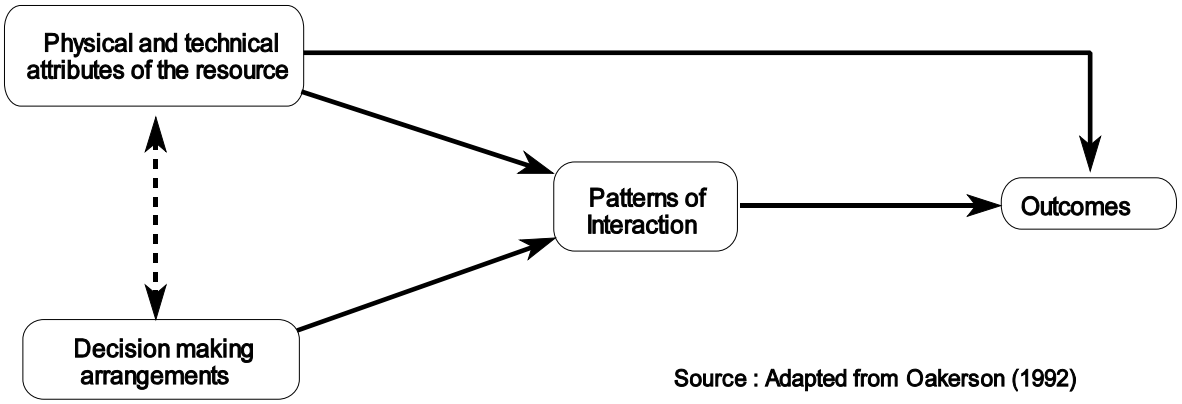
The Performance of Customary Marine Tenure in the Management of Community Fishery Resources in Melanesia

VOLUME 1

Project Background & Research Methods

Oakerson's Framework for the analysis of the commons



Source : Adapted from Oakerson (1992)

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1 Project Background and Research Methods

1.1 Introduction

Coral reef fisheries in the Pacific region exhibit a number of important (and inter-related) characteristics relevant to management by the centralized State agencies. They are typically of small-scale, communications are typically poor between the communities and urban/administrative centres and the fisheries systems are diverse in their individual institutional and environmental attributes. Coral-reefs are such complex natural systems that management is difficult and the techniques themselves are often based on a 'techno-fix' solution. Finally, there may be contradictions in overall management policy within the agency. In particular there is often a lack of coherence within the agency that has a remit to both develop fisheries (particular export commodities) and to promote sustainable use. Funds and training are being made available (often provided by aid-donor countries) for expansion of fisheries but this is not undertaken within the constraints of sustainable, or even pre-cautionary, management.

What are the implications of these characteristics for centralized management authorities in the Pacific region? Although the small scale of individual fisheries implies that investment in the management of one fishery need only be small, the sheer number of what are often village-sized fisheries of as few as 50-100 fishers requires a much larger total investment for the State. The required investment is further increased by the lack of development in communications (poor or no roads, limited telecommunications facilities etc). Simply organizing a meeting of village leaders, who may be absent from the village or some distance away in fields or even out fishing themselves, may require a number of preparatory visits and hence additional expense in time and money. The many individual fisheries display a huge diversity of attributes including language and cultural variations which is usually manifested as a diversity of form of community institutions. A State official, operating with limited financial and human resources, may be relatively unaware of the nuances of this complexity and diversity. Similarly, the complex environmental and ecological characteristics of so many sites requires of the State agency a suite of potential management responses and the technical skills to implement them in the correct manner. Although many of the region's senior fisheries staff have been trained in management and assessment techniques, they often lack the support of more experienced individuals to assist and guide their work. Applications of management formulae adapted from literature are often applied without a full appreciation of the complexity of the system. Furthermore, 'the long-established biological emphasis in fisheries management has meant that the role of fishermen, (and even more so, fisherwomen) has largely been ignored' (Hviding and Baines, 1994:13; Hassett, 1994).

In combination, these factors can result in management interventions which lack congruence with reality in the fishery (Ostrom, 1990). This lack of congruence may result in attempts to alter or impose institutional structures alien to a communities traditions and norms (e.g. Village Fisheries Development Programme, Vanuatu). It may also result in management (or operational) rules that do not take into account particular physical attributes or accurately reflect

technological conditions. The contradictions in policy within the State agency can lead to significant inefficiencies in use of scarce funds. Although agencies have promoted development (through the provision of ice facilities, subsidized vessels, engines, fuel and fishing gears, e.g. in Fiji), there has been little in terms of developing coherent management policies. Adams reported that 'the majority of governments have not pursued any policy at all and have been restricted to crisis management (usually involving an export commodity)' (Adams, 1996:2). In the worse-case scenario centralized management interventions may lead to conflict and discourage sustainable resource use (Jentoft and McCay, 1995).

But many fisheries in the Pacific region have one additional, and crucial characteristic. The presence of customary marine tenure (CMT) systems. These systems, based on wider cultural institutional forms, are community or tribal-based common property-type systems of marine tenure (Ruddle and Johannes, 1990; Hviding and Baines, 1994). In general research has been focused on the documentation of a number of extant CMT systems, and a body of literature exists for Palau (Johannes, 1978, 1981, 1991), Solomon Islands (Hviding, 1988, 1989, 1990), Fiji (Kunatuba, 1989; Fong, 1994; Cooke, 1994), Vanuatu (Amos, 1993; Johannes, 1994) and Western Samoa (Fairburn, 1992). The work of these researchers has resulted in many different interpretations of the function of CMT systems. They may act simply to control invasion of local marine space, to regulate use by groups within the community or tribe or they may act to control exploitation of specific resources and the use of particular fishing gears.

Much that has been written on these systems is positive. Berkes and Farvar (1989) argue that common-property and community-management systems traditionally performed a number of critical roles in the local community. Their role in maintaining livelihood security was vital where the local environment was the sole source of food; common-property systems therefore needed to ensure conservative utilisation of resources (eg Johannes, 1981). Johannes (1994) indicated that 'Vanuatu's example suggests some strategies and conditions that would favour the success of government-support, village-based management of small-scale fisheries in other Pacific islands'. Hviding and Baines (1994:36) concluded that 'CMT systems like that operating in Marovo [Solomon Islands], building not just on local autonomy and self-reliance, but also on highly detailed knowledge of the coastal marine environment and day-to-day monitoring of resource bases, offer potential for appropriate 'self-regulation' of fishing effort.....Traditional resource managers like those of Marovo are proponents of de-centralized resource management, participatory planning and a non-sectorized approach to rural development'.

However, other researchers have a taken a more cautious line, for example Polunin (1984) undertaking research in Irian Jaya and Papua New Guinea could not determine any conservation basis to the CMT systems he observed there. Although traditional relationships may be based on a deep interaction with the environment (e.g. Johannes, 1981,1994) this does not necessarily equate to management for sustainability. Bulmer, (1982, cited in Carrier, 1987:162), observed that 'the underlying beliefs about the nature of the universe and the powers at work in it are hard, if not impossible, to relate to modern conservationist principles'. Carrier, reporting on his research in Papua New Guinea, noted that 'it is recognized that traditional inter-village fishing rights and other indigenous forms of marine tenure do not guarantee sound management and conservation of fish stocks' (Carrier, 1987:143) and went on to report that 'they [Ponam Islanders] saw divine rather than human action as the salient source of environmental change' (Carrier, 1987:154). Cordell and McKean (1992:197) observed that a 'truely self-regulated fishery presumes not only that fishermen know both the limits of their resources and the impact of their equipment on

resource availability, but also that they have the ability to keep the rates of exploitation in line with the productive capacity of the environment. It is doubtful that there is a traditional system anywhere that would meet this presumption'. One of the important implications of this observation is that it may be questionable to place too much emphasis on CMT systems as independent management units, acting completely independently of institutions that may usefully offer advice and a precautionary approach.

Because of the wider political and cultural context of CMT systems it would be wrong to think that they have existed in isolation and that they have only been 'discovered' relatively recently. Cordell and McKean wrote in 1992 that 'in recent years, however, ethnographers have begun to investigate the neglected domain of customary property relations in maritime fisheries and have discovered "sea tenure"'. This may have been true for ethnographers but many of the region's states have incorporated CMT systems into their fisheries policy for decades. The earliest example in the region is probably for Fiji, where the rights of the traditional custodians was recognized in the late nineteenth century. In a speech given by the Governor of Fiji in 1881 he stated:

'Chiefs of Fiji....it is Her Majesty's desire that neither you nor your people should be deprived of any rights to those reefs which you have enjoyed under your own laws and customs; and I may tell you, on my part, that measures will be taken for securing to each [clan] the reefs that properly belong to it, exactly in the same way as the rest of their land will be secured to them....'. These sentiments were formerly incorporated in Fiji's fisheries legislation in the 1942 Fisheries Act which aimed 'to protect rural Fijians' rights to maintain their subsistence livelihood, and to give a measure of basic protection to stocks of food-fish and shellfish' (Adams, 1993).

Other examples from the region include the Vanuatu Constitution. Article 74 of the Constitution states that 'The rules of custom shall form the basis of ownership and use of land in the Republic of Vanuatu'. This definition includes land and reef areas. The Vanuatu Fisheries Act, Cap 158 (1989) demands that aquarium-fish may only be exported with a licence from the Minister of Fisheries but that a 'permission granted under this regulation shall not affect any obligation to reach agreement with custom land owners regarding the use of land and waters for the catching of aquarium fish'. The Western Province of the Solomon Islands promised to 'recognise and respect customary fishing rights and knowledge and use these as foundations on which to build modern inshore fisheries' (Western Province, 1985:21, cited in Adams, 1996). The Cook Islands Fisheries Act of 1989 devolved some management authority to local island councils although 'these do not necessarily coincide with traditional leadership structures' (Adams, 1996).

However, it should be noted that fisheries departments in the region 'have not been as quick to try and take over comprehensive control of coastal fisheries management,.... This has been because most Pacific Islands already have a strong tradition of local-area fishing rights ownership, wielded by communities and local chiefs. In the Pacific Islands, almost all the voters and certainly most of the traditional power brokers, live in the coastal zone, and the majority of them make full use of their fisheries, and resist attempts to abrogate authority' (Adams, 1996). This observation is a key one because it identifies the strength of independence of CMT systems. The potential of CMT for future fisheries management may be limited because of the desire of these authorities to maintain control.

On the other hand, the shifting economic and social structures of many of the small fisheries in the region can place these traditional authorities under pressure. These systems may be

structurally unable to meet the challenge of rapid exogenous change and hence fail to meet the role in fisheries management which many believe they are capable of fulfilling (e.g. Johannes, 1994; Ruddle, 1998). Although as Kunatuba observed 'It is important to note that the social and political setting of a fishing community is not a problem; rather it is a situation. It would prove very costly and time-consuming to try to change that 'situation'' (cited in Ruddle, 1998).

This research project arose in an attempt to assess what the 'situation' actually is in Melanesia and the performance of community-based management under this situation. This was a demand led project, arising from a 1995 MRAG poll of research demands of South Pacific Commission (now the Secretariat of the Pacific Communities) member states. Hviding and Ruddle (1991) undertook a regional assessment (review) of the potential of CMT to contribute to fisheries management in the Pacific region. They indicated what they see as important themes for research. Amongst these themes they argued that research on the dynamics of CMT systems in evolving to meet the demands of changing social, economic and ecological circumstances was critical. Such research would include investigation of the politics of resource use and allocation with its central implications for the formulation and implementation of fisheries co-management policies. They also recommend that investigations into CMT systems were implemented through a multi-disciplinary approach. This project, utilising a multi-disciplinary team, sought to identify the constraints and advantages of extant CMT in Melanesia and the potential for a working (and disciplined) cooperative management between the state and customary marine tenure systems. Research was undertaken in two Melanesia countries, Vanuatu and Fiji, from July, 1996 to November, 1998. These countries, as was noted in Section 1.1, have extant CMT systems and these systems have to some extent been incorporated into national legislation. Both countries have a body literature on CMT systems by which to provide useful background information. Fiji is the home of the University of the South Pacific's Marine Studies Programme which also undertakes research into CMT systems, particularly in Fiji.

1.2 Evaluating the performance of Customary Marine Tenure

Institutional arrangements and the management strategies based on CMT in Fiji and Vanuatu were categorised based on existing information (Amos, 1993; Cooke, 1994; Fong, 1994; Johannes, 1994). and were verified and augmented by a frame survey of six customary fishing rights areas (CFRAs) in Fiji (known as *qoliqoli*) and seventeen small (village) CFRAs in Vanuatu. A number of sites were selected for further study, these representing a variety of management strategies operating under different fishing pressures. Target fish species important in the catch, or selected for specific management, were identified during the frame survey. The frame survey also documented physical and technical attributes of the fishery, including description of the types of fishing units and available infrastructure.

A monitoring programme over two years was established to further augment socioeconomic and fisheries appraisals with data collected by village-based data collectors. A locally-recruited field manager was appointed in each country to manage this task and to verify and assure the quality of data collected.

1.2.1 Social and economic assessments

Data on the social and economic context of the CMT systems at each study site were gathered using the semi-structured appraisal techniques proposed by Townsley (1993) and Pido et al (1996). Two MRAG-contracted research staff, Mr Jim Anderson and Mr Phillip

Townsley joined with staff from the relevant fisheries departments, staff from Marine Studies Programme and the locally-based Field Managers to undertake the initial rural appraisals in 1996.

The first step in the appraisals was a review of existing literature on marine tenure and management in the two countries studied. The review included collation of statistical information on population in different areas and documentation of the policy and legal framework for both land and marine tenure in Fiji and Vanuatu. When combined with visits to the field and an initial assessment of information on the fisheries characteristics of different areas, the review enabled the identification of a range of potential sites as a frame.

The identified sites were visited and the communities contacted to explain the programme and gain approval for the project's activities in their areas. The initial appraisals were carried out in each community over a 2-3 day period. Key informants in each community were selected as representative of different gender, age and where appropriate different socioeconomic groups. Data were gathered on existing marine tenure arrangements, patterns of use of marine resources, village institutions and local people's attitudes and opinions regarding marine resources and their management. Data on local marketing conditions and on the historical and seasonal context of the fisheries and tenurial arrangements were also gathered. During interviews, extensive use was made of sketch mapping for the illustration and discussion of marine management areas and tenure arrangements as well as for patterns of marine resource use. Ranking exercises were used to establish priorities and approximate levels of exploitation of different resources from different areas.

Using these techniques, a detailed picture of the characteristics of the fisheries' stakeholders and their communities was obtained. Clearly, many sensitive areas regarding the political and social relationships surrounding tenure arrangements could not always be investigated fully in the time available. Further investigations of these relationships were incorporated into the two-year monitoring programmes and undertaken by MRAG staff in collaboration with project field staff.

Table **1** - Summary of Information from Frame Survey of *9 Qoliqoli* in Fiji

Site	Types of management measure	Coverage	Explicit Intention	Implicit Intention	Observance
Namuka/Dogotuki, Vanua Levu	1. Ban gill-netting at night	whole *qoliqoli*	conserve fish / eliminate waste	improve equity of access for locals	good
	2. Ban on diving at night	whole *qoliqoli*	conserve fish		fair
	3. Area closure to commercial fishing	inshore bays	protect juveniles	claim areas within combined *qoliqoli*	good
	4. No licences for Indo-Fijians		restrict access for non-locals		good
	5. Goodwill payments for licences	locals only	finance community projects		
Naweni, Vanua Levu	1. Ban on all fishing	Tacilevu village	ritual purpose	demarcate sub-area	good
	2. Ban on all fishing	Naweni village	ritual purpose	demarcate sub-area	good
Navadra, Vanua Levu	1. Ban on all fishing	partial	ritual purpose - death of *tui* (related village)		good
	2. Ban on all fishing	One disputed reef	protect resources	enforce *tui's* claim to area	good
Nasavusavu, Vanua Levu	1. Goodwill payment for licences	Commercial fishers	finance community projects		poor
Tavua, Viti Levu	1. Goodwill payment for licences		finance community projects		Indo-Fijians ✔ Fijians ✘
	2. Ban on set gill-nets	Rivermouths	protect juveniles & spawners		good
	3. Ban on all fishing	Manava Reef	protect resource / giant clam project		poor
Cautata, Viti Levu	1. Ban on licences for non-locals	Whole *qoliqoli*	Protect resources for primary access right holders.		Non Issued
Vitogo/Vidilo, Viti Levu	1. Goodwill payments for licences	Whole *qoliqoli*	Finance community projects		Indo-Fijians ✔ Fijians ✘
Yanuca, Viti Levu	1. Goodwill payments for licenses	Whole *qoliqoli*	Limit fishing activity		Poaching

Table **2** - Summary of Information from Frame Survey in Vanuatu (1)

Sites	Management Measure	Coverage	Explicit Intention	Implicit Intention	Observance
Lelepa Island	1. Ban on all fishing	Selected reef areas	Preserve resources for future generations		good
	2. Ban on diving at night	Whole village reef area	Preserve resources for future generations		fair
Taseriki	1. Ban on all fishing	Selected reef areas	Source of occasional income		good
	2. Ban on all fishing	Reef area leased by resort	Preserve resources		fair
Sunae	1. Ban on *trochus* harvest	Selected reef areas	Rehabilitate resources		good
Saama	1. Ban on all fishing except for shellfish collecting for consumption	Whole village reef area	Rehabilitate resources	Response to closed area in neighbouring village	good
Emua	1. Ban on all fishing	Whole village reef area	Rehabilitate resources		good
	2. Ban on use of poisons	Whole village reef area	Preserve resources		good
Takara	1. Ban on *trochus*	Shoreline reef areas	Village development (church construction)		fair
Mele	1. Ban on all fishing	Area adjacent to resort	Preserve Resources		fair
	2. Restricted access to shoreline	One stretch of shoreline	Preserve fish, coral and forest resources	Restrict resource use by nearby immigrant community	good, when policed

Table **3** - Summary of Information from Frame Survey in Vanuatu (2)

Sites (Vanuatu)	Types of management measure	Coverage	Explicit Intention	Implicit Intention	Reported Observance
Peskarus Village (Maskelyne Islands)	1. Ban on catching of (*Siganidae* spp.)	Whole island reef area - seasonal (November)	Protect spawning fish - enhance resources		poor
	2. Ban on gill-netting and diving at night	Individual custom owners on reef areas - currently imposed by **all** custom owners	Preserve resources	Establish property rights to reef areas	fair
	3. Ban on *trochus*	Individual custom owners on reef areas	Preserve resources	Protect source of income for custodian	good
	4. Ban on all fishing	Sugalump Reef - imposed by custom owners	Preserve resources	Establish property rights to reef areas	good
	5. Ban on all shellfish collection	Reef around Vulai island	Preserve *trochus* resources		good
Pellonk Village (Maskelyne Islands)	1. Ban on gill-netting, diving at night and fishing with lights	Whole village reef area (6 months/year - October-March)	Protect spawning fish - enhance resources		good
	2. Ban on octopus	Whole village reef area - temporary	Enhance resources		good
	3. Ban on *trochus*	Individual custom owners on reef areas - currently imposed by **all** custom owners - lifted periodically	Protect resources		good
	4. A 'marine sanctuary'	Introduced by one custom owner with government support	Protect resources	Establish custodian's claim	fair

Table **4** - Summary of Information from Frame Survey in Vanuatu (3)

Site	Management measure	Coverage	Explicit Intention	Implicit Intention	Reported Observance
Lutes Village (Maskelyne Islands)	1. Ban on gill-netting, diving at night and fishing with lights	Whole village reef area (6 months/year - October-March)	protect spawning fish - enhance resources	-	good
	2. Ban on octopus, lobster, *beche-de-mer* and giant clam	Whole village reef area - temporary	enhance resources	-	good
Uripiv Island (N.Malekula)	1 Alternating ban on commercial crabbing and gillnetting	Specified mangrove area - *tabu* alternate every 9 months	enhance resourecs	-	fair
	2. Ban on gill-netting and diving at night	Individual custodians on their reef areas	protect resources	-	good
	3. Ban on all fishing	Individual custodians on their reef areas	protect marine and land resources	establish property rights to reef area and adjacent land	fair
Wala Island (N. Malekula)	1. *tabu* on all fishing	Individual custodians on their reef areas	protect resources enhance resources for tourism	establish rights to reef area and adjacent land	good
Atchin Island (N. Malekula)	None at time of initial frame survey	-	-	-	-

Table **5** - Summary of Information from Frame Survey in Vanuatu (4)

Sites	Management measures	Coverage	Explicit Intention	Implicit Intention	Reported Observance
Tapekoro Village (Emae Island)	1. Ban on *trochus beche-deimer* & green snail	Whole village reef area	Enhance resources	-	good
	2. Ban on all fishing	Whole village reef area (3 years)	Enhance resources	-	good
ChiwoVillage (Emae Island)	1. Ban on *trochus*	Whole village reef area	Finance village development	-	good
Sangafa Village (Emae Island)	1. Ban on all fishing	Part of village reef area	Finance village development	Response to neighbouring village's closed area	good
Marae Village (Emae Island)	1. Ban on all shellfish, octopus and *trochus*	Part of village reef area	Enhance *trochus* resources -	-	good
	2. Ban on gill-netting	Whole village reef area except for community purposes	Preserve resources	-	good
Finonge Village (Emae Island)	1. Ban on all fishing	Whole village reef area (lifted for special occasions and on special requests	Preserve resources - enhance resources to finance village development	Response to neighbouring village's closed area	good
Tongamea Village (Emae Island)	1. Ban on all fishing	Part of village reef area - lifted for special occasions and for special requests	Preserve resources - enhance resources to finance village development	-	good

Following the rural appraisals at the sites identified in Tables 1 to 5, a number of sites were chosen in each country covering a range of estimated fishing pressures. In Fiji, the Yanuca Island site was abandoned after 12-months. Data collected at Tavua over the first 9 months was also discarded and a replacement Field Manager and data collector for this site employed. In Vanuatu, the Pellonk village site was changed in favour of Emua Village after 12-months.

Table **6** - The sites chosen for longer term monitoring and research

Country **Site (Village)**	**Period of Monitoring**	**Estimated Fishing Pressure**
Fiji		
Verata (Ucunivanua)	July, 1996 to June, 1998	Medium
Yanuca (Yanuca)	July, 1996 to June, 1997	Low
Tavua (Landing sites)	April, 1997 to March, 1998	High
Naweni (Naweni)	July, 1996 to June, 1998	Low
Naweni (Tacilevu)	July, 1996 to June, 1998	Medium
Vitogo/Vidilo (landing sites)	October, 1997 to September, 1998	High
Cautata (Cautata)	October, 1997 to September, 1998	Medium
Vanuatu		
Atchin Island	November, 1996 to October, 1998	High
Wala Island	November, 1996 to October, 1998	Medium
Uripiv Island	November, 1996 to October, 1998	Medium
Pellonk Village	November, 1996 to October, 1997	Low
Emua Village	November, 1997 to October, 1998	Low
Lelepa Island	November, 1996 to October, 1998	High

1.2.2 Fisheries assessments

Volume 3, on Biological Outcomes will address the questions: If traditional models of community management are to be the basis of new co-management initiatives, how effective, across a range of fishing and population pressures, are existing attempts at management based on customary principles, in terms of biological sustainability? What is the status of fishery resources inside managed areas - has management conferred any benefit compared to un-managed open access areas?

To investigate the success of any management interventions, for fish populations and communities it is necessary to understand the effects of fishing and the effects of different management actions. A summary of the key areas of investigation are presented in Tables 7 and 8

Table 7 - The effects of fishing

Single species effects	Multi-species effects
Reduction in density and biomass (and CPUE) Reduction in mean length Increase in growth, and size at age Increase in fishing mortality	Changes in species assemblage Changes in species richness

For study areas, it will be seen that there are 3 types of management:

Table 8 - The effects of different management actions

Closed Areas	Licensing / restricted entry	Gear controls
Reduce Effort Depleted stocks recover Reverse effects of fishing Protects important habitats	Reduce Effort Moderate effects of fishing	Reduce Effort Moderate effects of fishing Affect size at capture Alter species composition

1.2.2.1 Research Methods

In order to study fishing and management effects, Volume 3 will examine management success across a range of fishing pressures at different sites in Fiji and Vanuatu using a combination of two methods (see Table 9).

Table 9 - Methods employed to Assess Biological Sustainability

1.Underwater Visual Census	2. A Fisheries monitoring programme
Habitat characteristics Species and family abundance Species assemblages Species length differences	Species length and growth differences Mortality differences Species and family abundance Species assemblages

A data collection programme was established at the sites described in Table 6. At each site a local data collector was selected and training in data collection provided by field staff. At each site data-entry forms were provided in the local language. Because of the wide familiarity of fishers with their own language names and the potential problems with training to species-level identification all fish were identified using local language (or in the case of Fiji, dialect) names. Some names were for individual species, some covered a range of morphologically-similar species. Some species, especially sexually dimorphic species, were

found to have different names for different periods in their life-cycle. Data was collected on each fishing trip covering details of the fishing trip including the name of the fisher, the duration of the trip, the type of vessel (where appropriate), the gear used and the number of fishers operating together. Data on the subsequent destination of the catch (consumption, market, gift etc) was also collected. Biological data was collected using measuring boards provided by the project (to the nearest 1cm). A random selection of 10 fish (as a maximum) per 'species' were measured by the data collector per trip, following a chose one, discard one protocol. The total number of fish caught of each 'species' was also recorded. The data collectors were employed full-time by the project but it was recognised that not all trips would be recorded especially when a number of fishers arrived at the beach landing site together and for some fishing trips taking place at night. To account for this additional effort, a second data-entry form was provided and the names of those who had fished, but for whom detailed data was not collected, was recorded by date. In the case of Tavua and Vitogo/Vidilo, a data collector with extensive and highly accurate taxonomic knowledge was employed from April, 1997. At these sites data were collected to species level. The variable costs and wholesale revenues of each trip were recorded at these two sites and cross-checked with fish-dealers.

Two field managers were employed by the project to undertake in-country management of data collection, data-entry (with the assistance of the relevant fisheries departments) and budget management (with assistance from the University of the South Pacific). The field managers followed a two-week collection cycle during which they would visit each site and work with the data collectors. The following two-weeks were spent entering data in the offices of the two fishery departments in Vanuatu and Fiji using a relational database developed by project staff. Additional data on social and economic aspects was also collected by the field managers during their field visits following protocols devised by the project's rural appraisal advisor, Mr Philip Townsley.

1.2.2.2 Assessment Expectations

Managed areas are expected to have low or zero (closed areas) fishing effort, and for these, only UVC data may be available.

Throughout Volume 3, the effects of fishing on single species and communities of fish, and how management actions have moderated those effects will be examined through:

- Direct comparisons between tabu (managed) and open access areas;
- Correlation of study variables (e.g. mean length, cpue, abundance) with the level of fishing effort applied, to see if this explains any observations derived.

The results from studies reported in Volume 3 are summarised for Vanuatu and Fiji in Volume 2, Chapters 1 and 2 respectively.

The terms ***site***, ***area*** and ***dive-location*** are used consistently throughout this report. Fishing-***sites*** refer to the Customary Fishing Rights Areas (CFRAs) within which fishing **areas** exist and which may be subject to management interventions by the fishing communities. For Underwater Visual Census work a number of replicate **dive-locations** within each area were surveyed.

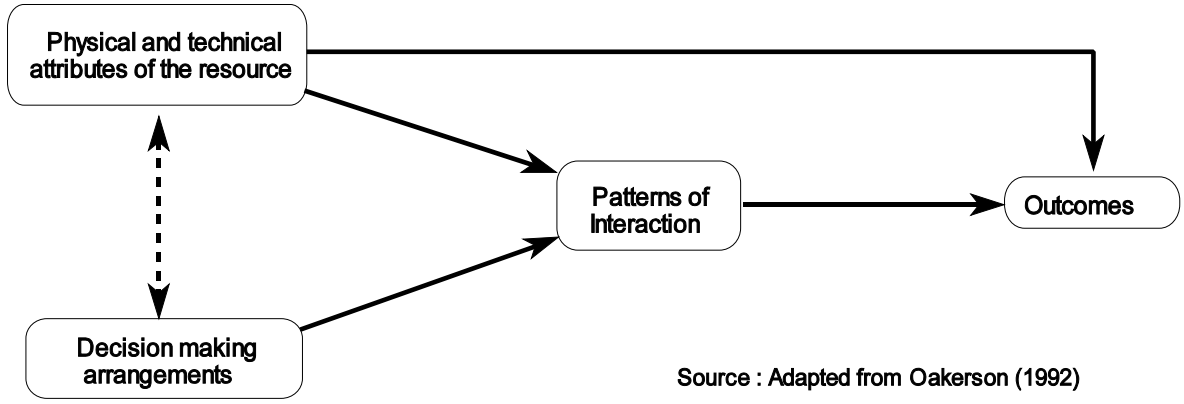
Length frequency data from the fisheries monitoring programme were employed to derive population demographic variables for key species identified in the catch. The von-Bertalanffy growth parameters (K, $L\infty$) were derived using a version of the ELEFAN method (Pauly, 1987) with the aid of the computer packagee LFDA (LFDA, a computer aided programme for

length frequency distribution analysis, The LFDA Package, vesrion 4.01, MRAG Ltd, 1995, London). Total mortality (Z) for each study species was derived from length converted catch curve analysis (Jones, 1984) applied to aggregated length frequency data each season. The instantaneous coefficient of natural mortality (M) was estimated empirically (Pauly, 1980) at a water temperature of 27^{o}C (from the Nautical almanac for the Pacific Ocean). Fishing mortality was derived by subtraction (F=Z-M).

1.3 The analytical framework

Customary marine tenure systems have been described as the ways 'in which inshore fishers perceive, name, partition, own and defend local seas space and resources' (Cordell, 1988). This definition, while perfectly accurate, belies the complexity of CMT. CMT is the interaction of a host of cultural, historical, geographical, biological, legal and technical components. These diverse influences have stimulated the evolution of many different, and complex, expressions of CMT-based management. This complexity creates difficulties for the analysis of even a single expression of CMT let alone a comparative analysis of *different* CMT systems At one level, CMT systems can be assessed using familiar techniques. For example, the *efficiency* of the CMT systems under investigation may be assessed using, for example, the analysis of spatial and temporal catch/effort data. Equity issues can be addressed through economic analyses. However, these techniques do not examine the crucial *interaction*s between fishers, management institutions and the resource. To better understand and later adapt such systems it is therefore essential to adopt a standard framework for single and comparative analysis. To assess the complete management *system* the research therefore employed Oakerson's Institutional Analysis and Development (IAD) framework (Oakerson, 1992), which was originally borrowed from the science of political economy (Ostrom, 1994). The Oakerson Framework (see Figure 1) brings together the outputs of different scientific disciplines into a single system analysis.

Figure 1 - Oakerson's Framework for the analysis of the commons



To achieve this, the framework seeks to identify the fundamental *elements* of a resource system and the relationships between them. The four basic elements to the framework are: (1) the *physical and technical attributes* of the resource, (2) the *decision-making arrangements*, (3) the *patterns of interactions* that result from mutual choice and (4) the *outcomes* that are observed in the resource system.

1.3.1 Framework elements

1.3.1.1 *Physical and technical attributes*

The physical and technical attributes of a resource directly limit and indirectly constrain the outcomes observed. Some attributes, such as the basic productivity of a marine resource, will affect outcomes independent of human action. The attributes set the limits to what outcomes are achievable in any given system. However, the physical and technical attributes of the resource also affect outcomes indirectly by influencing human choice and subsequent action. The nature of the resource, along with any rules in place that determine its use, sets the range of opportunities open to potential appropriators. Individuals make decisions on the basis of these and their resulting actions directly affect outcomes.

Oakerson describes three key aspects of such attributes that broadly constrain the decision situation faced by all common-pool resource users. These three features are as follows: the degree to which resources can support mulitple users, the ease of excluding others from the flow of resource benefits and the scale of management.

Governments and stakeholders seek a flow of benefits from a resource. The capacity of a resource to support multiple users describes the degree to which individual and cumulative exploitation reduces the capacity of the resource within a single CFRA to provide these benefits. For communities responsible for management of a resource they seek to maintain a flow of these benefits. Not surprisingly the types of benefits sought by stakeholders, and the regulations devised to maintain them, will reflect local cultural objectives and socio-economic conditions. In the same way, those charged by governments with responsiblity to manage resources will also have a set of objectives to meet and socio-economic demands to statisfy. Until recently these have often conflicted and this conflict, aggravated by wider changes in society, has threatened the flow of all types of benefit. Analysis of subtractability should include both the perspective of stakeholders and governments.

In the face of increasing demand, the excludability of marine resources is an important consideration when making management rules and in understanding the fishers' subsequent behaviour. For example, it is more difficult to exclude fishers from benefiting from a highly migratory resource. At a management level, exclusion may be fully regulated to limit the activities of all fishers or it may be partially regulated, limiting the activities only of those outside the community holding right of access.

The final consideration in the analysis of the physical and technical attributes is over what scale of the physical environment should management activity most efficiently take place, is the current scale appropriate to the underlying resource base and the technological attributes of the fisher? In the case of migratory resources mentioned above, then a number of small, independent units along the path of migration is likely to be inappropriate, on its own, for effective management. On the other hand, for highly sedentary, locally recruiting resources (such as *trochus*) then a relatively small area of a reef could be an effective management unit. Consideration of the divisibility component of the physical and technical attributes is especially important when developing co-management in areas not currently under marine tenure. By comparison, in an extant common-property regime one's analysis is, at least initially, limited to the existing borders of that regime.

1.3.1.2 Decision-making arrangements

There are three areas of interest in this component of the framework. The institutions and circumstances that define the boundaries for legitimate individual and collective choice within a community are known as the conditions of collective choice. These boundaries are

implemented via some suite of regulations on behavior (operational rules). Decision-making arrangements also include legal, political and even economic factors (external arrangements) that set the wider context of community management activities and the rules that can be developed.

Operational rules directly affect fishers and the resource by setting out how, where, when and by whom resources may be harvested. In some situations these rules may simply ban the use of a particular gear; they may enact a temporary closure on a certain area of the fishing grounds, perhaps linked to some cultural event; or they may create a complex of nested usufruct rights reflecting wider social relations or hierarchies. Operational rules are the easiest facet of the decision-making arrangements to describe. They are also the easiest to change so would therefore figure strongly in any prescriptive analysis of a resource system. Operational rules can also be viewed as an outcome themselves; an outcome of the previous 'cycle' of resource management and use.

Conditions of collective choice determine the rules for *how* decisions can be made (the 'rules for making rules' (Oakerson, 1992)) and the objectives of the management action. They provide the institutional context and mandate to those seeking to act as management authority. In many cases, the form of these institutions will be determined by wider cultural norms. In some cases a single individual (such as a tribal chief) may hold sole responsibility for decision-making. In other cases, an elaborate network of councils and feedback mechanisms combine to produce a more democratic process. The relative importance of fisheries in the community may not even warrant an individual institution and decisions may be taken by an institution that performs many roles in the wider community. Given their cultural context, conditions of collective choice will be less easy to change than will operational rules.

The management objectives and the set of rules devised to achieve these objectives often cannot be viewed in isolation of the wider political, legal and developmental environment. These External Arrangements act to create a boundary for the opportunities available to an 'independent' management system. However, external policies are generally organized on a national scale and so individual management areas and the fishers themselves will generally work within their parameters rather than seek to change them. Research into a range of CMT systems within one country would typically, therefore, be covered by a single set of external arrangements.

1.3.1.3 Patterns of Interaction

Patterns of interaction are the aggregate of all the actions taken by individuals within the system. The actions of fishers are dependent on the perception of the costs and benefits associated with different types of action. This will be constrained by physical and technical attributes already mentioned and by the nature of the rules imposed. The role of management is to provide rules that lead to an incentive structure that culminates in the desired patterns of interaction.

The degree to which rules are followed is determined by two key relationships; between an individual and the rules set, and between the individual and others within the system. In any action situation a fisher will weigh up the costs and benefits of following the rules. The benefit of transgression is that the individual no longer operates under restrictions imposed by the operational rules (while others may continue to do so) and therefore he would expect to increase his marginal benefit derived from the resource. These benefits are offset by the risk of some form of sanction, such as the cost of transgression. This assessment of

cost/benefit will take place whether or not the individual has participated in the formation of the rules, - although if he did participate, it is more likely that the rules would have created an incentive structure that he, as an individual, would be more willing to follow.

The behaviour of others to a particular set of circumstances is also a strong influence on the behaviour of the individual. Two important strategies are ‘free-rider’ behaviour and reciprocity. If an individual feels that others will ignore a set of rules and that he will therefore suffer from complying with the rules, it is more likely that individualistic, free-rider behaviour will become dominant. If, on the other hand, the situation encourages others to abide by the rules, then it is more likely that the individual will also comply, expecting some benefit from the reciprocity of his action despite possible misgivings about the rules themselves.

1.3.1.4 Outcomes

The final component of the Oakerson framework seeks to assess the outcomes of the management system and any constraints imposed by the physical and technical attributes of the resource. A set of outcomes will include some yield from the resource base, biological (and even physical) effects resulting from the extraction of that yield, and economic and social effects. Outcomes can be directly constrained by the physical and technical attributes but are also dependent on human choices (the patterns of interaction).

To determine the outcome of management, evaluative criteria are employed as standards by which to judge performance across the various sites. The choice of criteria will, of course, reflect the objectives of management. Typically a modern assessment is undertaken in terms of the efficiency of resource use and the equity (or fairness) of the return obtained by stakeholders participating in the management system. Efficiency of resource use relates to the level of exploitation relative to the natural productive capacity of the resource (the sustainability of fishing) but will also include consideration of the economic efficiency of current exploitation rates. In both Fiji and Vanuatu sustainability are clearly stated as objectives of the national fisheries management policy. The specific evaluative criteria employed in this study included analysis of fishing mortality, analysis of mean lengths (across different management regimes), catch-rate (as an index of abundance) and gross yields (kg/sq.km/yr^{-1}). Equity was judged by analysis of access (using GIS) to fishing grounds by different stakeholder groups within the community. Equity was also judged by access to decision-making which is analyzed through institutional analysis.

It does not necessarily follow, however, that traditional management objectives mirror those of a fishery manager, so the evaluative criteria are also likely to differ. Where objectives are identified by traditional management authorities as being different in some way from the concepts of efficiency and equity, different (albeit simple) evaluative criteria are employed. These included reporting the qualitative assessments (by stakeholder groups) of the performance of management viz the explicit objectives. Some objectives are clearly implicit rather than explicit, for example, where they are politically sensitive. In this case again, qualitative assessment of the performance was made according to the perceptions of fishers. In both cases (explicit and implicit) additional quantitative assessment was used where appropriate and feasible.