

Status of coral reef and reef fish resources of Vanuatu

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Introduction to Vanuatu

Vanuatu is an archipelago of over 80 islands stretching 1300 kilometres from north to south in the Western Pacific Ocean. The islands include both igneous formations and limestone derived from uplifted fringing coral reefs (Preston, 1996). The combined land area is 12 190 km². The maritime exclusive economic zone covers 680 000 km².

Vanuatu's population, 79% of which live along the coast, is experiencing rapid growth, at least 2.8 % annually, according to the 1989 Consensus (Statistics Office, 1994). Of the estimated 177 400 people, 44 300 live in the two urban areas of Port Vila and Luganville (Statistics Office, 1997:2). Almost 80% of the population live on 7 islands: Efate, Santo, Luganville, Tanna, Malekula, Pentecost, Ambae and Ambrym. Over 70% of the population live on their traditional lands, growing food crops and harvesting forest and marine resources for local cash needs, personal consumption, exchange and gifting (Government of the Republic of Vanuatu, 1999b). Over 110 languages were in use in 1989 (Statistics Office, 1997).

Status of coral reefs and other benthos and biodiversity

Coral Reefs

The coral reefs of Vanuatu contribute to rural incomes, nutrition, shoreline protection and, more importantly, self reliance for the people of Vanuatu, particularly coastal communities. However, there are relatively few extensive shallow water reefs surrounding the 80 high islands in the Vanuatu archipelago. Inner reef areas are limited to narrow fringing reefs and reef platforms surrounding islands and a few lagoons and barrier reefs, totalling an area of approximately 408 km² (Bell & Amos, 1993). Mangroves and estuarine habitat amount to a total area of only 25 km² (Bell & Amos, 1993). The distribution of all reefs in Vanuatu down to 400 metres is provided in table 1 (David & Cillaureen, 1989).

A nation-wide survey of the corals and associated ecosystems in Vanuatu was conducted in March and April, 1988 by scientists from the Australian Institute of Marine Science (AIMS) and the Great Barrier Reef Marine Park Authority (GBRMPA) (Done & Navin, 1990). The survey described the current condition, character and baseline information about coral reefs and seagrasses for 35 locations throughout Vanuatu.

Islands	Surface Area (ha)				
	Island	Shelf	10-100m	100-400m	Total Reef Area
Torres	12 000	1600	26 130	20 600	48 330
Ureparapara	3900	289	1650	5150	7080
Vanua Lava	33 000	1640	6500	16 390	24 530
Mota	1500	110	850	3170	4130
Mota Lava	3100	570	2450	4120	7140
Mere Lava	1500	30	550	1780	2 360
Gaua	33 000	1 510	3280	16 990	21 780
Rowa	10	2630	1700	4270	8600
Santo-Malo	424 800	4 500	60 000	142 970	207 470
Ambae	41 000	230	3850	11 480	15 920
Maewo	28 000	780	6030	33 470	40 280
Pentecost	49 000	1730	8950	25 000	35 680
Malakula	205 300	10 110	45 100	101 350	156 560
Ambrym	66 500	700	7250	26 650	34 600
Epi-Paama-Lopevi	47 800	2500	19 130	76 510	98 140
Tongoa-Tongariki	5 000	150	4720	16 530	21 400
Emae-Makura-Mataso	3 600	2020	4660	30 820	37 500
Efate	92 300	8070	28 450	95 330	131 850
Erromango	88 700	1340	4250	55 660	61 250
Tanna	56 100	13 10	7450	42 440	51 200
Aniwa	800	310	1150	5120	6580
Futuna	1100	100	1400	3700	5200
Aneityum	16 000	2580	18 450	14 820	35 850
Total	1 218 900	44 800	362 950	754 680	1 063 430

Table 1
Area Distributions of Vanuatu Reefs down to 400 m
(David & Cillauren, 1989).

Vanuatu's coral reef exhibit a range of characteristics expected of an archipelago including exposed outer reefs, sheltered flats and lagoons, partially sheltered open embayments and sheltered embayments (Done & Davin, 1990). Exposed coral reef slopes and crests were dominated by coralline algae and robust plating and branching corals (*Acropora* and *Pocilloporidae*), changing to dominance of a mix of massive and branching corals 3 to 5 metres below the level of the reef flat (Done & Davin, 1990:17). Sheltered parts of the outer reef were characterised by various species of *Acropora* and *Montipora* (Done & Davin, 1990:17). Massive *Porites* were prevalent in open embayments while sheltered embayments were strongly dominated by soft corals (Done & Davin, 1990:22). It is postulated that the colonisation of coral reefs in Vanuatu is assisted by a dispersal pathway through the Solomon Islands to the Great Barrier Reef in Australia (Done & Navin, 1990).

The coral reefs surveyed included many areas of exceptional visual quality while others had various degrees of coral death and physical damage, probably as a result of cyclones and crown of thorns starfish (Done & Navin, 1990). The most aesthetically appealing reefs were at Inyeug, Aneityum, Cook Reef, Hog Harbour, Santo, Reef Islands, and Ureparapara (Done & Navin, 1990).

The AIMS survey team concluded that, overall, the reefs had deteriorated since an earlier survey carried out in 1985. At approximately half the sites surveyed, there was at least as much dead standing coral as live hard coral, and in approximately one fifth of the sites, there was more than four times the percent cover of dead standing coral as there was living coral (Done & Davin, 1990:26).

Status of fishes (commercial, subsistence and aquarium)

Shallow water reef fisheries

The survey by AIMS (Done & Navin, 1990) on shallow water (<30 metres) reef fishes identified a total of 469 species, of which 25 were easily distinguishable under 6 major groups. These include 10 species of Pomacentridae, 5 of Scaridae, 3 of Labridae, 3 of Acanthuridae, 2 Siganidae and 2 Chaetodontidae (Williams, 1990). Williams (1990) noted that the south eastern side of Cook Reef and the eastern side of Santo had a particularly high fish species diversity and that some species, especially scarids, were more abundant in these areas.

Vanuatu's largest coastal fishery is the artisanal and subsistence fishery where the bulk of the fish are sold locally and consumed in rural areas. The methods employed in the subsistence fishery range from collection by hand to gill netting on the reef, set or surround nets and diving using spear guns. In more remote areas, more traditional methods, generally limited to the shallower areas of the coastline, include spears, bows and arrows, fish fences and traps and poisoning using leaves (Bell & Amos, 1993).

The size of the subsistence harvest was recently estimated at approximately 2500 tonnes (Wright, in prep) making it 4 times larger than the commercial catch (Preston, 1996)¹. However, the market is also affected by a high incidence of ciguatera poisoning. Table 2 shows the percentage breakdown for the village fisheries catch in 1983, at that time estimated to be 2402 tonnes.

Item	%
Fish	42.5
Shellfish	33.5
Lobster	20.5
Octopus	3.0
Fresh water prawns	0.5

Table 2
Percentage fish groups from Village Fisheries in 1989 (David, 1990).

Shallow water reef fish and coastal pelagics provide and estimated 40 tonnes to the local markets (Wright, In prep). Beche-de-mer, trochus, green snails, crustacean fisheries and aquarium fish provide coastal communities with immediate cash, possibly up to VT40 million annually (Wright, In prep).

Deep water reef fisheries

The Secretariat of the Pacific Community (SPC) and Institute for Research and Development (IRD) conducted studies of deep slope fish stocks between 1974 and 1988 as components of a range of fishery development projects (Dalzell & Preston, 1992). The initial aim of these studies was to establish whether deep dropline fishing was viable at a given location and to use this information to set up 25

¹ Despite an incentive scheme involving a subsidised fuel price program to those that submit data returns, and 50 Vatu for every form returned and correctly completed, there is under-reporting of subsistence fish catches (Bell & Amos, 1993) and accurate figures are not available for the actual size of the artisanal and subsistence fishery.

village based fishing enterprises. However, the rate of expansion exceeded expectations and by 1986, there were 80 such enterprises throughout Vanuatu (Dalzell & Preston, 1992). Since that time, numbers have declined dramatically, possibly because the equipment and ice making facilities are no longer serviceable.

Demersal or bottom fishing activities are usually carried out in shallow coral reefs and lagoon areas. Dominant species are the snappers (*Lutjanidae*), groupers (*Serranidae*) and emperors (*Lethrinidae*) (Dalzell & Preston, 1992). The percentage composition of the dropline catches by number and weight from dropline fishing on deep reef slopes (after 4 visits by SPC Master fisherman) for Vanuatu and the average of a range of Pacific Island countries (PICs) is shown in table 3 below:

Catch	Vanuatu		Mean for all other PICs	
	No.	Wt. (kgs)	No.	Wt. (kgs)
Etellinae/Apsillinae (Deep water snappers)	49.5	45.5	38.7	32.7
Lutjaninae (Shallow water snappers)	23.6	10.6	15.7	12.1
Lethrinidae (Emperors)	3.5	2.1	9.9	6.1
Serranidae (Groupers and Coral Trouts)	13.0	19.1	4.3	12.0
Carangidae/Scombridae (Trevallies, jacks, tunas & mackerals)	2.1	3.9	9.2	11.7
Gempylidae (Oilfish and snake mackerels)	1.6	4.6	3.3	6.8
Sphyraenidae (Barracudas and seapikes)	0.1	0.2	1.5	1.7
Other teleosts	2.5	1.3	3.6	2.1
Sharks	4.0	12.9	3.8	15.1

Table 3
Percentage catch composition by number and weight from dropline fishing on deep reef slopes for Vanuatu and other Pacific Island countries.

Fishing in deeper waters outside the lagoon takes the form of trolling and mid water hand lining for pelagic species such as tuna and mackerels. Dalzell and Preston (1992) used the results of research by Brouard and Grandperrin (1985) and Carlot and Nguyen, (1989) to estimate the total standing stock of Vanuatu to be roughly 980 tonnes and the maximum sustainable yield (MSY) to be between 98 and 294 tonnes. However, these figures should be treated extremely cautiously due to poor data quality, inconsistent sampling methods, differences in experimental designs, observer bias etc. Brouard and Grandperrin (1985) concluded that 'the bottom fish resources of the outer slope are, as it turns out, rather limited, which means that the fishery must be managed with great care'.

The deep slope fishery was initially established to increase the supply of fish to Port Vila, for export and to supply the burgeoning tourist industry (Dalzell & Preston, 1992). In the early 1990s, landings of deep slope fishes amounted to between 30 and 40 tonnes/year from the village based fisheries (Dalzell and Preston, 1992). It is now estimated that deep-water snapper fisheries provide 80 tonnes annually to domestic markets with relatively minor amounts exported (Wright, in prep).

Consumption of deep slope fishes by Ni-Vanuatu has increased gradually to the point where fish originally sent from rural centres to Port Vila is now retained for local consumption (Dalzell & Preston, 1992). Other contributing factors to the decline in the amount of fish reaching the main urban centre include poor vessel design because vessels cannot operate profitably after they had fished the initial virgin biomass (Dalzell & Preston, 1992), absence of a reliable inter-island freight service, lack of ongoing support to the fledging businesses, infrastructure and ongoing training.

Small amounts of aquarium products and bech-de-mer are exported but revenue to the government has been limited (Wright, in prep). For example, the annual average value of shell during the last decade amounted to VT98 million, representing 90 percent of marine product exports (Wright, in prep).

Natural and man made threats to biodiversity

Man made threats

Man made threats to the marine resources of Vanuatu include coastal construction, land reclamation, waste disposal, livestock farming, logging, soil erosion and effluent from septic tanks (SPREP, 1999). Done and Navin (1990) further suggest that the two major threats to the coral reefs of Vanuatu appear to be siltation accompanying logging of steep watersheds and eutrophication caused by domestic sewage discharged into reef waters.

The main threats to coral reefs in Vanuatu appear to occur in and around Port Vila. A study of water quality in 2 areas of Port Vila by Yeun (1980) showed high levels of faecal contamination and BOD in some areas, attributed to a malfunctioning water tank at the hospital treatment facility, storm water effluent and effluent from hotels. More recently, there is anecdotal evidence that during periods of high rainfall, runoff from settlements located behind the airport has affected the water quality in the Mele Bay harbour E. Bani (2000, pers. comm., 2 May). One tour operator reported a bleaching event of corals in this Bay during 1997. Also in the Port Vila area, areas of coral reef flats have been denigrated through land reclamation as a result of construction of resorts and villa's.

Outside of the main urban areas, the Environment Unit have received reports that some coastal village communities are concerned about the level of harvesting of non motile reef biota L. Silas-Nimoho (2000, pers. comm., 2 May). Destructive fishing practises including dynamiting have largely ceased, although there has been reports of Clorox use in the river systems E. Bani (2000, pers. comm., 2 May). Indiscriminate use of nets of all sizes is also increasingly recognised as a key threat to marine biodiversity L. Silas-Nimoho (2000, pers. comm., 2 May).

Collection of corals for the local tourist trade and home decorations (Bell & Amos, 1993) is not a significant problem for Vanuatu at present as only one operator was licensed as of 1997 *D. Kalfatak* (2000, pers. comm., 2 May). However, approximately 3 operators have recently applied for permits to export live coral (including both coral rubble which are covered with turf algae and other small organisms) for the aquarium trade. These proposals involve the culture of corals and giant clams (*Tridacna*) for export. Landowners, unaware or not concerned with the regulations of the Environment unit, have also been know to use corals to build houses and sea-walls.

Natural threats

Vanuatu is regularly under the influence of cyclones, ranging in frequency from 1 every 3 years to 3 in a year (Anon, 1984). The most devastating cyclone in the last 20 years was Cyclone Uma which passed through Vanuatu in 1987, causing extensive damage to Efate and it's coral reefs. A number of less intense cyclones have passed over Vanuatu in recent years but the extent of damage to the coral reefs has not be assessed.

Large populations of the Crown-of-thorns-starfish *Acanthaster planci* were located at 10% of the sites visited by the AIMS survey team, namely Port Vila, Aneiyum, Epi and Malekula (Done & Navin, 1990). Nevertheless, coral regeneration was good across all sites (Done & Navin, 1990). Crown of thorns outbreak have been of concern to local tour operators over the years. One outbreak was also reported in 1996 on Efate E. Bani (2000, pers. comm., 2 May). However, the amount of damage to those areas from this predator has not been properly assessed.

In geologic time and even during the last 50 years, periodic tectonic uplift and subsidence of islands have been catastrophic to Vanuatu's coral reefs and seagrasses when they were left permanently exposed to air (Done & Navin, 1990).

Current and potential climate change impacts

The Pacific Islands Climate Change Assistance Programme (PICCAP) country team in Vanuatu has determined that the impacts of climate change will be spread inequitably throughout the islands of Vanuatu, and will particularly affect low lying islands and their fringing reefs. The main impacts include significant increases in the frequency of cyclones, a gradual decline in rainfall and an increase in temperature of between 1 and 2 degrees up to the year 2050 (Government of the Republic of Vanuatu, 1999b: 24).

Coral mortality as a result of raised sea surface temperatures is a serious concern for the Vanuatu Government. Apart from reduced opportunities for fishing, similar concerns are shared for the state of fisheries where rises in sea surface temperature and consequent reduction in the amount of available oxygen could result in increases in fish mortality (Government of the Republic of Vanuatu, 1999b: 30).

The impacts from sea level rise are expected to be negated by the rate of tectonic uplift of some islands (Government of the Republic of Vanuatu, 1999b). However, the impacts of sand extraction from the reef flats and mangrove removal may be compounded by the effects of sea level rise.

The first National Communication, prepared through PICCAP, cautions that there is insufficient data to properly quantify impacts, identify areas of high vulnerability and design appropriate adaptation policies (Government of the Republic of Vanuatu, 1999b). For example, only one weather station in the country has records exceeding 50 years. The Action Plan proposed as part of this first National Communication emphasises activities that will address this lack of data and strengthen national capacity, especially at a national and provincial level to meet this challenge (Government of the Republic of Vanuatu, 1999b).

The Vanuatu government is also considering integrating climate change considerations with multi sectoral activities and institutionalising integrated social, environmental and development planning (Government of the Republic of Vanuatu, 1999b). The current Prime Minister of Vanuatu, the Honourable Donald Masikevanua, has declared his commitment to participating in international efforts to combat global warming and sea level rise (Government of the Republic of Vanuatu, 1999b).

Marine protected areas and level of management

Each cultural group in Vanuatu has its own traditional approaches to the management and conservation of marine biological resources D. Kalfatak (2000, pers. comm., 4 May) which include the establishment of managed or protected areas. Many coastal communities apply simple environmental indicators to manage their marine resources such as the physical size of the resource, abundance and catch per unit effort (Whyte *et al.*, 1999). Traditional approaches to coral reef conservation have been supplemented by a range of measures introduced by government and non government organisations and individuals in the private sector.

Taboos which apply to one managed area can be transferred to other areas. Some protected areas have management provisions that take into account religious practices. For example, within the Nagha and Pincia Protected Areas, turtles are protected during the nesting season but, since the community are Seven Day Adventists, fishing is allowed on Fridays J. Whyte (2000, pers. comm., 4 May). Unfortunately, however, not all management provisions and taboos are adhered to by neighbouring village communities and visitors.

Table 4 provides some examples of protected or managed marine areas which have been set up under customary tenure arrangements by coastal communities and by the Vanuatu government. Such measures have usually grown out of the need to protect and develop important economic industries such as fishing and tourism as well as conservation measures such as restocking of trochus and giant clams *Tridacna* D. Kalfatak (2000, pers. comm., 4 May).

Currently, there is only one formally declared marine protected area (MPAs) in Vanuatu (see table 4). The Colonial government designated small areas of land off Espiritu Santo which include foreshore areas (eg Aore Recreational Park, Bucaro Recreational Park, Naomebaravu-Malo Reserve), but in general, people are not aware that they are maintained as a reserve and the use restrictions placed upon them J. Whyte (2000, pers. comm., 3 May).

The Draft Environmental and Resource Management Bill (1999), currently being circulated for public comment, provides for the establishment of Community Conservancy Areas. Under these arrangements, a land owner or group of land owners can approach the national government to register their interest in establishing a private conservation scheme. The proposal is then to be considered by the Biodiversity and Conservation Committee who are required to: consult with the land owners and other interested parties to review and evaluate the nature of the scheme; accurately identify the area; verify rights and interests in land proposed to be included in the scheme and; identify and evaluate any conservation, protection and management options that may be proposed (Government of the Republic of Vanuatu, 1999c).

In order to meet the requirements of the (draft) Bill, the Biodiversity and Conservation Committee may also provide technical assistance to the land owner or group of land owners to undertake any survey or inspection of the area. Once all requirements of the Bill have been met, the Community Conservancy Area may be registered, maintained for this purpose by the Environmental Registry maintained by the Department of Environment and Conservation.

Island	Place	Community	Purpose	Year	Term (years)
Ancityum	Anawonjei Reef	Onedec Community	Protect marine resources/custom tabu	1991	10
Ancityum	Anelgauhat Reef	Anelgauhat	Maintain marine resources – Fisheries Act	1991	10
Efate	Emua	Emua & Saama Village	Tabu on reef	1995	3
Efate	Erakor and Empten Lagoons	Erakor Village	Tabu on harvesting marine resources	1997	1
Efate	Hideaway Island	Mele Village	Trochus stocking/marine reserve	1996	3
Efate	Mangalilu	Mangaliliu Village	Protect marine resources	1995	5
Epi	Ponkovio	Ponkovio Village	Tabu protecting marine resources	1989	?
Malakula	Nagha and Pincia Protected Area	Wiawi Village	Marine and forest conservation	1994	10
Malakula	Narong Marine Reserve	Selanamboro Village	Protect marine nursery area	1992	10
Malakula	Nawo Marine Konsevesen Area	Uripiv Island	Conserve reef and marine life	1995	3
Malakula	Nevnal	Leviamp Village	Conserve marine and forest area	1995	10
Malakula	Ringi Te Suh	Pelongk Village	Conserve marine resources	1991	5
Pentecost	Lekavik	Lebwibwi Village	Tak tabu on marine area	1998	15
Santo	Loru Conservation Area	Khole Village	Protect forest and marine resources	1994	?
Santo	President Coolidge Marine Reserve	None	War grave and dive site		

Table 4
Examples of Marine Protected Areas in Vanuatu (adapted from Whyte *et al.*, 1998).

Government policy, laws and legislation

The Constitution (Chapter 21, Article 71) ascribes “all land in the Republic as belonging to the indigenous custom owners and their descendants”. The Land Reform Act (CAP 123) defines land as “extending from the seaside of any foreshore or reef but no further”. However, this is at variance with common practice since customary ownership is often exercised over uninhabited offshore or detached reefs and islands (Preston, 1996: 17).

Traditional ownership of nearshore areas, particularly coral reefs, is hereditary (Amos, 1995). Customary law in Vanuatu dictates that most nearshore areas, especially coral reef flats owned by clans or larger communal groups, are not subjected to open access fisheries (Amos, 1995). Therefore, the marine resources of these areas are the property of landowners who may exploit or restrict access to them as they see fit (Preston, 1996).

The primary related responsibility for marine and coastal resource management in Vanuatu rests jointly between the Department of Fisheries within the Ministry of Agriculture, Quarantine, Forestry and Fisheries and the Environment Unit within the Ministry of Lands and Natural Resources. However, Vanuatu is party to, and abides by a range of regional and international agreements. Key legislation for the governance of Vanuatu’s marine sector is shown in table 5.

Legislation	Purpose
Marine Zones Act, CAP 138 of 1982	Delimits archipelagic zones to define territorial sea and other maritime zones (Preston, 1996).
Fisheries Act, CAP 158 of 1982	Development and management of fisheries including provisions to prohibit the use of explosives, poisons and noxious substances for fishing (Preston, 1996).
Fisheries Regulations Order No 49 of 1983	Conservation and regulation of fisheries including aquarium fish and coral.
Foreshore Development Act CAP 90	Regulates foreshore works.
United Nations Convention on the Law of the Sea (UNCLOS)	Law of the sea issues
Convention on Biological Diversity (CBD)	Signed in 1992 and ratified by the Vanuatu Government in 1993. Framework to manage and conserve biological diversity.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Regulates trade on 'red' listed species including giant clams.

Table 5
Key legislation of Vanuatu's Marine Sector.

The Fisheries Department, is responsible for the regulation, development and management of fisheries resources within Vanuatu. The objective of the Department is to have control over access to the fishery resources that ultimately limits, redistributes or otherwise modifies the type or amount of fish or seafood being caught.

The main piece of legislation dealing with the management of inshore fisheries is the Fisheries Act (CAP 158) 1982 and subsequent amendments. Under this Act, export of corals and coral products is only permitted with licences and permits. Fisheries Regulation number 19 prohibits the taking of more than 3 pieces of coral in any period of 24 hours except with the permission of the Director of the

Fisheries Department. Other restrictions considered in the past by the Vanuatu government include licensing collectors, imposition of quotas, prohibition of the use of SCUBA, restrictions on the collection of certain species, zonation of areas for collection and restrictions on the number of operators (Bell & Amos, 1993).

Although, it has tended to focus on the development of commercial fisheries, some observers (see Palfreman and Stride, 1996) feel that the Fisheries Department should place "greater priority... on the management of reef resources on which a far larger target group depends and which make a greater contribution to rural incomes, nutrition and self reliance in the rural areas than the commercial fishery". That said, it is expected that the traditional customs of people and customary marine tenure will have greater emphasis in the 2000 review of the Fisheries Act (CAP 158) 1982 (Jimmy, 1995).

Consideration of the impacts from developments on the environment is the responsibility of the Environment Unit, Ministry of Lands and Natural Resources. The Environment Unit is responsible for advising the Government on a wide range of environmental issues and for developing policies, programmes and projects concerned with environmental management. Policies and programs include surveys of flora and fauna, new legislation and environmental impact studies.

A set of general guidelines for the production of Environmental Impact Statements (EIS) was produced by the Environment Unit in 1987 (Government of Vanuatu, 1987). A requirement of these guidelines is to produce a report or statement with a description of the existing environment including the ecological resources, and design of a monitoring programme which will investigate adverse impacts for as long, or longer than, the project itself (Government of Vanuatu, 1987). The guidelines provide for community consultation and local knowledge to be taken into account in siting of development projects. However, ensuring compliance of these guidelines is particularly problematic in Vanuatu because the islands are so scattered and the cost of travel is high.

The EIS guidelines will continue to be used as a formal policy document for assessing environmental impacts on projects until the (Draft) Environmental and Resource Management Bill (Government of the Republic of Vanuatu, 1999c), submitted for public review in April 1999, is approved by Parliament E. Bani (2000, pers. comm., 4 May). Within three years of this Act coming into force, a Coastal Management Committee is required to initiate and develop a coastal resource inventory at the local, island, provincial and national level (Government of the Republic of Vanuatu, 1999c).

The Foreign Investment Review Board within the Vanuatu Government has right-of-veto over any foreign development project. In the outer islands, however, it is often the case that developers will approach the local villages and communities directly, thus bypassing the appropriate licensing and permitting authorities L. Silas-Nimoho (2000 pers. comm., 4 May).

Reclamation of lands in the Port Vila area is governed by the Foreshore Development Act and is the responsibility of the Ministry of Internal Affairs. However, in rural areas this responsibility falls to the Ministry of Lands and Natural Resources.

The Tourist Office administers permits to tour operators. Although no guidelines are provided to prospective operators, most operators appear to have adopted good codes of practice during their operations R.Dennis (2000, pers. comm., 3 May).

Current monitoring and management capacity

Monitoring Capacity

Survey and monitoring of coral reefs has only been conducted on an ad hoc basis since the AIMS survey in 1988, largely as part of the feasibility assessment of foreshore development projects (eg jetties) and as a result of the establishment of a Marine Protected Area in Hogg Harbour.² Due to tectonic uplift, poor siting and construction methods and lack of community acceptance, many of these development projects are no longer operational and follow up monitoring has not been carried out. E. Bani, (2000, pers. comm., 2 May).

Both the Fisheries Department and the Environment Unit believe that monitoring of coral reefs is a priority but lack the resources to develop the programme. SPREP have tried to encourage monitoring through the conduct of training in coral reef monitoring to people from the government and non government sectors of Vanuatu in 1990 and again in 1998. Whilst equipment was provided to all participants, most lacked the resources to design and implement monitoring projects on their own.

Vanuatu also participates in the 'State of the Environment Reporting' initiative co-ordinated by the Statistics Office and the Environment Unit. This is a UNEP initiative implemented through SPREP to establish a database of relevant environmental criteria for ongoing assessment of the state of Vanuatu's environment. The last national report was prepared in 1995. However, although forms were circulated, they were not generally completed.

A small research unit was formed within IRD, formerly ORSTROM, in the early 1980s. Although no longer in Vanuatu, the unit conducted some exploratory surveys of sea-mounts and reef slopes and promoted the establishment of a coastal station for the study of the marine environment (Bell & Amos, 1993).

Despite the lack of government, non government and international organisations involved in coral survey monitoring programmes, many coastal village communities regularly undertake monitoring of marine resources through observations of simple environmental indicators (Whyte *et al.*, 1999). In this context, the key consideration for the communities is the capacity of marine ecosystems to provide adequate resources to meet village needs in the short term (Whyte *et al.*, 1999).

Management Capacity

In the past, because of a lack of resources, regulatory agencies typically have had difficulty maintaining their services and instead have tended to focus only on immediate pressing concerns (Government of the Republic of Vanuatu, 1999b). Despite concerted effort through the Comprehensive Reform Programme (CRP) during 1999, and a plethora of training and other capacity building initiatives, this situation is unlikely to change in the short to medium term.

The Environment Unit currently has 2 full time staff although other staff have been funded out of project costs. The Vanuatu Fisheries Department currently has a staff of 14, located throughout the country, representing a 44 percent decrease in the total staffing budget since 1999 (Wright, in prep).

² Funded by USAID through the Profitable Environment Protection Project K. Fry (2000, pers. comm., 3 May).

According to the 2000 – 2004 Corporate Plan for the Ministry of Agriculture, Quarantine, Forestry and Fisheries (Government of Vanuatu, 1989), emphasis for the Fisheries Department will be to strengthen its services to the rural population to enhance maximum benefits of their resources. The 2000 budget for the Vanuatu Fisheries Department is approximately USD300,000. Other than the salary component (approximately 70%), the budget will be used to fund 4 programmes:

Program A - Resource Assessment, Management, Computer and Information Section;

Program B - Rural Fisheries Development Programme;

Program C - Administration and Support Services and:

Program D - the Santo Boat building Project.

Of these programs, Program A and Program B are most likely to contribute to coral reef management. Program A is concerned with stock assessment of marine resources, although a stronger emphasis on stock and habitat monitoring is also planned. Program B is concerned with the sustainable development and management of coastal fisheries up to the six nautical mile limit.

The Decentralisation and Local Government Act of November 1994, an indirect response of earlier government reform, gives more powers to Local government Councils in six newly defined provinces of Vanuatu (see Preston, 1996). As a consequence, Provincial Governments have become more active in the administration of fishing activity within six nautical miles offshore (Jimmy, 1995 and Wright, in prep). However, the majority of the Provincial Governments have few trained technical staff who have the capacity to assess and monitor any damage arising from the projects, none have dedicated fisheries/environmental officers or planners, and all have extremely limited resources (Government of the Republic of Vanuatu, 1999b: 42). In some cases, decisions have been made by the Provincial Governments which contradict national laws and legislation, resulting in a number of 'conflicts of interests' at different management scales and confusion as to roles and responsibilities of the respective agencies.

Decentralised village based management may work well in Vanuatu, especially in areas where customary tenure facilitates local control of fishing activities and villagers have access to biological information about the resource (Johannes, 1994). Coastal village communities have also used resource management tools such as bans on fishing individual species or entire sections of fishing grounds, but lack adequate technical advice to tell them how, where and when to maintain these restrictions (Johannes, 1994).

Requirements and recommendations for coral reef conservation

Coral reef conservation and associated resources in Vanuatu can only occur through good governance and stewardship. The main factors hampering good governance and stewardship include: a lack of understanding and awareness of the short and long term effects of various pressures on coral reefs and responses to them; ineffective management arrangements and frameworks to integrate the various management initiatives, policies and plans, including those developed at the community; limited capacity at the regional, government, community, and individual level to manage coral reefs and; inappropriate and intermittent technical and financial support to sustain reef conservation initiatives.

Understanding coral reef resources status, pressures and responses

The lack of reliable data and information about the use of coral reefs, fish stocks and condition of the habitat makes it difficult to get an accurate picture of levels of exploitation and levels of sustainability. In addition, some marine resources require more information to manage than others due to complex life histories, ecological characteristics and demand factors. Various innovative incentive schemes³ have been trialed to address this problem with mixed success. Improvements are also needed in completing and sending fisheries and environmental data to the appropriate places for processing, analysis and storage.

Jimmy (1995) recognises the need to educate some coastal communities on basic biological information on inshore resources and fishery management tools such as taboos, closure areas and catch size limits. Fisheries or Environmental Extension officers may have a significant part to play in teaching coral reef monitoring methods to coastal communities and vice versa. These officers could help raise awareness of the importance of particular coral reefs, and at the same time, provide practical site specific response options. It may also be possible to incorporate coral reef educational material in the school curricula, although this has had limited success as environmental topics are often out-competed by other core curricula subjects.

Awareness of the importance of coral reefs in Efate is now fairly widespread as a result of initiatives such as the 1997 Pacific Year of the Coral Reef Campaign in Vanuatu. However, this awareness is yet to reach the broader community and particularly the outer islands. Most of the previous environment awareness raising activities have been broadcast over radio. However, although radio is one of the only media which is accessible throughout the islands, it is unable to provide visual and physical cues and suffers from language barriers (Government of the Republic of Vanuatu, 1999b). Alternative approaches, although far more expensive, are those that involve visual clues through questioning and discussion. Meetings, workshops and particularly drama are also of demonstrated value in Vanuatu. For example, the Wan Smol Bag theatre group has been very successful in raising awareness of the need for coral reef conservation and has been instrumental in establishing MPAs in some coastal communities.

Management arrangements

Vanuatu is currently undergoing reform in the traditional spheres of governance as well as the larger macro-economic environment such as infrastructure, communications and services. However, as mentioned previously, there are still some fundamental problems that need to be addressed to improve the effectiveness of those arrangements, once finalised.

³ An incentive scheme to encourage fishers to provide information on their fishing operations in return for purchasing fuel at duty free prices has so far only provided data from 34 of the 88 artisanal fishing projects that were operational in 1988 (Wright, in prep).

Any initiatives to monitor and manage the reef need to be co-ordinated and integrated to ensure that the knowledge base is well documented and accessible by all stakeholders. Despite the extensive personal networks throughout the government sphere, inter-governmental and intra-governmental co-ordination is currently relatively weak but could be enhanced through team building and improvements in communication technology.

Donna Kalsatek and Leah Nimoho (2000, pers. comm., 3 May) argue that monitoring and management of coral reefs should be devolved to the communities, as the principle resource owners. Such measures legitimise the in-depth knowledge that Ni Vanuatu have of their local environments. Johannes (1994) also believes that such decentralised village based management work well in areas where customary tenure facilitates local control of fishing activities, providing coastal communities have an adequate biological information from which to make management decisions. Currently, however, coastal communities are applying controls (eg closures of individual species or entire sections of fishing grounds) without adequate technical advice.

Whyte *et al.* (1999) emphasise that traditional resource management and monitoring will not be effective unless: tradition remains strong; immigration has not led to sectors of the population not responding to local institutions; cosmopolitan influences are relatively weak; and local leaders are committed to resource management. Also, while Ni Vanuatu perceive that their marine resource base is resilient, they will not be easily motivated to make major changes to their existing resource management practices (Whyte *et al.*, 1999). In any case, devolution of management to the coastal communities may be more efficient for many of the earlier stages of management (assessment, exploring values etc.) but may require more effort in compliance.

In order to achieve economies of scale and synergy at the various levels of community and government, possibilities exist to work through the stakeholder network (comprising representatives from national governments, provincial governments, non government groups and the private sector) set up under the National Biodiversity Strategic Action Programme (NBSAP) to conduct monitoring of marine protected areas.

Opportunities may also exist to involve the local dive industry in monitoring the sites of their operations. Members of dive associations such as Dive Adventures, PADI and ProDive in Australia and other neighbouring countries, could be provided training in these techniques prior to coming to Vanuatu and undertake the surveys during their holidays J. Denis (2000, pers. comm., 4 May). To be successful, information sessions would also need to be held in Vanuatu for local dive operators. However, the dive industry is seasonal where the only opportunity to conduct monitoring programmes occur through the second half of January, the whole of February and March.

Capacity building

Capacity building in coral reef conservation is a long term process that needs to focus on training in coral reef monitoring and management as well a whole range of business development skills including marketing and financial management. Capacity building measures in the past have included use of volunteers and expatriate advisers. Although expatriate advisers can cross boundaries that Ni Vanuatu may be reluctant to cross due to cultural and social reasons, they often have short tenures and can interrupt project continuity. On the other hand, expatriate advisers can provide a form of advice based on experience that the Vanuatu may not necessarily possess, also reducing the requirement for larger government.

Support is also needed to trial and extend the results of pilot coral reef conservation projects to other areas. Partnerships with others who are the beneficiaries (e.g. industry) or stakeholders of the resource should be developed to ensure efforts by any one promoter or broker are enhanced, encouraged and supported.

Community groups in general are aware that their coastal and marine resources are declining (Whyte *et al.*, 1999). Feedback to government regulatory agencies indicate that most communities are familiar with the nature of the threats to their resources. However, they cannot be expected to manage some of these threats, such as some of the land based sources of pollution, and may need external help (see also The World Bank, 1999) and training.

Financial support

The key to sustainability of coral reefs is to offer communities, government, NGOs, the private sector and donors financial support to develop a sound and well integrated monitoring and management system. Initially, this will require scoping of critical issues through a range of meetings and other consultative mechanisms. Donors should also be brought into this process to ensure that their funding programmes can be structured accordingly. To be successful in the medium to long term, such initiatives need to be supported by a modest but steady influx of resources over a sustained period and linked to a range of new and existing conservation and management initiatives.

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