# Recent evolution of village-based marine resource management in Vanuatu

*F.R. Hickey[1] and R.E. Johannes*

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## Abstract

In 1993 a study of coastal villages in Vanuatu revealed that within the previous three years there had been a rapid increase in marine resource management (MRM) activities. The initial impetus for these events was the Vanuatu Fisheries Department's promotion of a voluntary, village-based trochus management programme. Initially the programme involved only a few fishing villages out of a total of several hundred. The Department surveyed their community trochus stocks, advised the people that regular several-year closures of their trochus fishery, followed by brief openings, would generate far more profit than the usual practice of harvesting continually. They left it to the villagers to decide whether or not to act on this advice.

The 1993 study revealed that villages that followed this advice found it so profitable that other villages quickly followed suit. Moreover, seeing what conservation could do for their trochus stocks, many villages decided to implement their own conservation measures to protect other marine animals, including finfishes, lobsters, clams, beche-de-mer (sea cucumbers)[2] and crabs, as well as to ban or restrict certain harmful fishing practices such as night spearfishing and the use of nets, especially gill nets. One of the surveyed villages set up a marine protected area and stocked it with giant clams (*Tridacna* spp. and *Hippopus hippopus*).

In 2001, we resurveyed 21 of the villages surveyed in 1993 to determine how successful these community-initiated management measures had been in the eyes of the villagers. This was done by determining how many MRM measures had lapsed and how many new ones had been initiated. Our reasoning was that maintaining or increasing MRM measures, which all entail short- or medium-term sacrifices to fishers, would only happen if the fishers thought they were worth the longer-term benefits.

Our results revealed that village-based MRM measures had more than doubled between 1993 and 2001. There were a total of 40 MRM measures in the 21 villages in 1993. By 2001 five of these had lapsed but 51 new ones had been implemented.

While the Fisheries Department continued its seminal extension work in the villages, and broadened its scope, another potent source of motivation for village-based MRM that emerged in 1995 was the locally renowned travelling theatre group called Wan Smolbag (WSB). WSB brought to many villages a play on the plight of sea turtles. WSB's efforts were catalytic as 11 of the 21 villages we surveyed banned or restricted harvesting of turtles within the next several years. None of the villages controlled turtle harvesting when they were surveyed in 1993. WSB also encouraged many villages to select 'turtle monitors' to tag turtles and to help oversee the conservation of turtles and turtle eggs in their villages.

1. Vanuatu Cultural Centre, PO BOX 1655, Port Vila, Vanuatu.

2. The term beche-de-mer more properly applies to the dried commercial product produced from various sea cucumbers, but is often also used to refer to the live animal in Vanuatu and some other areas. Trepang is another term commonly used in parts of the Indo-Pacific.

Several lessons emerged from our study:

1. When properly targeted, village education on marine conservation can be a very powerful tool. In addition to the proliferation of village-based MRM initiatives, the observance of national marine conservation laws was enhanced. An important reason for villagers disobeying these regulations in the past was found to be their widespread ignorance of them or of their rationale. Once informed of these laws and their justifications, villagers' observance of these regulations was reportedly much improved.

2. The initial focus of both the Fisheries Department and WSB on single important animals (e.g. trochus and turtle) seems to have been more effective in enhancing village conservation awareness than if the more complex goal of total coastal resource management had been targeted right away. This broader objective can be phased in later. This is now being done by both the Fisheries Department and WSB.

3. The Fisheries Department emphasises that customary marine tenure (CMT) — the traditional right of villagers to control activities on their traditional fishing grounds and to exclude outsiders — provides the essential foundation for nearshore MRM in Vanuatu. This study supports this contention. The mean number of MRM measures in effect in the eight villages that reported CMT disputes was less than half the number in the 13 villages that reported no such disputes, and the difference was highly statistically significant.

4. One way of encouraging the resolution of CMT disputes is the withholding of outside MRM assistance from villages where such disputes are active.

5. Government personnel and aid donors need to be aware of the fact that subsistence fishing in nearshore waters is worth more in almost all Pacific Island economies (including Vanuatu's) than nearshore commercial fishing. The distribution of government fisheries management resources often suggests government personnel and aid donors believe the opposite. Fisheries extension work targeting village-based MRM deserves greater support.

## Introduction

Vanuatu is situated about 2000 km east of northern Australia between roughly 12°S and 22°S (Fig. 1). There are over 80 islands, 67 of which are inhabited. The population is about 187,000, and 78.5 per cent live in rural areas. Seventy per cent live along the coast. Overall there are about 790 villages, with an average population of less than 200. Reefs, mangroves and other shallow nearshore habitats are important sources of animal protein for this population. A Vanuatu Statistics Department survey reveals that collectively, 67 per cent of the households in the 21 villages we discuss here carry out subsistence harvesting of fish and other seafood, and 23 per cent sell some of their catch.


***Vanuatu***

Some reef animals are exported, or sent for sale to urban centres. Trochus, a marine snail whose shell is used for making buttons and inlay, and as an ingredient in certain paints, has been the single most important commercial marine product for many coastal villages. Through the 1980s trochus populations were typically overharvested, and yields became very low. Responding to this problem in 1990, the Vanuatu Fisheries Department initiated a programme to encourage communities to manage their trochus stocks (Amos 1993). Initially the programme was introduced in five fishing villages, which had responded positively

to radio announcements stating the availability of the Fisheries Department for such activities.

Hearing reports of the success of this programme, in late 1993, Johannes (1998a) interviewed villagers in 26 coastal villages in Vanuatu about their marine resource management. (We define a marine resource management measure as a measure employed deliberately to reduce or eliminate overfishing or other damaging human impacts on marine resources.) Villages that adopted the trochus management measures suggested by the Fisheries Department (harvest closures followed by short harvest periods plus strict observance of size limits) often reported much improved subsequent harvests.

Observing these successes, other villages not only began to emulate the initial five villages, but many also extended their management efforts to other marine resources. Johannes (1998a) found that 25 of the 26 villages surveyed had implemented MRM measures since 1990. These measures varied from village-to-village but covered trochus, lobster, octopus, beche-de-mer (sea cucumbers), green snails, various clams, crabs, various types of reef fishes, and/or marine resources in general. They consisted of closures of certain areas or taboos (bans) on taking various species or on the use of certain fishing gear including spearguns and nets, especially gillnets (Johannes 1998a). The results of this modest initiative by the Fisheries Department, costing a few thousand dollars in the initial years, had a more positive impact on marine resource use than a multi-donor, aid-funded Vanuatu fisheries development project that cost tens of millions of dollars (Johannes 1998a).

### *Customary marine tenure*

Understanding traditional marine resource-use rights is central to understanding marine resource management in Vanuatu. Rights to coastal waters contiguous to traditional land holdings are usually owned by the clans, chiefs or villages that own the land. Rights may be subdivided and allocated to individual heads of families. These rights are recognised in Chapter 12, Article 73 of the Constitution of Vanuatu, which states 'All land in the Republic belongs to the indigenous custom owners and their descendants.' 'Land' here includes 'land extending to the seaside of any offshore reef but no further', under the Land Reform Act (Cap. 123). In addition to providing the foundation for all village-based MRM measures (see below), CMT also contributes to the equitable distribution of the harvest and spreads fishing effort.

The initiator of the Department of Fisheries trochus management programme (and now Director of the Department) is Mr Moses Amos. He stressed to the authors that the fundamental cultural institution that provides the foundation for village-based management in Vanuatu is CMT. He also stated that CMT forms the primary link between the Department and the communities. Where ownership disputes (see below) weaken CMT, the Department will not invest efforts in MRM support.

## Methods

Here we describe the results of interviews carried out in 2001 in 21 of the villages studied originally by Johannes in 1993. We sought to determine the extent to which these management efforts were now perceived as succeeding or failing. Statistically sound before-and-after marine biological surveys in each of these villages' fishing grounds would have been extremely expensive and time-consuming. Villagers' testimony as to the effectiveness of these measures could sometimes be coloured by a desire to impress the interviewer. With these two problems in mind we used two criteria indicators to measure the perceived success of these MRM measures.

The first criterion was whether or not these measures were still in effect. Like most conservation measures, the ones implemented in the early 1990s involved sacrifices by fishers. Closing trochus harvesting, for example, involved foregoing — for up to five years (the length of the longest closure) — the money that could be made from selling the shell. Closing reef areas to other types of fishing or putting a taboo on the use of certain types of fishing gear similarly involved sacrifice. We reasoned that if, after eight years, such sacrifices were judged worthwhile, the relevant management measures would still be operating.

A second criterion of the perception of villagers of the value of marine conservation is the extent to which they implemented additional MRM measures since 1993.

In compiling the list of village-based MRM measures here, we did not include national conservation laws[3] that village leaders were widely reported to be enforcing more actively than in the past. Greater efforts to educate villagers about marine conservation have made villagers and village leaders more aware of the existence of these laws and of the reasons for them. This, we were often told by village leaders, made villagers more supportive of them.

3. These laws set, for example, size limits on trochus, crayfish and green snail and ban the taking of turtle eggs or crayfish with eggs, or the use of poisons or explosives for fishing.

Another objective of our research was to identify lessons that might be useful in future efforts in Vanuatu and elsewhere to facilitate community-based MRM management and learn how outside agencies (governments, NGOs, aid-donors) might better assist with these activities.

The present study was carried out by F.R. Hickey under the direction of R.E. Johannes over a period of five weeks between June and August 200l. It involved informal interviews with villagers and with government officers and NGO personnel assisting with MRM in Vanuatu villages. A set of general questions was used to focus the interviews loosely, but informants were encouraged to range well beyond the immediate subjects of these questions if they chose. Johannes et al. (2000) have described why formal questionnaires may limit the scope of information obtained when used as the main tool in interviews with local natural resource users that involve broad subject areas.

## Results and observations

There were a total of 40 MRM measures in the 21 villages in 1993. By 2001 five of these had lapsed and 51 new ones had been implemented (Tables 1 and 2).

Village-based MRM measures more than doubled in the 21 villages we surveyed, rising from a mean of 1.9 per village in 1993 to 4.1 in 2001 (Table 2).

**Table 1.** Marine resource management initiatives in 21 Vanuatu villages, 1993 and 2001.

| | | TRO | F.C | TUR | BDM | SPR | NET | MPA | G.CL | CRA | HAB | MSC | # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anelgauhat | D | • | • | | o | | | | | | | • | 4 |
| Mele | | • | • | | | | | | | | | | 2 |
| Mangililiu | | • | • | o | | • | | | | | | | 4 |
| Tanolio | | | o | o | o | o | | | o | | | | 5 |
| Siviri | | • | | o | o | | | | o | | | | 4 |
| Saama | | o | | o | | | | | | | | | 2 |
| Emua | | o | x | o | • | | | | | | | | 3 |
| Paunangisu | D | | x | o | o | | | o | | | | | 3 |
| Epao | | | x | o | • | | | | | | o | | 3 |
| Eton | D | | o | | o | | o | | | | | | 3 |
| Erakor | | | | | | o | o | | | | o | | 3 |
| Marae | D | • | • | | | | | | | | | o | 3 |
| Lamen Bay | | • | •[2] | o | | | | | | | | • | 5 |
| Pescarus | | • | • | o | o | • | • | o | o* | • | | | 8 |
| Lutas | | • | • | o | o | o | o | | | o | | | 7 |
| Pelongk | | • | • | | | • | o | • | •* | o | | •o[3] | 10 |
| Litslits | D | | •o | | | | | | | | | | 2 |
| Uri | | | •o[2] | o | o | • | • | o[2] | o* | • | | o[2] | 12 |
| Uripiv | D | | •o | | | o | o | | | | | | 4 |
| Norsup | D | x | x | | | | | | | | | | 0 |
| Tautu | D | | | | | | | | | | | | 0 |
| TOTAL | | 11 | 18 | 11 | 10 | 8 | 7 | 5 | 5 | 4 | 2 | 9 | **87**+ |

D Marine tenure disputes current
• Operating in both 1993 and 2001
o Operating in 2001
x Operating in 1993 but since lapsed
# Total number of village management initiatives in effect in 2001.
TOTAL Total number of village management measures of each type in 2001. Numerals indicate more than one such initiative operating in a single village.
* Giant clam initiative that is also listed as MPA.
+ This figure is 3 less that the sum of the totals for each MRM measure because the 3 giant clam sanctuaries in which all other species are also protected, are also listed as MPAs, but were not double counted to calculate the total.

TRO Trochus
F.C Fishing ground closures
TUR Turtles
BDM Beche-de-mer
SPR Spearfishing
NET Use of nets
MPA Marine Protected Areas
G.CL Giant clams
CRA Crabs
HAB Fishing methods destructive of habitat
MSC Miscellaneous

**Table 2.** Number of MRM measures in 21 Vanuatu villages, 1993 and 2001

| | 1993 | 2001 |
|---|---|---|
| Total MRM measures operating | 40 | 86 |
| Average number per village | 1.9 | 4.1 |
| Lapsed MRM measures since 1993 | | 5 |

The most often used MRM measures in 2001 were fishing ground closures (18), trochus closures (11), taboos on taking turtles (11), beche-de-mer closures (10), spearfishing taboos (8) and taboos on using nets (7). All of the turtle taboos had been implemented since 1993.

Of the five measures that lapsed, three involved fishing ground closures. But during the same period six such closures were initiated in five other villages.

The three Maskelyne island villages we surveyed had an average of 8.7 MRM measures — more than twice as many as the mean number (4.1) of MRM management measures for all 21 villages surveyed. We surmise that this may reflect their relatively heavy dependence on their rich marine resources for subsistence and as a means to generate cash, which provides the incentive to manage the resources well. These villages are on small islands with limited agricultural potential. (They have additional agricultural land on the mainland but it is somewhat far from villages.)

A recurring theme among those interviewed was that the experience of the past decade has shown that if village reefs are divided into several sections with different owners, MRM measures will be more effective if the owners cooperate to manage the entire area as a single unit, rather than managing different sections independently.

## Enforcement

The punishment for breaking MRM taboos ranges from simple admonition to fines in the form of money and/or food and kava[4]. The largest fine we heard of was in Pelongk — two pigs, two 25 kg bags of rice, six kava roots, some other food plus VUV 30,000 (about USD 200). This is a very high price to pay for the average rural villager. Some villagers also mentioned the shame and embarrassment involved in being caught and fined in village court. This comment applies mainly to villages where respect for traditional authority it still high. As mentioned earlier this respect tends to be weaker in peri-urban villages.

## Trochus and green snail

Trochus is probably the most easily managed of all reef resources. The species moves only short distances during its adult life and its populations are relatively easy to census. It is also the single most profitable commercial marine product in rural Vanuatu.

The enthusiasm of villagers for the results of their trochus management is often based on easily measurable results (e.g. sales receipts). Fisheries Department surveys, or surveys made by villagers trained by them, can readily demonstrate when a trochus ground is ready to be harvested.

Green snails, another species whose shell is exported for inlay, are generally subject to the same village-based regulations as trochus. They had been heavily overfished in most areas in the 1980s. They reach maturity at about the same age as trochus and one individual can produce millions of eggs with larvae that, like trochus larvae, settle soon after they are released (Yamaguchi 1993). Under the circumstances one might expect green snail stocks to respond well to the same closure periods as trochus, but this does not seem to be the case. Yamaguchi (1993) refers to 'the rapid depletion of green snail in actively fished areas and the slow rate at which populations re-establish after termination of fishing'. Green snails have become so depleted throughout most of the area surveyed that some teenagers have never even seen one.

## Sea turtles

Taboos on taking sea turtles constituted the largest fraction of the new regulations (11 out of 51) and involved the most villages (11 out of 21). Clearly there has been an unprecedented enthusiasm for turtle conservation in many villages since 1993.

Whereas it is against national law to dig turtle eggs, there is no national law in Vanuatu prohibiting the taking of adult turtles. Until recently in most coastal communities they were killed whenever the opportunity arose. In 1993 no villages sur-

4. Kava (*Piper methysticum*) is a large root from which an extremely popular and mildly intoxicating drink is made.

veyed mentioned a ban on the taking of turtles. Now more than half the communities interviewed did so. The reason for this striking change is unusual and instructive.

Many Vanuatu villages are visited periodically by a locally celebrated travelling theatre group called Wan Smolbag[5] (WSB). Operating since 1989, this group has made many village tours, putting on plays that simultaneously entertain and inform villagers about important issues such as HIV/AIDS, malaria reduction through mosquito control, etc.

In 1995 the theme of the main play they presented in the villages was the plight of sea turtles and the need to conserve them. The villagers were apparently receptive to this message in part because, as many informants told us, they were already aware of a marked decline in turtle numbers in their waters over the previous several decades.

Not only did WSB suggest that turtles should not be killed, but also that each village should select a 'turtle monitor' to help encourage turtle conservation and to tag nesting turtles and turtles caught in nets before they are released. There are now 150 turtle monitors in roughly 80 Vanuatu coastal villages. In 11 of the 21 villages where we interviewed, turtle monitors had been appointed. Two of these villages appointed two turtle monitors. Turtle monitors also report to village leaders anyone who is found taking turtles or turtle eggs. Some of them have taken it upon themselves to post signs at nesting beaches during the egg-laying season to remind people that it is illegal to take the eggs. Communities that do not have turtle monitors reportedly continue to take turtles whenever they can.

Some villages we surveyed now ban the killing of turtles outright. In general, only communities with turtle monitors have recently put taboos on their harvesting and in such villages compliance with the government prohibition on disturbing turtle nests has also generally increased in these communities.

In some other villages people are allowed by their leaders to kill one or more turtles only on special occasions. Where these regulations were in effect a number of informants reported now seeing many more turtles in their waters than they had seen for many years[6].

***Erakorlif: A 'namele' leaf at Erakor used to indicate that all fishing is closed in this area until the village chief removes the leaf.***

***Lamentabu: A tabu leaf at Lamen Bay used to indicate that a clan's fishing area is closed due to the death of a clan member.***

5. The name means 'one small bag' in Melanesian pidgin and refers to the fact that this is all the company needs for carrying its theatre equipment.
6. Due to these animals' low growth rates, adult turtle numbers in Vanuatu could not have increased significantly during just a few years' protection. But local numbers in protected village waters could be expected to increase within this time simply due to the turtles not being harvested and being quite mobile (i.e. moving in from elsewhere). Protecting turtle eggs could, of course, have an immediate positive effect on reproductive success.

Experience in many other Pacific Islands has been that protecting sea turtles is one of the hardest conservation measures to persuade islanders to observe. The World Bank (1999) 'found that the perceived compliance with turtle regulations was very low.' and 'was perceived (during a survey of attitudes in Pacific Island communities) to be quite poor. Communities felt such rules conflicted with cultural obligations, such as the custom in some villages of giving turtles to chiefs, and that 'turtle meat was just too tempting to resist.' Wan Smolbag's accomplishments in this regard seem to be setting a new standard.

With Word Wildlife Fund and European Union funding and Department of Fisheries participation, WSB now runs workshops to train turtle monitors. At their most recent meeting in June 2001, the turtle monitors voted to broaden their mandate to coastal resources in general, and to change their name to Vanua-tai Resource Managers (vanua = land, tai = sea). In addition, Wan Smolbag's latest play, still in the planning stages, concerns a wider range of issues of coastal resource management. WSB is shaping up to become an important conservation force in Vanuatu.

## *Finfish*

The costs of obtaining statistically sound information on fisheries and fish stocks in so many villages would doubtless greatly outweigh the potential benefits (e.g. Johannes 1998b). Mees et al. (1999) were unable to demonstrate differences in abundance of finfishes in open and closed reefs in five Vanuatu villages. But their data consisted of an average of only two underwater visual censuses per fishing ground, each of which consisted of counting fishes within a 7-m radius of a stationary diver. The statistical power of these data was thus very low.

Russ and Alcala (1996), however, present more persuasive data from the Philippines (and cite other studies) that support their statement that gains in biomass of finfishes 'of a magnitude potentially useful in fisheries management are likely to occur in reserves on scales of 5–10 years, rather than just a few years.'[7] With a few exceptions, total finfishing closures reported to us in 2001 in Vanuatu villages lasted from six months to three years, with a mean of about 1.5 years[8]. According to Russ and Alcala (1996) even the longest of these bans would be too short to be of much value as a conservation measure for large predatory reef fish.

Even short closures, properly timed, could facilitate greater spawning. But the consequent potential for improved reef fish production would take even longer to manifest itself. In addition, much of it would generally occur outside the fishing grounds where the spawning occurred because of the small size of most of these tenured fishing grounds and the prolonged pelagic larvae stage of most reef fishes. And even short closures of fishing grounds to destructive fishing methods, such as using small mesh nets or night spearfishing for bumphead parrotfish (*Bolbometopon muricatum*) could reduce their effects on stocks. But this is only relevant where such destructive fishing practices occur.

Why, then, do Vanuatu villagers persist with relatively short closures for finfishing? The same answer to this question came up repeatedly in our interviews. When constantly pursued by fishers, reef fish tend to get 'wild,' (i.e. harder to approach in order to spear them)[9], and harder to scare into nets. 'Resting' the fish for a period causes them to lose their caution and makes them easier to catch.

After sufficiently long closures, marine protected areas (MPAs) have proven to benefit fisheries through the export of fish into adjacent fishing grounds (reviewed by Roberts and Hawkins 2000). Two of the villages we surveyed have declared portions of their fishing grounds as MPAs (Ringi te Suh of Pelongk and Narong Park of Uri) and two others, Mele and Paunangisu, were indefinitely protecting their marine resources in areas important to tourists. In addition, several other communities said they were planning to introduce MPAs.

The establishment of MPAs in countries such as Vanuatu, where traditional marine tenure exists, raises both novel problems and novel opportunities. Briefly, establishing MPAs in traditionally tenured Pacific Island waters requires obtaining the permission and cooperation of tenure owners after providing incentives to reassure them that they have more to gain than to lose from them. Larger MPAs would often require obtaining the permission and agreement of several groups of tenure owners. This would seldom be an easy task.

7. Short-lived, faster growing herbivores and small predators would increase in biomass more quickly than this.
8. There are, however, two MPAs in the villages we surveyed that have been closed for periods of about 8 and 10 years.
9. As any spearfisher who has stalked reef fish in both fished and unfished waters quickly learns, fish in the unfished waters are far less wary of the approaching diver and present much easier targets.

On the other hand, once established, MPAs would be more likely to attract strong surveillance and enforcement by local people because of their traditional defence of local fishing grounds.

In developing countries where, unlike Vanuatu, local marine tenure does not exist, or is not widespread or not recognised by the government, surveillance and enforcement are typically weak to non-existent in MPAs. Hence the preponderance of 'paper' MPAs in some of these countries (e.g. Alder 1996).

What about the efficacy of taboos on specific fishing methods such as night spearfishing and netting? There is increasing circumstantial evidence that the banning of night spearfishing helps conserve parrotfish (especially the prized bumphead parrotfish, *Bolbometopon muricatum*), which sleep in shallow water during part of the lunar month and are then very easy targets for night spearfishers.

Fishers in many Pacific Islands are critical of the impact that night spearfishing has on these fish. For this reason, banning of night spearfishing is one of the most common management measures that have been implemented in the Pacific Islands in the past 25 years (Johannes 1978; Fa'asili and Kelokolo 1999; Hviding 1996; Dulvy and Polunin in revision; Johannes unpublished). Dulvy and Polunin (in revision) have demonstrated that the bumphead parrotfish is probably extinct around at least six islands and rare around the six others they surveyed in an area of Fiji where it was once reportedly abundant. In some Vanuatu villages, night spearfishing is banned for part of the year; in others it is banned throughout the year. Obviously the second alternative is preferable although seasonal banning of night spearfishing during spawning aggregations would clearly help protect various spawning species.

Over the past 25 years the ban on gill nets and other nets has been another management measure often initiated in Pacific Island villages (Johannes 1981 and unpublished; Hviding 1998) including seven of those in the present survey. This undoubtedly helps protect against catching undersized fish, unwanted species and more fish than are needed. In Vanuatu it also protects against overharvesting mullet and rabbitfish on their spawning migrations and in their spawning aggregations; the locations and timing of these are sometimes well known to village fishers. Johannes (1981 and unpublished) has been told by villagers in Papua New Guinea, Palau, Solomon Islands and Vanuatu of mullet migrations/aggregations no longer forming, because of their elimination by gillnetting during these vulnerable periods.

One argument for allowing gill net fishing at certain times and places is that it facilitates the capture of some species that are not readily caught by other methods, including mullet, *Selar* spp. and some species of rabbitfish.

## Beche-de-mer

In recent years interest in harvesting beche-de-mer has decreased in many of the villages we surveyed. This was due, at least in part, to some unusual beliefs that have recently emerged concerning the roles of beche-de-mer in the ecology of local waters. Because beche-de-mer are sediment deposit feeders, the belief has apparently been fostered by some conservation personnel that they 'clean up the reef'. Many villagers have taken this comment to heart. In several villages informants said that their waters had become cloudier since the beche-de-mer populations had been overharvested, or that their waters had become clearer because ceasing to fish for beche-de-mer had allowed their numbers to increase. In some villages there was a belief that if beche-de-mer were overharvested this was likely to cause ciguatera (the development of toxicity of reef fish to humans as a result of consumption of a toxic dinoflagellate directly or via the food chain. Ciguatera is not uncommon in Vanuatu). In several other villages it was said that when beche-de-mer were fished out, the white sand turned yellow with algae, and that slimy green algae also proliferated.

Many sea cucumbers feed by using their tentacles to gather and ingest particles in the top few millimetres of sediment and digest the microbial coatings on them. Perhaps this reduces microbial growth that might otherwise turn some sediments yellow. Other species feed on hard substrates such as dead coral or coralline-algal pavements by ingesting the thin dusting of sediment and associated microbiota on them. This activity may prevent green algal slimes from proliferating. It is not clear why the absence of either of these activities due to the harvesting of the beche-de-mer would result in greater turbidity of the overlying water. We know of no scientific research that examines these questions.

In one village the belief was expressed that beche-de-mer give birth to certain reef fish and it was good to protect them for this reason. This belief may have arisen from the fact that certain small fish of the family Carapidae actually live within certain sea cucumbers, exiting via the cloacal opening at night in order to feed. Finding these fish inside sea cucumbers when processing them for the beche-de-mer trade could logically lead to the above conclusion.

### *Department of Fisheries extension activities*

Since 1993 the Department began to focus less effort on fisheries development and more on fisheries extension work. The new focus for Fisheries Extension Officers (FEOs) was to assist with the management of nearshore resources by providing advice and information to fishing communities. FEOs were provided with preliminary training in cooperative management through a ten-day workshop. The Research Section of the Department played an active role in this training and followed this up by working with FEOs in the field to help introduce this cooperative management approach. The Enforcement Officer was also involved.

Since then FEOs have made numerous awareness tours to villages in most parts of the country and have broadened their focus from trochus to all nearshore living resources. Their work, says the Department, has been responsible for numerous communities re-vitalising their traditional system of putting taboos on select resources, reef areas and fishing methods. This process was in part constrained by the loss of some Department personnel following a civil service strike in late 1993 and some were not re-recruited until 1997.

Starting in 1999 the Extension Services decided to help provide alternative sources of income for rural communities, in part to compensate for the sacrifices required in order to rebuild nearshore seafood stocks through closures and other taboos. It now spends roughly half its time on cooperative management and the other half on promoting some new (and old) development initiatives. The Extension Services underwent a name change to reflect this shift in focus and is now called the Rural Fisheries Development Program. The new initiatives to date include the culture of *Eucheuma* seaweed, giant clams and blacklip pearl oysters, re-vitalising the canoe enhancement programme (using local canoes for the deepwater fishery), deploying new fish aggregation devices to promote the pelagic fishery and the reseeding of reefs with juvenile and adult trochus. The Department has also purchased five new ice plants to be placed at provincial centres to help re-develop the deepwater and pelagic fisheries.

Most of the above-noted initiatives are donor-funded. Ongoing training will also be provided to FEOs to enhance their ability to continue to provide the cooperative management needs of communities. For example, a workshop to train FEOs in basic reef assessment techniques is planned in 2002. With these skills, FEOs will be able to better assist communities in monitoring the impacts of exploitation and managing their reefs.

### *A local conservation ethic?*

A conservation ethic can be defined as an awareness of one's ability to overharvest or otherwise damage one's natural resources coupled with a commitment to reduce or eliminate the problem. A marine conservation ethic can be found in some tropical fishing cultures but not in others. Determining whether it exists or not is important, it determines how one goes about education for conservation. If a marine conservation ethic does not exist then village educators, such as fisheries extension officers, must begin at the beginning — they must first inculcate this ethic, which can be a very challenging job. But only then can they take the next step and promote specific conservation measures.

A marine conservation ethic is clearly in evidence in Vanuatu today. Anderson (1999) summarised the reasons given in the mid-1990s by representatives of 12 Vanuatu fishing villages for employing a total of 48 individual MRM measures. 'Enhancing', 'preserving' or 'protecting' resources was the explicit reason given for 43 of these measures. To 'finance village development' was given for five, 'to protect spawning fish' was given by three and 'a source of occasional income' was given by one. (More than one reason was given in several instances.)

Anderson stated it was apparent that additional 'implicit' reasons were operative in six instances. All of these related to protection or establishment of property rights. Villagers' appraisals of the observance of the 48 measures by fishers was 'good' in 37 instances, 'fair' in ten instances and 'poor' in one instance.

This offers independent support for our observations that most villages we surveyed did manifest a marine conservation ethic; they were aware not only of the need for marine resource management in their waters but were also taking concrete actions to address this need. (Young men were most often singled out as the group least imbued with this ethic, and were usually identified as the main breakers of MRM taboos and government regulations.)

### *Marine tenure disputes*

While CMT provides the basic foundation on which sound, village-based MRM in Vanuatu can operate, it does not guarantee it. Johannes (1998a) reported that reef ownership disputes interfered to varying degrees with MRM in Vanuatu in 1993. Ownership disputes were reported in five of the 21 villages in 1993 and in eight in 2001. While the difference is not statistically signifi-

cant, it is consistent with the prediction made by some village leaders to Johannes during his 1993 study; namely, that such disputes will increase as cash economies become increasingly important in rural Vanuatu and export markets and local populations increase (i.e. that disputes over natural resources will increase as these become more valuable) (Johannes 1998a).

Such disputes sometimes related initially to land tenure but had spilled over into contiguous fishing grounds. Aswani (1997) and Foale and Macintyre (2000) report similar disputes in areas in nearby Solomon Islands.

In 2001 the eight Vanuatu villages reporting ownership disputes had a mean of 2.25 MRM measures in place. In two of these villages there were none. In the 13 villages where no management disputes were reported, the mean number of MRM measures was 5.3. The difference was statistically significant ($P<0.01$). Our findings thus provide strong statistical support for the conclusion of the Vanuatu Fisheries Department that village-based MRM is stronger in the absence of CMT disputes.

There are six levels of resolution of fishing disputes available to Vanuatu fishing rights owners, ranging from adjudication involving heads of families, clans or villages up to the Supreme Court of Vanuatu (Johannes, 1998 a). Certain disputes were being adjudicated at the time of Johannes' 1993 study as well as the present study. The Fisheries Department's decision to withhold its support from villages with unresolved marine tenure dispute provides one incentive for villagers to resolve them. (Readers should also see the Addendum in this paper for further relevant information, as some of the information described here has now been superseded with the recent passage of the Land Tribunal Act.)

## *Reasons for quick adoption of new MRM measures*

Clearly the upsurge in community interest in village-based MRM in the early 1990s has not abated. Some readers may be surprised at the alacrity with which Vanuatu villagers have continued to introduce new marine resource management measures that entail reducing their own fishing pressure.

One reason, already discussed, is customary marine tenure, which provides the foundation for MRM in Vanuatu. Fishing by uninvited outsiders (mainly people from nearby villages) is a relatively minor problem in most communities (especially in those with easily monitored fishing grounds) because it is against cultural norms. Villagers thus tend to reap most of the benefits of their self restraint on the fishing grounds. Improved trochus yields due to sound management is a good example.

In addition, because Vanuatu's nearshore habitat consists mainly of narrow fringing reefs, village fishing grounds are typically small enough and close enough to the village for surveillance to be relatively easy. (Nevertheless poaching among adjacent communities, especially for trochus and other commercial species such as lobster is reportedly increasing, although it is still not a major problem in most villages surveyed.)

Another reason is that most individuals, families and/or clans own their own land. Raising various vegetable crops, pigs, fowl and cattle is widely practised. Thus, villagers have other foods to fall back on when they forego fishing. In addition, excess produce and cash crops such as kava, copra, cacao and nuts can be sold for consumption in the capital, Port Vila, and other district centres or for export. This provides money to buy such things as inexpensive canned mackerel and corned beef, which are often available in village stores and have the advantage of an indefinite shelf life. In addition, as mentioned above, the Department of Fisheries is helping some villages to set up additional alternative income projects.

Furthermore, over centuries the people of Vanuatu have developed strong traditions of community organisation, leadership and systems of decision-making that govern their use and allocation of natural resources. Development, westernisation and the introduction of a money economy are weakening this organisation to varying degrees, especially in urban and peri-urban centres. But traditional rules and customs still provide the foundation of rural community organisation, leadership and collective behaviour. Thus, when rural village leaders declare taboos relating to fishing they are usually respected and observed by most.

Finally, villagers are becoming increasingly aware of the relationship between maintaining resources and winning tourist dollars,

## *Police support for customary law*

Another relevant and interesting trend we encountered in some villages during this study is the increasing use of state police to informally support and back-up decisions made by the chiefs in peri-urban villages. Individuals who repeatedly ignore their chief's rulings and fines for breaking village taboos, including taboos relating to MRM, may be turned over to the police.

This is only done when a chief has exhausted other possibilities within the village to bring an individual into compliance. The miscreant is typically held by police overnight or longer in the local 'calaboose' (accommodation that is far from appealing) and encouraged to rethink their position on ignoring their chief's wishes. In this way, chiefs and police cooperate to maintain harmony within the village. The chief still makes the decisions, generally through consensus with his community, but the police are available to help enforce his rulings where necessary. This cooperation, to date, is done on an informal basis.

Most rural communities do not have police readily available to intervene in such situations. On most islands it is the chiefs that manage to maintain order and social harmony among their communities, as has been done for centuries. However, with the recent social changes brought about by the intrusion of western lifestyles and a shift away from respecting traditional institutions, many chiefs are feeling the need for some sort of support from the government to formalise their ability to enforce their rulings. As it is now, decisions made by chiefs in the village courts are not legally recognised. This situation is currently under review by the government, which has commissioned a 'Chief's Legislation Project' to explore this issue and survey the chiefs' viewpoints on this matter.

Their report was presented to government by the end of 2001. Depending on the recommendations of the project, the Government may look toward enacting legislation to formally empower the chiefs' village court decisions. If this sort of formal recognition of village court is to eventuate, it would significantly strengthen the chiefs' abilities to enforce the communities' marine resource management decisions.

## Conclusions

Our data indicate a high level of approval by villagers of their MRM measures; in the 21 villages surveyed only five out of 40 MRM measures had lapsed between 1993 and 2001 while 51 new MRM measures had been implemented. In only two villages were there fewer MRMs in 2001 than in 1993. One of those was one of the villages where there were marine tenure disputes. One way of encouraging the resolution of CMT disputes is withholding of outside MRM assistance from villages where such disputes are active. This is the policy of the Fisheries Department.

### *Reasons for success*

There have been many attempts to generate improved MRM in Pacific Island villages and few seem to have achieved such widespread success as the turtle and trochus initiatives in Vanuatu[10].

Some of the factors that have influenced the growth in MRM in Vanuatu were already identified in the 1993 survey (Johannes 1998a). Customary marine tenure provides the foundation upon which MRM is built, refined and enforced in Vanuatu. Strong leadership and village cohesion are important in determining how well MRM functions. Villagers can benefit greatly from outside assistance to help focus and refine MRM initiatives to adapt to contemporary circumstances.

These conclusions are also relevant to a variety of other Pacific Islands where customary marine tenure is found (e.g. World Bank 1999). Are there, in addition, any unusual forces at work in Vanuatu in connection with MRM?

The upsurge in village-based MRM in Vanuatu since 1990 demonstrates clearly how outside assistance, when properly targeted, can generate major benefits. Certain elements of the assistance in Vanuatu are unusual and perhaps unique.

The demonstration of the value of trochus closures by the Vanuatu Fisheries Department was clearly the original catalytic influence on the growth of community based MRM — an influence that quickly motivated community experiments with other forms of MRM. The Department's extension work continues to the degree that its limited budget allows. Trochus management education has been carried out and juvenile trochus have been released in 25 villages around the country.

It has not been proven that trochus transplanting generally improves trochus populations any more than simple trochus ground closures would. However, the instigator of the programme, Mr Amos, says that trochus transplanting enhances communities' support for and compliance with trochus closures. This is due, he says, to the increased awareness associated with the training they get, along with their participation in re-stocking the reef with juvenile trochus and the monitoring their stocks. Part of the increased commitment to trochus conservation seems also to be because the villagers were given something concrete (the juvenile trochus) and in return they feel more

10. Samoa, using quite different extension methods has also seen a major upsurge in village-based MRM in the past few years (e.g. Fa'asili and Kelokolo 1999).

committed to regulating the resulting fishery. A strategy for further enhancing the feeling of community involvement in the trochus re-stocking is that the Fisheries Department actually borrows adult trochus from the community for breeding the stock they subsequently release there.

We suspect that an important common element in the Department of Fisheries' and WSB's catalytic initiatives[11] in village-based MRM is that both focussed initially on a single important animal. Trochus are rural Vanuatu's most commercially valuable shallow water marine resource. Turtles are a highly esteemed food, and in some areas have customary significance. They are thus both of particular interest to coastal villagers.

Once villagers saw the benefits of trochus management, it encouraged them to think harder about how they could better manage their other marine resources. It would probably have been harder to motivate villagers, we suspect, if either of these initiatives had been based *from the start* on the more complex goal of improving MRM in general. WSB and the Department of Fisheries, as described above, are now heading in that direction, but only after having gained credibility through the turtle and trochus initiatives. (Perhaps noteworthy is the fact the play that WSB put on in the villages a year before the turtle play was entitled 'On the Reef' and was about the importance of protecting the total reef environment. It did not seem to have nearly the impact on village MRM as the turtle play judging by villagers' comments.)

The effectiveness of enforcement of these regulations varies with the strength of village leadership, fishing ground geography (i.e. ease of surveillance) and presence or absence of tenure disputes. The fact that these regulations are not always effectively enforced, however, does not distinguish them from MRM regulation in most, if not all other countries, developing or developed.

## *Education — not just for villagers*

Another lesson emerges from this study. Education is important in several ways. When national conservation regulations were explained to villagers and were perceived by them to coincide with village interests, they were often incorporated into village management. This greatly enhanced their observance according to many informants. Ignorance of these laws and the reasons for them had previously been widespread in rural Vanuatu — as it was in the villages in five other Pacific Island countries surveyed recently by the World Bank (1999).

Effective enforcement of such regulations by central government agencies in developing countries such as Vanuatu is quite out of reach. In most cases they must be enforced by village authorities or not at all (see also World Bank 1999). They will not enforce them if they are not educated about their existence, their purpose and their ultimate value to the community. In managing coastal marine resources the villagers provide for free what the national government could not possibly afford to do itself. And even if it could, it would be extremely cost-ineffective (e.g. Johannes 1998b). This is why there is little effective, government-based nearshore fisheries management in many Pacific Island countries.

Johannes (1990) argued that Pacific Island fisheries extension work that focuses on fisheries management (in contrast to development) needed much greater emphasis. The present research reveals the benefits of this emphasis, along with the research of Johannes (1998 a), Fa'asili and Kelokolo (1999) and World Bank (1999). Yet the World Bank's study of fishing communities in five Pacific Island countries in 1998 revealed that only 40 per cent of the 31 communities they surveyed had been visited by a government official to discuss coastal management issues during the previous decade, and that an average of only 25 per cent of fisheries department budgets were for extension work (including both management and development components).

Villagers are not the only ones needing more education concerning rural MRM. National governments need to realise that nearshore subsistence fisheries in almost every Pacific Island country are worth more than nearshore commercial fisheries (Dalzell et al. 1996). (The value of the subsistence catch was calculated by these authors as the price it would fetch if it were sold.) In the early 1990s according to these authors, subsistence fisheries in Vanuatu provided five times the catch of nearshore commercial fisheries and were worth almost l.5 times as much. If the foreign exchange

11. We do not intend to suggest that assistance by the Environmental Unit, The Vanuatu Cultural Centre and the Foundation for the Peoples of the South Pacific have not contributed significantly to village-based MRM in Vanuatu. They have. Their efforts have assisted certain villages to strengthen traditional management systems and to establish small MPAs, for example. But the two initiatives of the Fisheries Department and WSB have had by far the widest impacts on village-based MRM management throughout the country as a whole during the past decade.

cost of imports to support higher technology commercial fisheries were factored in, the benefit ratio of subsistence and commercial fishing would have increased further (Johannes 1998a). On economic grounds, then, extension work in rural fishing communities, where subsistence fishing usually dominates the catch, deserves a larger proportion of fisheries funding than it usually gets. Commercial fisheries almost always seem to get more attention when island politicians and aid donors decide on funding priorities.

## Addendum

Commencing on 10 December 2001, the Land Tribunal Act was enacted in Vanuatu to provide 'for a system based on custom to resolve disputes about customary land' and including 'the waters within the outer edge of any reef adjacent to customary land'. This new legislation allows for the establishment of Village, Custom Sub Area, Custom Area and Island Land Tribunals to deal with all customary land disputes. Effectively, appeals of the Village Land Tribunal decisions can only go as far as the Island Land Tribunal, hence, under this new legislation, customary land disputes will be resolved through custom on the island where the dispute exists. Prior to the introduction of this legislation, most land disputes that could not be settled within the village were appealed all the way to the Supreme Court in the Capital.

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