlot A, Nguyen F. Exploitation of deep sea fish resources by the village fisheries in Vanuatu. ORSTOM, Port Vila, Vanuatu, Notes and Documents on Oceanography 1987;16:145.
- [29] Rodman MC. Deep water, development and change in Pacific village fisheries. Vancouver, Canada: University of British Columbia Press, 1989:173.
- [30] Bell LAJ, Amos MJ. Republic of Vanuatu Fisheries Resource Surveys. FFA Report # 93/49. South Pacific Forum Fisheries Agency, Honiara, 1993:137.
- [31] Graham To, Idechong N. Reconciling customary and constitutional law: managing marine resources in Palau, Micronesia. Ocean & Coastal Management 1998;40(2/3):143-164.
- [32] Graham T. Flexibility and the codification of traditional fisheries management systems. Traditional Marine Resource Management and Knowledge Information Bulletin. 1993;3:2-6.



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Assessment and management of the Trochus Fishery at West Nggela, Solomon Islands: an interdisciplinary approach

Simon Foale*

Department of Zoology, University of Melbourne, Parkville, Victoria, Australia

Abstract

A proper understanding of the management status of small-scale subsistence and artisanal fisheries requires not only detailed sociocultural study, but comprehensive analysis of the state of the fished population(s), using rigorous stock assessment and other fisheries biology tools. In this article I describe several approaches taken to assess the artisanal trochus fishery at West Nggela. This includes stock density and other data, that demonstrate many reefs are overfished. I discuss the social and economic factors influencing the performance of the fishery. The importance of an understanding of property tenure is dealt with in some detail. An analysis of the various categories of fishers' ecological knowledge about trochus is also presented, and discussed with respect to the categories of biological and ecological information considered by most fisheries biologists as essential to the assessment and management of a fishery. © 1998 Elsevier Science Ltd. All rights reserved.

1. Introduction

At West Nggela, Solomon Islands (Fig. 1), the management of sedentary invertebrate fisheries is based on Customary Marine Tenure (CMT), common throughout coastal Melanesia [1-3]. Under this system, reefs and the stocks they support are owned by lineage-based groups, and primary rights (which include rights of exclusion) to resources are typically inherited under a variety of systems [4-9]. There is now a large body of literature on CMT and its significance in the management and conservation of marine resources [2,9-14]. However, little detailed stock assessment work has been done to support the many claims about the

*Tel.: 00 613 9344 4844; fax: 0061 3 9344 7909; e-mail: sfoale@zoology.unimelb.edu.au.