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Editor's note

In "The value of many small vs. few large marine protected areas in the western Solomon Islands", the first article in this issue, Shankar Aswani and Richard Hamilton describe their work in establishing a network of marine protected areas (MPAs) in the Western Solomon Islands. They summarise the biological and social rationale for setting multiple small reserves within a biogeographical region, and argue that for the Western Solomons, a network of small MPAs is a more biologically effective and socially attainable strategy than establishing a few large reserves. They also suggest that practitioners pay more attention to economic factors and social sustainability issues when establishing MPAs, rather than focusing on just their intrinsic biological and ecological value. Aswani and Hamilton outline some lessons learned and the necessary steps involved in reaching committed community participation for the long-term sustainment of MPAs.

The overarching management goal is to establish a network of MPAs in the Roviana and Vonavona region of the Western Solomon Islands. Twelve have been established so far. These projects also work toward fulfilling local developmental needs by establishing long-term cash enterprises, assisting with infrastructural development (e.g. three clinics, three schools, three community halls, and two women's halls, among other things), and assisting in educational capacity building.

In this issue we are adding a new service feature. Following Aswani and Hamilton's article, we include abstracts of these authors' recently published articles. In future issues of the bulletin, we will try to provide the same service, whenever possible.

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The other article in this issue, “The context of gendered knowledge: A comprehensive minimum dataset on women in coastal communities” is authored by Reiko Omoto, a graduate student in the School of Policy Studies, Kwansai Gakuin University, Japan. Ms Omoto’s objective is to make a first attempt at preparing a comprehensive minimum database for use in field research on women’s activities in fishing communities, specifically for understanding the background for her further studies of gendered knowledge in resource use and management. After briefly outlining the contents and shortcomings of other such databases and field instruments, she describes 18 topics with a total of 297 questions, that comprise the components of the database. This instrument places special emphasis on information needed to implement income-generating activities for women.

Kenneth Ruddle



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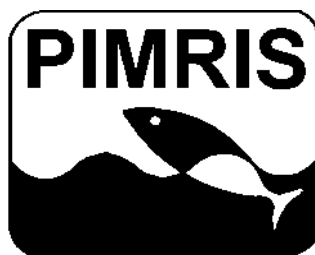
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PIMRIS is a joint project of five international organisations concerned with fisheries and marine resource development in the Pacific Islands region. The project is executed by the Secretariat of the Pacific Community (SPC), the South Pacific Forum Fisheries Agency (FFA), the University of the South Pacific (USP), the South Pacific Applied Geoscience Commission (SOPAC), and the South Pacific Regional Environment Programme (SPREP). This bulletin is produced by SPC as part of its commitment to PIMRIS. The aim of PIMRIS



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is to improve the availability of information on marine resources to users in the region, so as to support their rational development and management. PIMRIS activities include: the active collection, cataloguing and archiving of technical documents, especially ephemera (“grey literature”); evaluation, repackaging and dissemination of information; provision of literature searches, question-and-answer services and bibliographic support; and assistance with the development of in-country reference collections and databases on marine resources.



The value of many small vs. few large marine protected areas in the Western Solomon Islands

Shankar Aswani¹ and Richard Hamilton²

Introduction

Scientists and policy makers are universally promoting marine protected areas (MPAs) as a fisheries and ecosystem management tool. Experts generally agree that MPAs, particularly fully protected “no-take” zones, can enhance spawning stock biomass, allow for larval dispersal and the export of adults to adjacent non-protected areas, maintain species diversity, preserve habitat, and sustain ecosystem function (e.g. Bergen and Carr 2003; Johnson et al. 1999; Russ and Alcala 1999). In the case of tropical multi-species fisheries, in which absolute yields are difficult to predict and in which there are multiple users and fishing techniques, marine reserves also can act as precautionary tools to prevent overexploitation. Considering that orthodox fisheries management strategies have generally failed to prevent overfishing globally, the inception of MPAs as a management tool is of particular preventive significance (Russ 2002).

Proponents of MPAs have broadly debated the appropriate size and number of MPAs that should be established in order to produce what a particular management prescription proposes to deliver. Some scientists argue that for MPAs to be effective they should cover areas in the magnitude of hundreds or even thousands of square miles, depending upon the type of environment (e.g. Beattie et al. 2002; Man et al. 1995; Walters 2000). Others have suggested that from a fisheries enhancement perspective, many small reserves in a network are preferred over fewer, larger reserves (e.g. Roberts et al. 2003). Other debates have centred on how much attention should be paid to science-driven vs. stakeholder-driven considerations when designing MPAs (e.g. Agardy 1997; Alder et al. 2002; Christie et al. 2003; Jones 2002).

In this article, we describe our effort to establish a network of marine protected areas in the Western Solomon Islands and summarise the biological and social rationale employed for setting multiple small reserves within a biogeographical region. We argue that in the case of the Western Solomons, a network of small MPAs is a more biologically effective and socially attainable strategy than establishing a few large reserves. We also suggest that practitioners need to pay more attention to economic factors (e.g. McClanahan 1999) and social sustainability issues (e.g. Mascia 2003) when establishing MPAs, rather than concentrating on their intrinsic biological and ecological value alone. Finally, we outline some lessons learned and the necessary steps involved in attaining a committed level of community participation in order to sustain the MPAs over the long term.

The MPA network

The Western Solomon Islands (Fig. 1) lie in the Bismarck Solomon Seas Ecoregion. This area comprises a large marine ecosystem that extends through the Solomon Islands, the north coast of Papua New Guinea, and the northern West Papua region. Regional marine biotopes are highly diverse, productive, and moderately undamaged by human activities, making this area a biodiversity conservation hotspot (WWF South Sea Program 2003). Pressures from a population explosion and rampant development, however, are increasingly threatening the ecology and social stability of the region.

In light of these increasing threats, we designed a preventive management strategy to safeguard representative habitats and species in southwestern New Georgia. We marked for protection riparian

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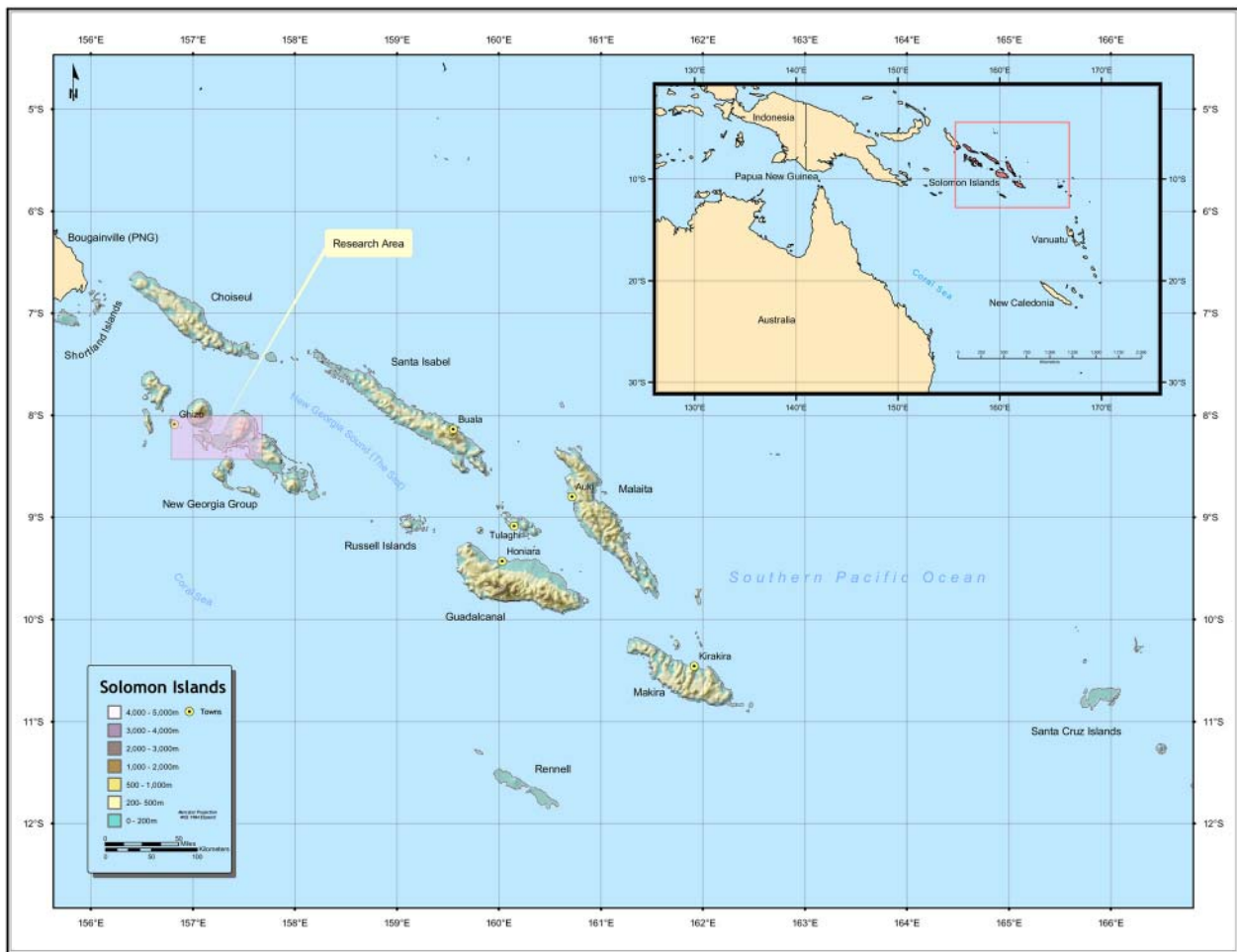


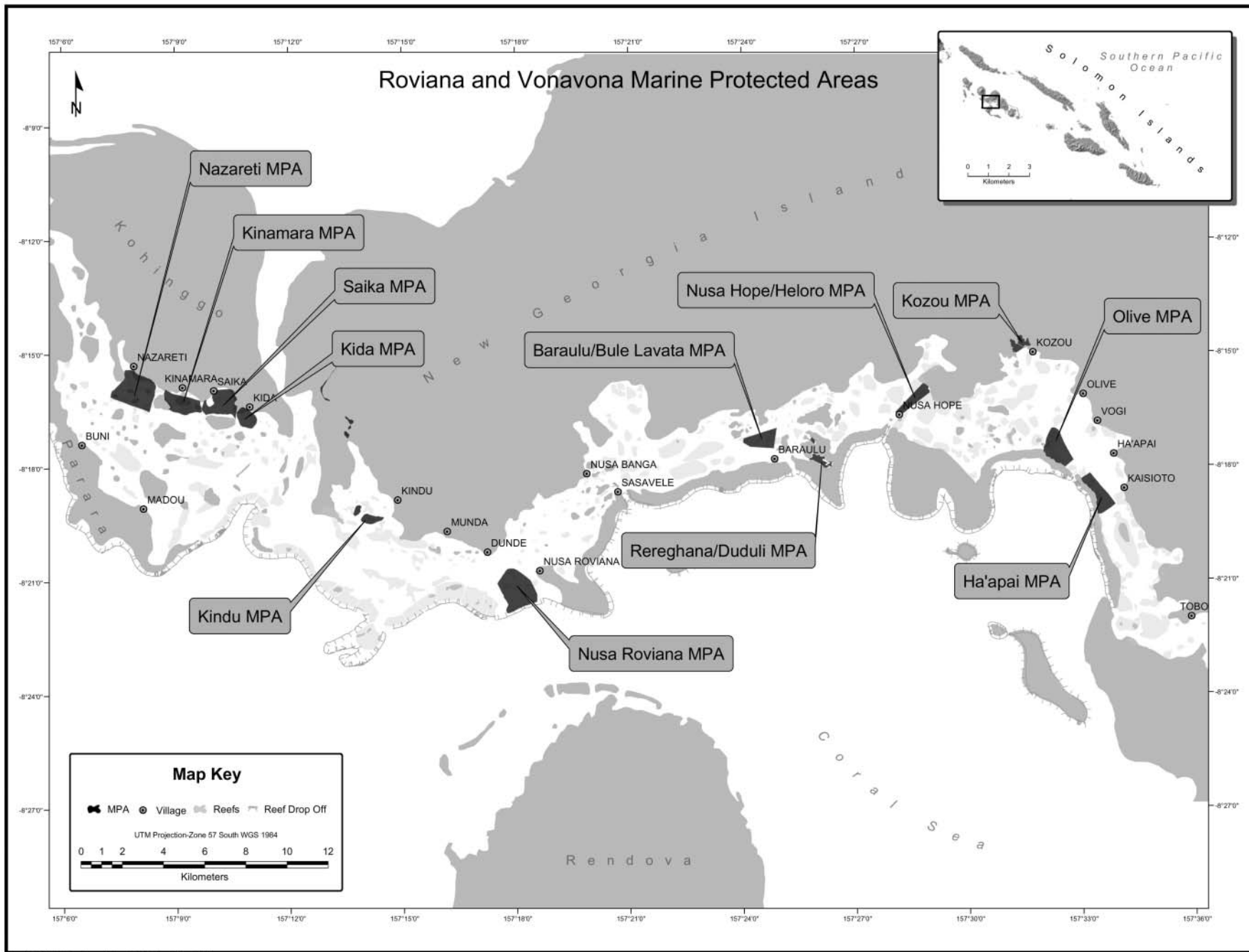
Figure 1. The Solomon Islands

and marine habitats, including outer-lagoon and shallow inner-lagoon coral reefs, inner-lagoon sea-grass beds, mangroves, coastal swamps, and strand vegetation. We also targeted for protection the critical habitats for flagship species such as bumphead parrotfish (e.g. Aswani and Hamilton 2004). Since 1999, we have assisted local communities in the Roviana and Vonavona Lagoons in establishing a network of MPAs under customary sea tenure (Fig. 2). We have instituted 12 MPAs, most of which have been set up as permanent “no-take” zones. Of these, four have dual zoning regimes, whereby one-half of the area is permanently closed and the other half temporarily so (the period of closure varies from site to site). In addition, two of the closures protect adjacent mangrove and swamp forest by banning land-based activities, such as clearing or harvesting firewood.

It should be noted that MPA designation has been consistent with local requests and socio-political processes. Our approach, which has been three-pronged, involves articulating conservation goals while also addressing such local needs as the

funding of infrastructure development and educational initiatives (see Aswani and Weiant in press). We have assisted with various development enterprises (e.g. a clinic, two health posts, two schools, a school renovation, three community halls, and two women’s halls), and we have supported local students with grants and capacity building. We project to establish 10 additional “no-take” MPAs in the inner and outer Roviana and Vonavona Lagoons, bringing their total number to 22 (or perhaps more, as local communities take the initiative to establish their own) (Fig. 3). It is quite likely that we will also work with local communities to establish MPAs in Marovo, Kolobangara, North New Georgia, Vella Lavella, and Choiseul.

Anthropological and marine science studies of indigenous resource use (e.g. local fishing methods and knowledge) and access practices (e.g. customary sea tenure) show that, for this region, MPAs are the most realistic and enforceable management prescription (e.g. Aswani 1999, 2002; Aswani and Hamilton 2004; Hamilton 1999, 2004). To achieve optimal MPA design, however, source



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Figure 2. Current MPA sites in Roviana and Vonavona Lagoons

and sink locations for protection must be selected based on the patterns of larval recruitment and dynamics, as determined by local hydrodynamics (e.g. Roberts 1998). In this regard, we currently have only fragmentary information, which is unfortunate because there are social and biological risks involved in establishing MPAs without comprehensive scientific information (Huber and McGregor 2002). We acknowledge this scientific uncertainty but, nonetheless, subscribe to an opportunistic approach (e.g. Johannes 1998; Ludwig et al. 1993; Roberts 2000) that harnesses available scientific information and indigenous ecological knowledge in selecting locations for and designing MPAs.

To this end, we have employed a research strategy that integrates indigenous ecological knowledge (e.g. GIS mapping of locally identified nursery grounds and spawning aggregation sites) with marine science (e.g. underwater visual census [UVC] surveys). We are especially interested in indigenous knowledge that is commensurable with scientific approaches to biodiversity conservation and the recovery of overexploited species (see Aswani and Hamilton 2004). Our approach to establishing MPAs also harnesses local forms of sea tenure and resource use and management strategies. We have studied customary sea tenure by researching economic, political, sociocultural, and demographic patterns across the region (see Aswani 1999, 2002). This stakeholder-driven strategy recognises that if members of sea tenure groups cannot enforce the exclusion of non-members and maintain harvest restriction rules, it is meaningless to implement a management regime no matter how rich in marine biodiversity the area may be. Because of the rapid rate of resource depletion in the region, this strategy may prevent further decline while also serving as a cost-effective way to manage resources despite the dearth of substantial biological information.

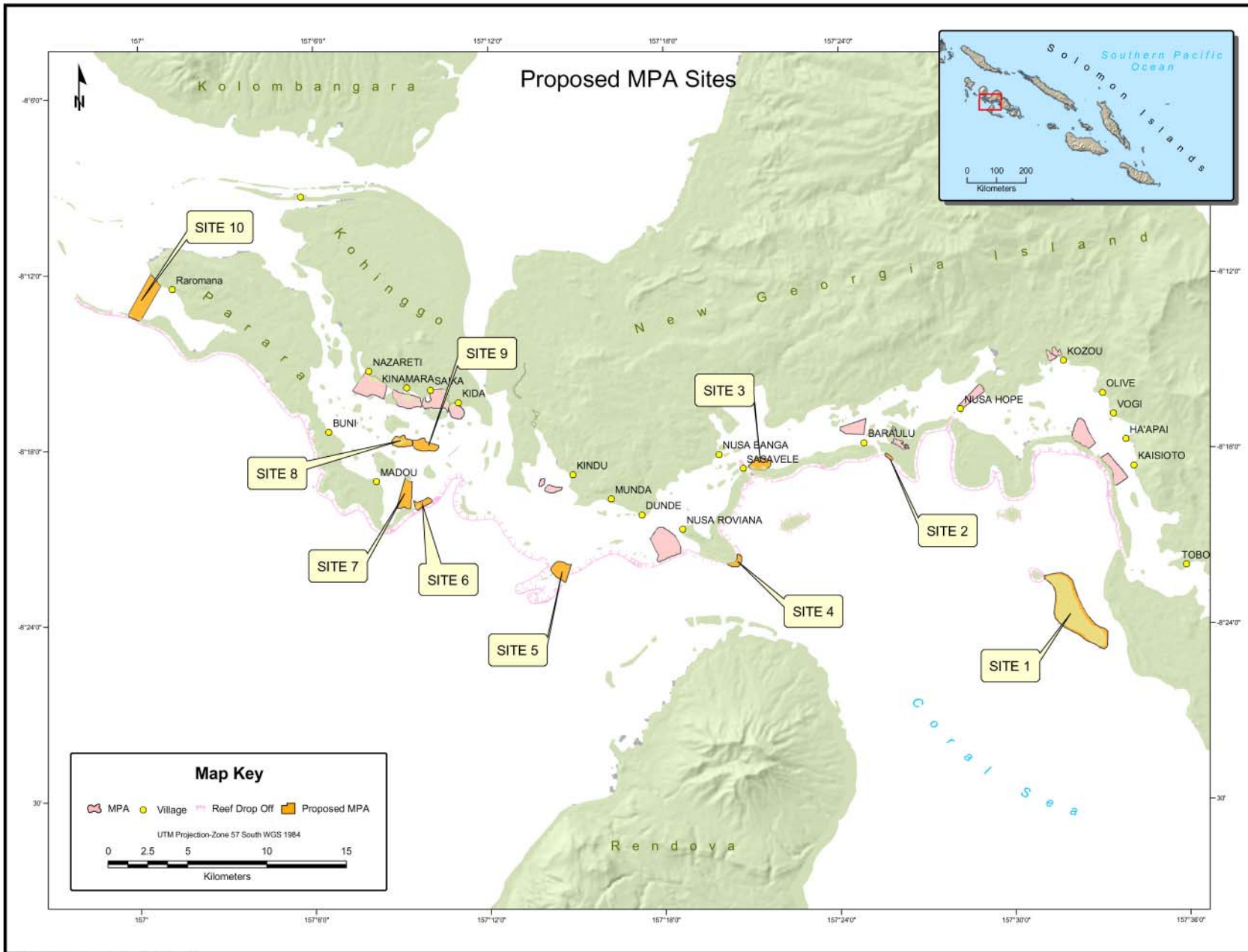
Biological rationale

The biological rationale for establishing a network of small MPAs has been to: 1) protect vulnerable species and habitats (i.e. biodiversity and ecosystem function), 2) protect susceptible life history stages (i.e. spawning and nursery grounds), and 3) enhance fisheries productivity in the region. Tropical lagoons are environments of low ecological resilience that are vulnerable to human disturbances. We believe that establishing a network of reserves will provide protection for representative habitats and for exploited marine organisms. Most experts view marine reserves as precautionary insurance policies against overexploitation and inadequate fisheries management strategies (e.g.

Lubchenco et al. 2003; Russ 2002). A recent review by Halpern (2003) of 89 reserves worldwide has shown that the magnitude of increase in abundance, biomass, size, and diversity of organisms is independent of the size of the reserve (the size range examined was 0.002–846 km²). The aggregated biological benefits of reserves increase directly with the total area protected, regardless of how this area is subdivided into reserve units. In designing marine protected areas, therefore, not only is biodiversity an important factor, but also the selection of sites that incorporate the ecological processes that support that biodiversity, including the presence of exploitable species, vulnerable life stages, and links among habitats, regardless of the reserve's size (Roberts et al. 2003). To this end, we have gained information on habitat characteristics and quality and species diversity through local interviewing (e.g. participatory GIS habitat mapping) and field research (e.g. underwater visual census and Reef Check).

Current MPA studies and an increasing amount of theoretical modelling data also suggest that a network of reserves buffers against the vagaries of environmental variability and provides significantly more protection for marine communities than does a single reserve (Hastings and Botsford 2003; Lubchenco et al. 2003; Roberts et al. 2003). In addition, from a fisheries enhancement perspective, many small reserves in a network are preferred over fewer, larger reserves. The large edge-to-area ratios of small reserves result in higher rates of juvenile and adult spillover and more regional benefits through greater larval export (Roberts et al. 2003). For instance, a recent study showed that within five years of creation, a network of five small marine reserves in St. Lucia increased adjacent catches of artisanal fishers by between 46 per cent and 90 per cent, depending upon the type of gear the fishers used (Roberts et al. 2001).

Generally, reserves in a network should be 4–6 km in diameter and should be spaced 10–20 km apart. This allows individual reserves to be large enough to contain the short-distance dispersing propagules and to be spaced far enough apart so that long-distance dispersing propagules released from one reserve can settle in adjacent ones (Hastings and Botsford 2003). Recent research indicates that protecting 20 per cent of each habitat present within a biogeographical region is considered necessary to support fisheries function and to safeguard biodiversity (Roberts and Hawkins 2000). Given a number of socio-political constraints, we are trying to protect between 15 per cent and 20 per cent of aggregated habitats in the Roviana and Vonavona Lagoons by working with various communities. To date, local communities, with our



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Figure 3. Proposed MPA sites in Roviana and Vonavona Lagoons

assistance, have protected 1474 ha of marine habitat divided into 12 MPAs, each site ranging in size from 25 ha to 266 ha, or about 5.7 per cent of all lagoon habitats in the area (Fig. 2).

Networks of small inner-lagoon reserves (e.g. in Roviana, Vonavona, Marovo, Nono, etc.) are also critical for protecting vulnerable life-history stages of many heavily exploited coral reef fish. The larvae of these fish predominantly settle out of the plankton into shallow water biotopes of high structural complexity such as mangroves and seagrass beds (Nagelkerken et al. 2000). The importance of the nursery function of the lagoon for coral reef fish species in this region can be deduced from the high densities of juveniles in the inner lagoon in contrast to the complete absence of juveniles on outer-lagoon coral reefs. We have documented this in the region for bumphead parrotfish (*Bolbometopon muricatum*) and humphead wrasse (*Cheilinus undulatus*) (Aswani and Hamilton 2004; Hamilton 2003, 2004), and other authors have documented the importance of inner-lagoon habitats for various threatened coral reef fishes (e.g. Nagelkerken et al. 2000). We predict that the number of juvenile coral reef fish will increase within reserves if nursery areas are protected. Further, the connectivity of inner-lagoon habitats and coral reefs means that this approach has the potential of enhancing adjacent coral reef fisheries through increased rates of juvenile recruitment.

We are also attempting to protect outer-lagoon coral reefs because the long-term benefit of protecting coral reef fish nursery grounds is dependant on these areas receiving an adequate supply of dispersive larvae from adult populations. These adult populations occur in low numbers or not at all within the inner lagoons, and if adult population numbers were to decline dramatically over a wide geographical area it could lead to widespread recruitment failure (i.e. shortage of eggs and larvae) and subsequent decline of juveniles within protected inner-lagoon reserves. Within the context of protecting adult spawning stocks, we are particularly interested in focusing management attention on known spawning aggregation sites of the larger grouper species and the humphead wrasse. Transient grouper spawning aggregations are highly vulnerable to over-exploitation (Colin et al. 2003), and the humphead wrasse is globally threatened throughout its range (Sadovy et al. in press). The conservation and management of such spawning aggregations is therefore critical for the persistence of the populations that form them (Sadovy and Vincent 2002).

Currently, we do not have the biological data necessary to determine the effects of the existing

reserve network on a variety of exploited species. We will soon begin to collect this biological information so that we can quantify which targeted species respond to this form of management and the long-term spillover effects of the Roviana reserve network. In addition to the biological value of such data, this information (i.e. assuming positive results) will be necessary to reinforce and validate the local perception that the MPA network has a positive fisheries value and to help ensure the network's permanent acceptance and protection. To date, we have only monitored invertebrate abundances and size distributions in the Duduli-Rereghana MPA (Baraulu) and have disseminated the scientific results locally (see Aswani and Weiant 2003, in press).

Socio-cultural rationale

The site-based implementation of community-based marine protected areas requires the identification of not only major biological and ecological processes but also the socio-cultural, economic, and political processes patterning the targeted area. For most of the Western Solomons, customary chiefs and elders control each of their district's seas and exercise control over resource use and access. Both property composed primarily of natural resources and property governed as part of management systems are subject to local controls (Aswani 2002). For this reason, any management prescription has to transpire within the context of customary sea tenure. Foale and Manele (2003:1) have argued that the "typical Melanesian CMT regimes make MPAs difficult to establish because many coastal zones are finely divided along clan boundaries, such that few clans would be willing to 'lock up' their own reefs for the benefit of neighbouring clans." The essence of their argument is that if a local group closes a reef, the benefits of their MPA are likely to be reaped by neighbouring groups because larvae produced in the closed site are likely to recruit in neighbouring or distant reefs that quite likely belong to other groups who are not bounded by the same restrictions. The question, then, is: Why forfeit harvesting one's own resources for the benefit of others? From a socio-cultural perspective, however, the only management prescription that can work in the Western Solomons is a network of small MPAs under customary sea tenure.

First, it is important to recognise that sea tenure is not homogeneous and to discern the institutional characteristics of governance and management intrinsic to existing forms. Studies in the Western Solomons have shown that different forms of customary sea tenure exist and that growth in population and consumption affect these institutions in

different ways (Aswani 1997, 2002; Hviding 1989). Concluding that customary sea tenure is uniform, therefore, is erroneous and misleading. For instance, in Roviana and Vonavona there are marked differences in cultural attitudes regarding governance and operational rules of management among regional polities. For various historical reasons, traditional leaders in some sea territories are more capable of managing their resources than are leaders of other sea estates. Hence, MPAs can be established successfully under sea tenure regimes as long as entitlements are *secure*. Such systems (or the territorial-enclosed regime) require that territorial boundaries be circumscribed, that the sea estate to be under a centralised traditional authority, and that people recognise and respect the territorial boundaries regionally (see Aswani 1999 for further discussion). In Roviana and Vonavona, these circumstances generally occur in areas in which the majority of sea entitlement holders live adjacent to their marine property (e.g. Kalikoqu and Saikile) (Fig. 4).

On the other hand, establishing MPAs in areas in which sea tenure is less secure and where there are

permeable boundaries (or the mosaic-entitlement regime), is more problematic given that neighbours are less likely to respect the management initiative. Still, it is conceivable that future management success in areas that have secure tenure will encourage stakeholders in other areas that are more vulnerable to resource conflict and overexploitation to negotiate with neighbouring groups to implement their own MPAs. This process, in fact, has already begun with the establishment of a spatio-temporal “no take” zone in Nusa Roviana in 2003 — an area in which a large proportion of the reef’s owners do not live adjacent to their property (particularly the nearby barrier reefs that have entitlements shared by many polities) and, hence, where sea tenure is highly contested by neighbouring villages (e.g. Munda area villages) (Fig. 4). It is essential, then, to map forms of sea tenure prior to drafting any form of co-management policies between local fishers and government or non-governmental organisations (see Aswani 1999, 2002).

Yet, even under a secure tenure regime, the questions remains: How can villagers prevent neigh-

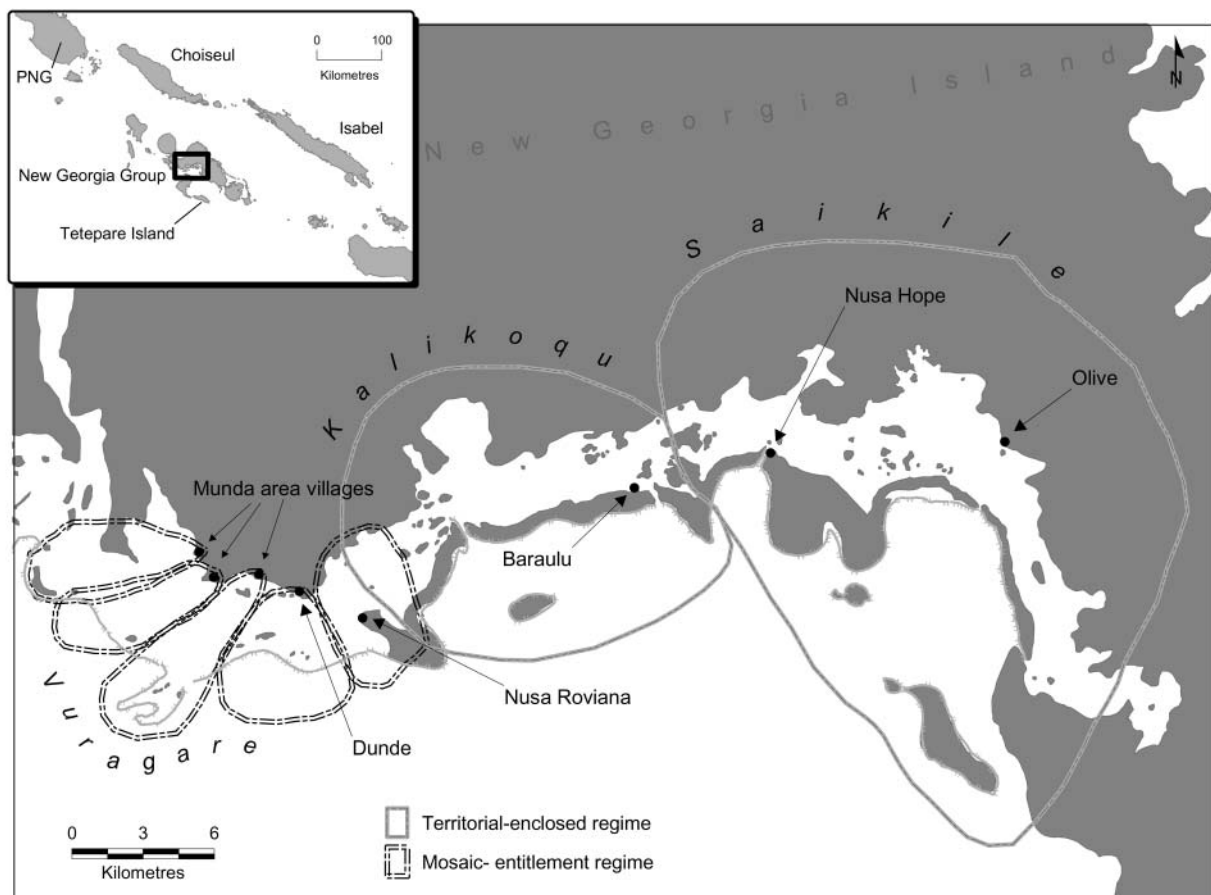


Figure 4. Sea tenure regimes in Roviana Lagoon (Vonavona regimes not shown). Note that these are only conceptual boundaries and are not definitive.

bouring groups from reaping the fishery benefits of their MPA by way of the spillover of adults and the export of larvae into neighbouring unmanaged reefs? The solution is to establish multiple sites within the boundaries of all regional sea tenure regimes that are institutionally secure. Given that the majority of polities in Roviana and Vonavona have secure tenure (as do most polities in the Western Solomons), it is possible to establish networks of MPAs. Simply put, all stakeholders have to share the biological and social costs and benefits of the closures under this prescription. From a fisheries perspective, multiple MPAs that protect representative habitats in a biogeographical region are likely to safeguard and improve the connectivity between sink and source populations and, therefore, result in fisheries enhancement. From a social perspective, conflict and free riding decreases when neighbouring tribes invest time and effort in managing their own marine resources respectively. Stakeholders of neighbouring MPAs will tend to respect each other's closures and prevent interlopers from exploiting their resources, because if everyone cooperates, all are more likely to benefit in the long term from sustainable resource management practices. We have seen this occur between the villages of Ha'apai and Olive (Saikile) and between various settlements in Vonavona Lagoon (e.g. see village MPAs adjacent to Kohinggo Island in Fig. 2).

Second, the MPAs should be relatively small, in addition to being strategically located within the confines of all secure sea tenure estates. Single large MPAs are likely to extend across the territory of various stakeholders and lead to difficult negotiations and conflict for most areas in the Western Solomons. Large MPAs would concentrate the burden of resource use and access restrictions on only a few polities, while neighbouring entitlement bearers would share the benefits. Thus, in order to work, the MPAs have to be small enough to be situated within the territory of a polity or village. Furthermore, they have to be sufficiently small in relation to the total sea estate to allow inclusive stakeholders access to alternative fishing grounds. Large MPAs restrict subsistence fishers from accessing their traditional grounds, leading to resource degradation in adjacent unmanaged reefs and, because of a lack of alternative sites, to an increase in poaching by inclusive fishers. The only area in the Western Solomons that could accommodate a large MPA is the uninhabited island of Tetepare. In fact, WWF-Solomon Islands is currently working with various regional stakeholders to establish a large MPA in the island.

Finally, for people to monitor their MPA successfully, it is essential that it be located within eye-

sight of the village. In other words, villagers have to be able to police their resources and spot poachers entering their area. Local monitoring and enforcement not only reinvigorates traditional authority over stakeholders' sea territories, but also generates innovative governance institutions that can be articulated with customary and statutory law. For instance, several Roviana and Vonavona communities have begun to form new governance institutions and to strengthen existing traditional ones. With our assistance, villages are establishing Resource Management Committees (RMCs), each formed by various village constituencies, including chiefs, church authorities, and women's representatives. The responsibilities of the RMCs are to: 1) ensure that the MPAs are secured and free from disputes; 2) enforce all agreed-upon regulations by warning, educating, and fining offenders if necessary; 3) run awareness workshops detailing the objectives of the MPAs; 4) organise workshops that will bring together other RMCs to discuss successes/problems/issues related to MPAs; and 5) encourage exchange and educational programmes with outside institutions. To date, a number of these new governance institutions have been set across Roviana and Vonavona Lagoons.

In sum, we suggest that building upon customary sea tenure is not only advantageous but also the only possible way to implement MPAs in this region effectively. Relying exclusively on scientific biological data to determine what species and habitats require environmental protection is an incomplete research and management strategy. As suggested in this discussion, mapping the forms of sea tenure (i.e. secure versus insecure tenure) is crucial for distinguishing regimes that are adaptable and capable of success from those that are not and in determining which MPAs are more likely to work.

Lessons learned to date

In general, we have learned a number of lessons, which are outlined below.

1. In the Western Solomons, fishery scientists and coastal managers will rarely achieve ecological sustainability and the protection of marine biodiversity unless they seriously consider local forms of sea tenure and their adaptability to introduced management regimes. Survey results indicate that up to 90 per cent of Roviana and Vonavona Lagoon inhabitants have confidence in the MPA initiatives. Their confidence in the programme derives partly from the fact that it includes customary authority and practices. That is, it represents an extension and revitalisation of traditional sea tenure practices in ways that the people can relate to

and articulate in the local cultural idiom (Aswani and Herman n.d.). Indeed, we can raise a number of issues concerning the integration of sea tenure institutions into fisheries co-management policies. These include issues regarding the differences between Western and indigenous forms of knowledge and questions of equity, empowerment, jurisprudence, and conflict resolution among local, state, and international players (e.g. Berkes 1999). However, the absence of any binding and enforceable legislative or regulatory tools in the Solomon Islands necessitates the use of sea tenure as a framework for establishing any form of fisheries regulations.

2. It is unrealistic to expect a community-based conservation project to succeed with only short-term expert guidance and financial support. Solomon Islanders have developmental aspirations that cannot be ignored. Hence, if local communities are to forfeit exploiting their resources, some form of alternative livelihood has to be furnished. While we provide infrastructural assistance to various communities (e.g. clinics and schools) and they contribute free labour and local materials, we believe that continued environmental education is vital if we are to move beyond the capital dependency created by financial incentives as components of conservation projects (see Aswani and Weiant in press).
3. Outside project leaders and funding agencies have to be prepared to accept that local interest in marine resource management may wax and wane over time, particularly in places such as Melanesia. For instance, local peoples may have diverse conceptions of a marine protected area's time horizon, and stakeholders' commitment to protecting a site indefinitely may vary widely.
4. The marine protected areas and their resulting biological outcomes are tangible means of demonstrating the significance of resource management. The witnessing of actual management results, whether real or perceived, is the most effective means of environmental education — i.e. "seeing is believing." Concurrently, the results of scientific monitoring become of critical importance. Scientific results can be a catalyst for reinforcing the local perception that the MPAs are having positive biological results (see Aswani and Weiant 2003, in press).
5. The participation of local church leaders is of paramount importance. The recent sanction of our project by the head of the Christian Fellowship Church, whose members have customary control over huge areas of the Western Solomons, will help ensure the long-term sustainability of the conservation and development initiatives.
6. It is possible for MPAs to meet their social and biological goals. From the perspective of the social sciences, however, we need to move beyond programmatic statements (e.g. promoting the value of social science for MPA design [e.g. Mascia et al. 2003]) and overemphasizing social critique (e.g. deconstructing colonial histories and analysing NGO discourses and intentions [e.g. Brosius 1997]) and take leadership roles by designing stakeholder-driven programs in partnership with natural scientists. These programmes should consider not only key biological and ecological parameters but also, as noted by Christie et al. (2003:25), the characteristics and behaviours of all the stakeholders involved, the desires of different stakeholders, and the stakeholders' knowledge. Only then will we completely realise the true value of social science research in MPA design and implementation. Stated another way, skeptical natural scientists need to "see" theoretically and methodologically informed applied social science in action.

Future initiatives

In consolidating the future of the community-based MPA network we will continue to: 1) foster MPA environmental education and awareness at the local, national, and international levels; 2) establish an institutional infrastructure to sustain the MPAs (e.g. encouraging the consolidation of RMCs); 3) enhance participatory development; 4) formally legalise all MPAs at the provincial and national levels; and 5) conduct baseline/evaluation marine and social science research on all of the MPAs. The latter is of key importance, as obtaining this information will not only provide baseline data for future reference and research but also allow for the dissemination of information to local communities on the effects of the current reserve network. This will enable us to work with local communities in developing additional management strategies such as increasing the level of participation and involvement of the communities, especially by the women and children, through training the participants in monitoring methods, encouraging local participation in the monitoring, and discussing the meaning of the monitoring results. These steps will be required to ensure the long-term sustainability of MPAs in the region.

Conclusion

In this article we have suggested that the optimal strategy for establishing MPAs in the Western Solomons is to create networks of small MPAs under secure customary sea tenure. Biologically, the MPA network is vital for protecting vulnerable life-history stages of many coral reef fish. The connectivity of inner-lagoon habitats (e.g. Roviana, Vonavona, and Marovo) means that networks can enhance neighbouring coral reef fisheries through increased rates of juvenile recruitment. Protecting vulnerable spawning aggregation sites and establishing MPAs in outer-lagoon coral reefs are also a critical next step, because the long-term benefits of inner-lagoon protection of vulnerable juvenile life stages of fish relies on an adequate supply of dispersive larvae from coral reef adult populations. Socially, small MPAs situated within secure marine territories build upon practices with which the community members are familiar, and thus the inhabitants are better able to grasp the biological value of the programme and understand the use restrictions it entails. Monitoring and enforcement are, therefore, less problematic. It is of paramount importance, however, to select sites in which: 1) there is minimal public contest over natural resources, 2) boundaries are well defined and recognised regionally, 3) there is little or no poaching by neighbouring groups, 4) there is a capacity to monitor and enforce rules, and 5) the majority of inclusive stakeholders endorse the management initiative. Furthermore, it is essential to create an MPA network so that all regional stakeholders share the costs and benefits of the MPAs.

In summary, understanding and including these social parameters are fundamental for the success of MPAs. If our work is successful in the long term, it will provide a methodology for establishing MPAs in regions that have socio-cultural, economic, political, and ecological characteristics similar to those of the Western Solomons, including the rest of the Solomons, Papua New Guinea, Vanuatu, and possibly Fiji. More generally, our work illustrates ways in which social and natural sciences can be linked for protecting vulnerable marine habitats and species in the Pacific region.

Acknowledgements

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Recent publications on related topics

Aswani, S. 2002. Assessing the effect of changing demographic and consumption patterns on sea tenure regimes in the Roviana Lagoon, Solomon Islands. *Ambio* 31:272–284.

Abstract:

This paper investigates how sea tenure institutions in the Roviana Lagoon, Solomon Islands, mediate among population, consumption, and the environment. The focus is on explaining how growth in population and consumption alter sea tenure regimes, and the factors that shape either their institutional robustness or vulnerability. The paper also addresses the regional differences among sea tenure institutional arrangements, the processes that are producing them, and the social and environmental outcomes of these institutions as they engage external forces and internal changes. A major question is how existing forms of sea tenure respond comparatively when faced with parallel demographic and economic transformations? Two villages representing different sea tenure arrangements within the Roviana Lagoon are compared. Results show that inhabitants in these villages perceive their systems of sea tenure governance similarly; yet their managerial responses to changes brought about by growth in population and consumption differ, and the responses produce contrasting environmental effects.

Aswani, S. and Hamilton R.J. 2004. Integrating indigenous ecological knowledge and customary sea tenure with marine and social science for conservation of bumphead parrotfish (*Bolbometopon muricatum*) in the Roviana Lagoon, Solomon Islands. *Environmental Conservation* 31(1):1–15.

Abstract:

Indigenous ecological knowledge and customary sea tenure may be integrated with marine and social science to conserve the bumphead parrotfish (*Bolbometopon muricatum*) in the Roviana Lagoon, Western Solomon Islands. Three aspects of indigenous ecological knowledge in Roviana were identified as most relevant for the management and conservation of bumphead parrotfish, and studied through a combination of marine science and anthropological methods. These were: 1) local claims that fishing pressure has had a significant impact on bumphead parrotfish populations in the Roviana Lagoon; 2) the claim that only small bumphead parrotfish were ever seen or captured in the inner lagoon and that very small fish were restricted to specific shallow inner-lagoon nursery regions; and 3) assertions made by local divers that bumphead parrotfish predominantly aggregated at night around the new moon period and that catches were highest at that time. The research supported claims 1) and 2), but did not support proposition 3). Although the people of the Roviana Lagoon had similar conceptions about their entitlement rights to sea space, there were marked differences among regional villages in their opinions regarding governance and actual operational rules of management in the lagoon. Contemporary differences in management strategies resulted from people's historical and spatial patterns of settlement across the landscape

and adjoining seascapes, and the attendant impact of these patterns on property relations. This was crucial in distinguishing between those villages that held secure tenure over their contiguous sea estates from those that did not. Indigenous ecological knowledge served to: 1) verify that the bumphead parrotfish was a species in urgent need of protection; 2) explain how different habitats structured the size distribution of bumphead parrotfish; 3) identify sensitive locations and habitats in need of protection; and 4) explain the effect of lunar periodicity on bumphead parrotfish behaviour and catch rates. Secure customary sea tenure identified locations best suited to bumphead parrotfish management programmes, with a greater likelihood for local participation and programme success. The information was used to establish two marine protected areas in the region for bumphead parrotfish conservation.

Aswani, S. and Weiant P. in press. Scientific evaluation in women's participatory management: Monitoring marine invertebrate refugia in the Solomon Islands. Human Organization (forthcoming summer 2004).

Abstract:

This paper summarises the results of a women's community-based marine protected area that has been successful in sustaining invertebrate biological resources and in promoting strong community support. We outline the project and the associated biological results, describe the processes involved in attaining a committed level of community participation, and review the lessons learned during the project's implementation. We attribute the project's preliminary success, with regard to improved shellfish biomass, enhanced local environmental awareness, and the reinvigoration of cultural management practices, to the following factors: 1) the high level of participatory involvement and community leadership, 2) the local perception that shell beds have recovered rapidly and the role that scientific evaluation has played in reinforcing this notion, 3) a research program that is cross-fertilizing indigenous and scientific ecological knowledge, 4) the unique marine tenure system that allows for the project's development and the area's policing, and 5) the tangible economic incentives created by the development project, which ultimately empowers local women. We hope that the project's findings can be generalized to other regions of the world with operational sea tenure regimes and that it can help to make the establishing of community-based marine protected areas (CBMPAs) across the Pacific region more effective.

Hamilton, R.J. 2004. The demographics of bumphead parrotfish (*Bolbometopon muricatum*) in lightly and heavily fished regions of the Western Solomon Islands. PhD. Dissertation, University of Otago, Dunedin.

Abstract:

In this research the ecology of the bumphead parrotfish (*Bolbometopon muricatum*) and the status of the bumphead parrotfish fishery in the New Georgia Archipelago are investigated. The bumphead parrotfish, or topa as it is known in New Georgia, is the largest herbivore on coral reefs and it is a species that is vulnerable to overfishing. Despite growing concern over its global status, the factors that make this species susceptible to overfishing are not well understood. The fishers of Roviana Lagoon (New Georgia, Solomon Islands) have targeted topa at a subsistence level for centuries, utilising a detailed body of indigenous ecological knowledge (IEK) to capture topa from known nocturnal aggregation sites. In recent decades burgeoning human populations, mounting dependence on cash societies and the adoption of new harvesting technologies have dramatically altered the dynamics of the Roviana topa fishery, with this fishery now being predominantly artisanal in nature.

A cross-disciplinary approach towards this research was adopted. In the initial stages of this study anthropological methods were used to: Firstly, gain an historical perspective of ecological and social changes that have occurred in the topa fishery and secondly, gather local knowledge on topa ecology. Marine biology methods including creel surveys, underwater visual census (UVC), telemetry, ageing and reproductive studies were then employed to quantitatively assess the status of topa stocks in Roviana Lagoon and provide the demographic data on this species that is required in order to make biologically based management recommendations for this fishery.

Anecdotal reports that in the last two decades catch rates of topa have declined markedly in Roviana Lagoon and that large topa have become a rare component of night catches were supported by comparative creel and UVC surveys conducted in the heavily fished Roviana region and at the lightly exploited

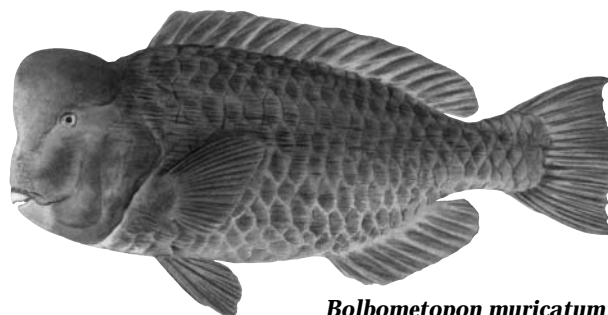
Tetepare Island. Growth overfishing of topa appears to have occurred rapidly in the Roviana region. The stimulus for overfishing topa stocks was the introduction of simple new harvesting technologies coupled with the advent of market driven fishing in this region. An investigation of the age-based demographics of topa provides evidence that this species is only capable of sustaining low levels of exploitation. Topa in the Roviana region were moderately long lived, appear to have low natural mortality rates and mature fairly late in their lifecycle. Such life history characteristics indicate that population turnover rates for this species are fairly slow.

This thesis achieves four aims. First, it investigates and documents the complexity of ecological knowledge on topa held by Roviana fishers, and the relevance of this information for research and management. Second, it provides a model of the cultural, social and ecological changes taking place in many high value South Pacific fisheries. Third, by incorporating anthropological and orthodox fisheries biology techniques, it provides baseline data on many unknown aspects of this species behaviour and life history characteristics. Fourth, it provides culturally suitable management recommendations for this species in Roviana Lagoon that take relevant biological, social and political factors into account.

Hamilton, R.J. 2003. The role of indigenous knowledge in depleting a limited resource - A case study of the bumphead parrotfish (*Bolbometopon muricatum*) artisanal fishery in Roviana Lagoon, Western Province, Solomon Islands. Putting fishers' knowledge to work conference proceedings, August 27-30, 2001. Fisheries Centre Research Reports, University of British Columbia, Canada 11(1):68-77.

Abstract:

This study highlights the way in which new technological and economic inputs into indigenous artisanal exploitation systems can have negative ecological effects on a fishery, and the fact that traditional ecological knowledge is not always used sustainably. The fishers of Roviana Lagoon (Western Province, Solomon Islands) fished bumphead parrotfish (*Bolbometopon muricatum* or topa in the Roviana language) for generations, using a targeting strategy based on precise knowledge of its aggregating behaviour built up over centuries. During certain moon phases at specific shallow water sites where the fish aggregated to sleep at night, fishermen speared them from dugout canoes by the light of dried burning coconut leaves. Catch rates were well below the maximum sustainable yield. When the underwater flashlight became widely available in Roviana Lagoon, however, this traditional fishing method was quickly replaced by night-time spear fishing using goggles and a steel hand-held spear. With this method fishers could easily take four to five times as many topa as before. In the late 1980s, new pressures were placed on the topa stocks when local markets developed, ironically under the umbrella of NGO sustainable development projects. Today artisanal spear fishers use their sophisticated indigenous knowledge of topa behaviour and ecology to move from one known aggregation site to another, spearing as many topa as possible in a night. A catch-per-unit-effort (CPUE) survey of night time spear fishing trips in Roviana Lagoon reveals that this resource is heavily overfished, with the majority of topa caught today being juveniles. Extensive interviewing with past and current spear fisher's reveals that this modern fishing method has caused major declines in topa numbers. The introduction of simple but new technologies coupled with small scale economic restructuring has thus thrown the system out of equilibrium.



Bolbometopon muricatum

Artwork: Les Hata © SPC



The context of gendered knowledge: A comprehensive minimum dataset on women in coastal communities

Reiko Omoto¹

Introduction

Local knowledge forms the basis of many systems of community-based renewable natural resource use and management and has been widely studied around the world. As a result, researchers and others are now familiar with local knowledge systems from societies based on agriculture, animal husbandry, forestry and agroforestry, and to a lesser but increasing extent, on fisheries (Ruddle 2000). As with all local knowledge systems, those in coastal societies are empirically based and practically oriented, and combine information on fish behaviour, marine physical environments, fish habitats, and other topics into comprehensive taxonomies (Ruddle 1994a, 1994b, 2000).

Local knowledge of tropical marine environments and resources has a large potential practical value in the modern world. It can provide an important information base for resource management where conventional data are scarce to non-existent, and can help pinpoint essential research needs.

Two of the principal commonalities of local knowledge systems pertaining to coastal-marine environments and resources identified by Ruddle (1993, 1994a), are that they are:

- 1) based on long-term, empirical, local observation, that it is adapted specifically to local conditions, embraces local variation, and is often extremely detailed; and
- 2) practical and behaviour-oriented, focusing on important resource types and species.

Further, Ruddle emphasised that among the structural and processual characteristics of local knowledge systems found around the world, skill and task training are age and gender specific and are taught by members of the appropriate sex (Ruddle and Chesterfield 1977, 1978; Ruddle 1993).

Gender issues in local knowledge

These characteristics suggest that both local knowledge and local knowledge systems are gender specific. Local knowledge is also “gendered”, because men and women usually have different and often complementary economically productive roles, different resource bases, and face different sets of social constraints (Warren 1989).

If this is not taken into account, then any understanding of fisheries management systems will be seriously deficient, with often disastrous consequences for the design of development and assistance projects (Nauen 1989). “Both consideration of logical structures of total systems of local knowledge and an awareness of gender and age roles in rural society makes it self-evident that gender considerations are important in understanding local knowledge in fishing communities” (Ruddle 2000). There are at least four main types of gender differences in local knowledge systems (Norem et al. 1989; Ruddle 2000). Men and women have: 1) different knowledge about similar things; 2) knowledge of different things; 3) different ways of organising knowledge; and 4) different ways of preserving and transmitting knowledge.

But coastal-marine resource use and management is generally perceived of as being the domain of men. As a result, research and development projects have mostly focused on men’s activities. Although women play important roles in coastal communities, hitherto their contributions have hardly been recognised because their activities are usually not seen as directly generating income.

As a consequence, in most parts of the world we know almost nothing about women’s local knowledge, its usefulness and transmission. But before we can fill that gap we must fill an even larger void. Very simply put, it is the absence of informa-

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tion on what women living in the coastal zone actually do. This lack of comprehensive and internationally comparative data on women, parallel to that available for males, is crippling.

This is now becoming broadly recognised. As Williams (2001), for example, noted, “active networks have an impact on the ground: Networks at national level, with links to mainstream women’s and gender programmes, can bring a chance of lasting impact. For additional impact, national networks and their focal points could benefit from regional linkage.” She also pointed out the problem of a lack of hard facts on women’s roles and contribution in every country and that more rigorous methodological and analytical tools are required.

Specifically, what gender and development in coastal communities urgently requires is an internationally comparable comprehensive instrument to reveal women’s activities and contributions within their societies. This should consist of a basic minimal set of essential data such as I outline in this article.

My objective in this article is to present a first attempt at developing such a comprehensive minimum database on women’s activities in fishing communities; my specific goal is to understand the background in which my own studies of gendered knowledge will be conducted. A second but equally important objective is to stimulate discussion and contacts to improve my own ideas and the conduct of research. The next step is to field test this instrument under various different social and cultural conditions, and then to revise it based on those exercises, together with comments and suggestions received.

Examples of sets of indicators or checklists

Various sets of indicators or checklists have been devised to measure the core role of women in developing countries. Five examples are given below.

1. *World Development Indicators 2003*, produced by the World Bank, includes a section on “Women in development” (female population percentage, life expectancy at birth, pregnant women receiving prenatal care and literacy gender parity index) and the ratio of female to male enrolments in primary and secondary school, among other topics. (World Bank 2003).
2. *Human Development Report*, produced by the United Nations Development Program (UNDP), includes a gender-related development index (GDI) and gender empowerment measure (GEM). The GDI is a composite index using the same variables as the human development index. The difference is that the GDI adjusts the average achievement of each country in life expectancy, educational attainment and income in accordance with the disparities in achievement between men and women. The GEM is a composite index using variables constructed explicitly to measure the relative empowerment of women and men in political and economic spheres of activity. There are three indices: economic participation and decision making, political participation and decision making, and power over economic resources (UNDP 2003).
3. *GenderStats*, produced by The World Bank Group, is an online database of gender statistics and indicators based on national statistics, United Nations databases, and World Bank-conducted or funded surveys. *GenderStats* includes indices such as labour force participation, education access and attainment, and health (World Bank Group 2003).
4. *A Special Targeted Group of Development Projects, Women in Fishing Communities, Guideline*, is a checklist prepared by FAO and which includes more specific questions about women in fishing communities. The questions include fishery related activities, household activities, and social activities of women (FAO 1988).
5. *Meeting Information Needs on Gender Issue in Inland and Small Water Body Fisheries* by Seki and Sen (1994) presents a guideline for a cross-disciplinary examination of gender in inland fisheries. This guideline contains sections on: “Information required for at the macro-level (Key questions on gender issues which should be answered during sectoral planning and project formulation)” and “Information required for inland and small water bodies fisheries at the micro-level. (Key questions which should be answered for development interventions in specific areas or communities.)”.

These five checklists have weaknesses in terms of understanding the role of women and related gender issues in fishing communities. Checklists 1, 2 and 3 provide national-level data and statistics. As such they are too broad in scale and too generalised to provide information on women’s activities at the community level. Community-level information is necessary for development programmes. Also, checklists 1 and 2 lack indices to measure women’s and men’s activities in agriculture, fishery and other industries. Checklist 3 contains some agriculture indices

(agricultural inputs, output and productivity) but nothing on fisheries.

Checklist 4 was prepared to measure women's activities in a fishing community; however it is intended for the evaluation of projects aimed at women or women as a part of fishing communities. Thus, this checklist lacks some basic information, such as demographic topics, necessary to implement development projects. Also the questions in each part are too brief to provide a full understanding of women's activities. They should be extended and made more comprehensive.

The aim of checklist 5 is basically the same as that of this article. It recognises gender as a cross-disciplinary issue and attempts to present issues from a gender perspective. So information or data collected based on it would be used in programmes to be implemented at the site surveyed. Although, the guideline encompasses cross-disciplinary questions, some items regarded by many of the other documents mentioned here as being essential are not included in Seki and Sen's list. For example, it does not include items on social services or time use of women. These are both items of major importance in affecting women's activities in a household and a community. Without information on them, a programme would not be well planned and certainly would not be adequate for policy-making on gender issues.

Another major problem with checklist 5 is that none of the questions are suitable for making a comparative study among communities and countries. Since the questions are not defined specifically and lack essential parts, the user must supplement them with more specific questions. This is not a problem if the guideline is used only for a single location, but it is not suitable for regional comparisons within a country or for international comparative studies.

Components of the database

This section is composed of 18 topics with 297 questions. Each question needs to be answered to demonstrate women's actual activities. This instrument places special emphasis on information needed to implement income-generating activities for women. The 18 topics are:

- A. Demographic information
- B. Fisheries activities
- C. Non-fisheries activities
- D. Social services
- E. Decision making procedures
- F. Education
- G. Gender division of labor

- H. Time allocation
- I. Seasonal labour demand and women's time use
- J. Access to financial support or loan
- K. Health
- L. Food security
- M. Nutrition status and physical status
- N. Marriage and family planning
- O. Income and expenditure
- P. Property rights and property management system
- Q. Socio-cultural norms and traditional beliefs
- R. Impact of condition changes: technological, economic, ecological, and social change

A. Demographic information

The community demographic situation

1. What is the total population of the community?
2. What is the sex and age ratio in the total population?
3. What is the crude birth rate in the community?
4. What is the life expectancy at birth in the community?
 - Men
 - Women
5. What is the death rate of the community?
6. How many households in the community?
7. What is the average household size?
8. What is the ratio of male headed to female headed households?

B. Fisheries activities

Fish production

1. What are the types of fishing style in the community? (The place of operation, seasonality of main species availability, equipment, targeted species including women only fishing etc.)
2. Do women participate any of them?
3. What is the role of women in fishing?
4. How much do they get (money or the catch) from the job?
5. Is the women's share of the catch equitable to the men's?
6. How do women use the catch? (sell at a market, processing and sell, or consume at home, etc.)
7. Are the fisheries activities a part of women's routine?
8. Are the fisheries activities seasonal or year round?
9. Do women make fishing gear?
10. Are they paid to make fishing gear?
11. Do women repair or maintain fishing gear?
12. Are they paid for repairing or maintaining fishing gear?
13. What percentage of their work time is devoted to fishing activities?

Fish processing

14. Are people in the community engaged in fish processing (rate of male and female)?
15. How do they process the fish (processing technique)?
16. Are there adequate storage facilities for fish?
17. What are the causes of post harvest losses?
18. What equipment or facilities are used for processing?
19. Do women own the equipment or the facilities? If not, whose property is it?
20. What kinds of materials are needed (e.g. fuel wood, water, salt, etc.)?
21. Are they easily available or do they add time or monetary costs or burdens to women?
22. Are the processing activities individual or cooperative?
23. Do women control the activity and the income?
24. How do they use the processed fish?

Fish marketing

25. Is there an available market?
26. How big is it (i.e. number of shops or number of people who use it)?
27. Who comes to buy fish?
28. What other products do the women sell?
29. Who is the person responsible for selling fish at the market (man or woman)?
 - All fisheries products
 - Only some
30. How much of their fresh and processed fish do they sell at the market to purchase other living necessities?
31. Do women sell products as individuals or cooperatively?
32. Which species of fish are sold at the market and which are consumed in the household?
33. What is the reason for question 31?
34. How do women transport products to the market?
35. How much does it cost for the transportation?
36. What kind equipment do women need at the market?
37. Who are the other sellers of fish and fish products?
38. Do women face significant competition with other sellers?
 - From large-scale sellers
 - From male small-scale sellers
 - From female small scale sellers
39. Is there a government price policy?
40. Is the government price policy applicable to small-scale sellers? If not, what is the reason?
41. Are there any quality controls at the market?
42. To whom do women sell their products?
43. Are there market intermediaries (“middlemen”) between the sellers and consumers?
44. Are the market intermediaries men or women?
45. What are their jobs?

46. Are they necessary?

47. How large is the spread between prices to middlemen and directly to consumers?
48. How much do women earn at the market?
49. Do women have control over the money earned there?
50. Do women have knowledge of marketing and bookkeeping?
51. Do women have any difficulties or problems at marketing?

Resource management of fisheries

52. Is there a traditional management system of fisheries in the community?
53. What are the fisheries common resources of the community area?
54. Are they the exclusive property of the community or is there free access to outsiders?
55. For each resource (sea, aquaculture pond and lakes, etc.):
 - Who/What is the authority?
 - Who has rights and what are they?
 - What are the rules applied to fisheries? Who performs monitoring, accountability and enforcement?
 - What sanctions are invoked?
56. Do women play any role in the traditional management system?

Aquaculture

57. Is the community involved in any aquaculture activities?
58. Is it industrial or small-scale aquaculture?
59. How many groups or individuals run aquaculture in the community?

For each type/location of aquaculture:

60. Where is the aquaculture located? How long does it take to get the right to operate?
61. Whose property is the pond, water supply and other related facilities?
62. Is it an individual or collective enterprise?
63. What kinds of species are farmed? (also the value of the species at the region)
64. Do women participate in aquaculture activities?
65. What is women’s status in aquaculture activities (i.e. just a man’s helper with no payment or with pay, etc.)?
66. What is women’s role in aquaculture?
67. Is there a women’s aquaculture management group? What are the activities of the group?
68. Do women control the activities and the income?
69. How do they use the products (i.e. consume domestically, processed and sold, sell at market, etc.)?
70. What materials do they need for aquaculture?
71. How much do the materials cost?

72. How much do they earn from aquaculture?
73. How much do women get from aquaculture?
74. Is the income equal for women and men workers?
75. What percentage of total income from fisheries is supplied by aquaculture?
76. What are the problems of current aquaculture in general? (technological, financial, environmental, etc.)
77. What are the constraints faced by women in aquaculture?
78. How much does it cost to run small-scale aquaculture?

C. Non-fisheries activities

Current situation

1. Are there any other income generating activities (farming, livestock, poultry, etc.)?
 - For men
 - For women
 - For children

For the women's activities

2. What are the products or services (products, unit price, etc.)?
3. Are they popular or in demand in the area? Why?
4. Who are the targeted people for the products or services?
5. Are the non-fisheries activities done by individuals or a cooperative?
6. If done by cooperative, how do they organize it and what is the advantage?
7. How much money does the activity earn?
8. Do women control the money?
9. How long do women spend on non-fisheries activities?
10. Do women have access to financial support or loans to run their non-fisheries activities?

Future possibility

11. Are there resources that are not yet exploited in the community?
 - Natural resources
 - Special valued food
 - Handicrafts
 - Services
 - Other skills
12. Is there a possible market or demand for the new resources?
13. Do women want to start new businesses? Why or why not?
14. Are there social or traditional constraints for women's participation in non-fisheries activities? What are they?
15. Is it possible for women to enter the market with their new products? What are the obstacles?

16. Is a loan or financial support available for women to start a new business?
17. Do women have any constraints to run non-fisheries activities (e.g. working outside of household or inside of the community)?
18. Do women work outside of household? If so, what work do they do?
19. Are there any customs or other social rules that prevent women from going outside their household to work?

D. Social services

1. What social services exist in the community? (Describe them with specific information)
 - Schools
 - Medical care service or public sanitation centre
 - Water
 - Fuel
 - Electricity
 - Market for food and necessities
 - Childcare centre, etc.

For each service

2. Is it accessible and responsive to people's needs?
3. Are these facilities available equally to both women and men?

E. Decision-making procedure

At the community level

1. What kind of organisation exists in the community? Men only, women only or mixed?
2. Are there any groups of women?
3. What are the aims or activities of the women's groups? Can they decide anything about their community?
4. Do women assume a leadership role in the mixed organisation?
5. Who comprises the community delegates at community meetings?
6. How do people decide the delegates?
7. Do women attend community meetings?
 - Yes: What do they do and do they voice their opinions?
 - No: Why they cannot /do not attend?
8. Are there any constraints on women expressing their opinions at community meetings?
9. Do women play an active part in the community decision-making process?
10. What do women see as their contribution in the community? Do men realise or admit it?

At the household level

11. Who decides these things in a household?
 - ask this question for each item in this instrument. (Fisheries activities, children's education, financial matters, food security, health care, family planning and property issues.)

F. Education

Enrolment and completion of formal education

1. What is the final education level for:
 - Females
 - Males
2. What are the reasons for girls and boys not attending school?
3. What percentage of women and men attain a level of literacy?
4. What percentage of women and men attain a level of functional literacy?
5. What are the constraints for each child to attend school (i.e. wanted child and unwanted, boys and girls)?

The quality of the formal education

6. What levels of education are available in the community or region?
7. What subjects of study does the school provide?
8. How much does it cost?
9. How long does it take to get to school from the community?
10. How many children and how many teachers in the school?
11. Are there female teachers at the school?

Informal education

12. Are there any types of informal education for females?
13. What are they? Describe the purpose, provider, prospective takers, contents, time and place, etc.

G. Gender division of labour

1. On what tasks or responsibilities and to what extent are there traditional distinctions between the roles of women and men?
 - Fisheries activities
 - Other productive activities
 - Controlling cash
 - Social, community activities
 - Political, decision making activities
 - Household activities such as making meals, caring for children, fetching water, collecting fuelwood, going to market, and feeding live-stock, etc.
2. In what activities are women engaged in their own right and responsibility and in which are they supportive?
3. Are there traditional written or implicit restraints or taboos on women engaging in particular activities? What are they? And why is it seen as so?
4. Does the community allow women to associate with men?

H. Time allocation

1. How do people allocate their time in a day? (Describe it from 0–24 hours. Needs to be focused on seasonal changes especially seasonal changes with regards to fishing targeted species or aquaculture procedures)
 - Male (old, middle and young)
 - Female (old, middle and young)
 - Percentage of paid labour time and unpaid work.
 - Percentage of time in domestic activities
2. Does the allocation change seasonally? Which part of it?
3. What are the core tasks and responsibilities of women that must be done either every day or at regular times throughout a year?
4. Do men and women have periods when they cannot work or have constraints to working?
5. What are the reasons for the period (e.g. religious, physical, social norms, and others)?
6. How do they supplement the lack of labour during the term?

I. Seasonal labour demand and women's time use

This section needs to be completed monthly throughout at least an entire year. Households to be sampled should be typical of the community. If there are some groups that can be sorted by sets of seasonal activity changes, take samples from each group (e.g. fishing + fish pond, fishing + farming, etc.).

1. What is the family structure of the sampled family?

Relationship to HHH*	Age	Full-time occupation	Part-time occupation

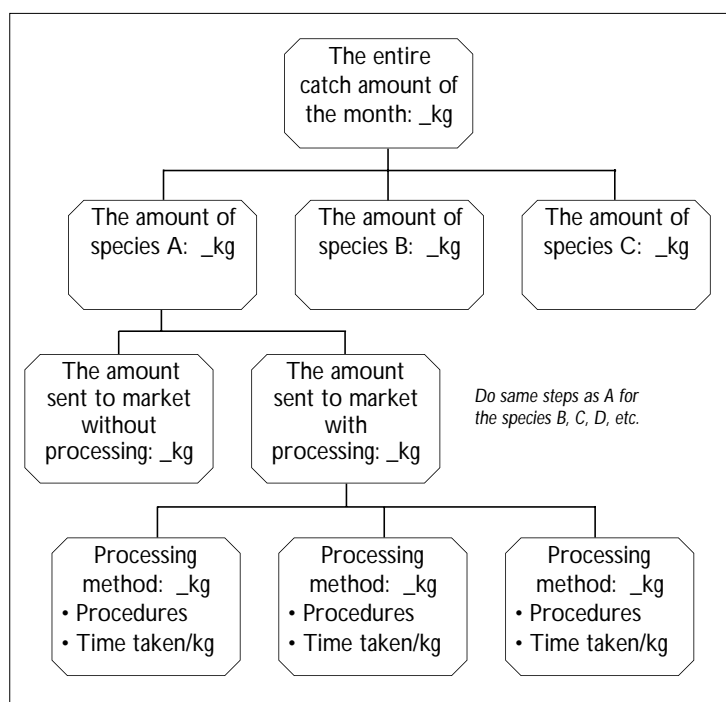
*HHH = household head.

2. What are staple income-generating activities of the household?
(Answer only questions that are applicable to the sampled household's women.)

Fishing seasonal tasks

3. Describe the seasonal schedule of fishing activities (by month, targeted species and gear types).

4. Describe the fish catch amount and fish species per month from fishing.
5. Sort this using the structure shown immediately below:



6. The whole catch amount for the month.
7. Sort by species.
8. Sort by the distributions: the amount marketed without processing and the amount used for processing procedures in the community.
9. Sort by processing methods. Describe every step of the method and the time taken for each step.

Aquaculture seasonal tasks

10. Describe the seasonal schedule of aquaculture activities (by month, by species and methods).
11. Describe the fish catch amount and fish species and other characteristics per month from aquaculture.

Sort this along the structure above

12. The whole catch amount for the month.
13. Sort by species.
14. Sort by the distribution: the amount marketed without processing and the amount processed in the community.
15. Sort by processing method. Describe the each step of the method and the time taken for each.

Marketing tasks

16. Do women sell both fresh and processed fish at the market?
17. How many times do they go to market? Describe on a monthly basis.
18. How long does it take to get there?

Farming seasonal tasks

19. Describe seasonal farming tasks by month and crop type.
20. Describe women's tasks by month and time taken.

Marketing tasks: describe this part if they go to market only to sell crops.

21. Do women go to market to sell crops?
22. How many times do they go to market? Describe it on a monthly basis.
23. How long does it take to get there?

Other staple income-generating activities of women

24. Describe the tasks of each activity on a monthly basis.
25. Describe women's time use for the activity by month.
26. Describe marketing time use of women for this activity.

J. Access to financial support or loan

1. What kind of financial support and loans are available in the community?
2. For each financial support or loan, who can use them and what is the purpose?
 - Female (married)
 - Male
 - Widow
 - Divorcee
3. For each financial support or loan, what kind of status of guarantee is required?
4. Can women access it (including widows and divorcees)?
5. Do they include direct support for women's activities?
 - Fisheries related activities
 - Non-fisheries income-generating activities
 - Domestic activities (purchasing necessities or child care)
 - Savings or investment
6. What constraints are there on women accessing financial support or loans?

K. Health

General information

1. What kind of medical facilities are available in the community? Are there people who have sanitation or medical knowledge?
2. What types of toilet do they use?
3. When men fall sick, do they see a doctor?
4. When women fall sick, do they see a doctor?
5. Where do they obtain basic sanitation knowledge?
6. What kind of information do they possess about basic sanitation?

7. How does disease or AIDS infection change women's and families' lives?

AIDS and knowledge of it

8. How many people have died from AIDS and how many are infected?
9. How much do they know about HIV (how to transmit or risk to children)?
10. How do they obtain information about HIV? Are any programmes available?
11. Do they know about contraception?
12. Where can they obtain contraceptives and information?
13. Do men offer to use condom?
14. Can women ask their husbands to use a condom?
15. How much do condoms cost? Are they affordable?
16. Do they take counselling (test) for HIV? Can women ask their husbands to take it?
17. How do they react if they know their partner is HIV positive?
18. How do people react toward people who are infected with HIV: Toward men and women (partner's family, village people, and others)?
19. Do men have sexual relationships inside/outside a community and who are the possible partners?
20. Is it permitted for a man (married and unmarried) to have sex with a woman who is not his wife?
21. Do women have sexual relationships inside/outside a community and who are the possible partners?
22. What are the reasons for men and women to have sexual relationship with persons who are not their husbands/wives?

Children's health

24. What are the causes of death of children under 5 years of age?
25. Do all children receive vaccinations?
26. Do mothers know about children's diseases and their causes?
 - Diarrhoea and contaminated water relationship
 - Other local diseases

Reproductive health

27. What is the rate of maternal death in a community?
28. Where do they give birth?
29. Who are the possible people who help women give birth? Are they trained?

Water supply

30. Where do they obtain water for drinking?
31. Where do they obtain water for household activities?

32. Who is responsible for fetching water?
32. How long does it take to bring water to the house?
33. How much do they bring at one time?
34. Is the water or water source safe?
35. Do they know that unsafe water causes diarrhoea?

L. Food security

1. How do people obtain food (fish, meat, vegetable, dairy products, etc.) (at market, from small agriculture, and fishing)?
2. Who is responsible for each basic foodstuff and overall food security in a household?
3. Is enough food available through a year? (Chronic shortage, seasonal or transitory shortage?)
4. What are the reasons for the shortage (shortage of food amount itself or lack of purchasing power)?
5. If they cannot have enough food, do they have a way to supplement?
6. Is enough quality and variety of food available?
7. Are people satisfied with the food available?
8. Do people eat various kinds of food (dairy products, egg, seafood, meat, beans, vegetables, potato, fruits, grain, sugar, fat, etc.)?
9. How much does a household spend on food (ratio to income)?
10. How do they use their fish catches?
 - Percentage consumed in the household
 - Percentage sold or processed for sale
11. What percentage of the fish catch is consumed by the household and what percentage is sold?
12. Is fisheries the main or only source of food for a household?
13. What are the other sources of food in the community or the household (farming, gardening, livestock, poultry and fruit trees, etc.)?
14. What are the potential food sources?
15. What are the potential food sources in the community?

M. Nutrition status and the physical status of women

1. How many calories do they take in a day?
 - Men (old, middle and young)
 - Women (old, middle and young)
2. What kind of diet do they have?
3. Are there any differences in diet between men and women?
4. Is their way of using food the best possible way to take full advantage of its nutritional value?
5. What is their physical status (measure heights and weights)?

N. Marriage and family planning

Marriage

1. How old are women when they first marry?
2. How old are men when they marry?
3. Why do women and men marry?
4. Do they have the custom of bride-price (marriage portion to bride family) or dowry?
5. Is it a patriarchal or matrilineal community?
6. After marriage, where does a couple live?
 - Wife moves to her husband's house?
 - Husband moves to his wife's house?
 - Both move to another location?
7. How does the inheritance system work by marriage formation (Who inherits whose property — land, house, livestock, fishing gears and fish pond, etc.)?

Family planning

8. Do men and women have a notion of family planning?
9. How do they practice it or try to practice it?
10. How many children does one household have on average in the community?
11. What is the reason for having children?
12. How many children are wanted and unwanted?
13. Do women know about contraceptive methods?
14. Do men know about contraceptive methods?
15. Do people use contraceptive methods? Why or why not?
16. How many children does a couple want to have?
17. How many children do they actually have?
18. How often do women give birth? (the interval of child bearing)
19. Who controls family planning?
20. Is there a place where men and women can obtain family planning information?
21. Do people use the place where they can obtain family planning information?

O. Income and the expenditure

1. What is the breakdown of all income in a household throughout a year?
2. What is the breakdown of all expenditures in a household? For whom is the money used?
3. What percentage of income is earned by men and what by women?
4. What percentage of total household income is derived from fisheries?
5. How much do women and men earn from fisheries related activities?
6. What are other sources of income?
7. How much do women and men earn from non-fishery related activities?
8. How much do they earn for each month or sea-

son? Are the fishing activities year round or seasonal?

9. Who controls the family's cash income?
10. How is the income distributed?
11. What is per capita income per household (total divided by family size)?
12. How does a household use the surplus income?

P. Property rights and property management system

1. What are the individual properties in a community? And who owns them?
 - Fishing gear
 - Land
 - House
 - Fish pond
 - Property rights on other resources like forest, river, etc.
2. For each of the above, are there written ownership rights?
3. According to the written certification or the rule in a community, is it possible for women to own property?
4. Are there any community properties (except fishery-related properties)?
5. For each of the types of property listed in response to question 4 describe:
 - Authority
 - Rights
 - Rules
 - Monitoring, accountability and enforcement
 - Sanctions
6. Do women play any role in imposing the traditional management system on community property/resources?
7. When a couple divorces or is broken by death, who inherits the property? (widows)
8. Is there any legal support for women to have property rights? And do they understand the system and is it accessible to women? Why or why not?

Q. Socio-cultural norms and traditional beliefs

Women's status

1. What is the general image of an ideal man and woman?
 - A male
 - A female
 - A boy
 - A girl
 - A married male
 - A married female
 - A widow
2. Ideally, in this society, for every item in this instrument what should only women and girls do or be?

3. Ideally, in this society, for every item in this instrument what should only women and girls not do or be (disadvantageous norms on women)?
4. Ideally, in this society, for every item in this instrument what can only male and boys do or be?
5. Ideally, in this society, for every item in this instrument what can only women and girls do or be (advantageous or protective norms on women)?
6. What do men think about women going outside of household or the community to work?
7. What do men think about women having their own income-generating activities inside of household or in the communities?
8. What do men think about women working with men?
9. What do men think about women obtaining an education or training to have income-generating activities?
10. What are other aspects that determine or limit women's activities (e.g. religion, myths, etc.)?
9. How have they influenced people's lives and the traditions (income, living condition, women's status, etc.)?
 - Men
 - Women
10. How do people evaluate them?
 - Women's point of view
 - Men's point of view

Fishery condition:

R. Impact of condition changes: technological, economic, ecological and social changes

Technological changes

1. Have new technologies been introduced to the community? (If fishery related, go to #11 below). What is it and how does it help people and who is the targeted of the new technology?
2. Does it work as it intended to? Does it help the targeted people?
3. How has it influenced people's lives and the traditions (income, living condition, women's status [reduction of labour burden], etc.)?
 - Men
 - Women
4. How do people evaluate it?
 - Women's point of view
 - Men's point of view

Economic changes:

5. Have new economic items been introduced to the community?
6. How have they influenced people's life and the traditions (income, living condition, women's status, etc.)?
 - Men
 - Women
7. How do people evaluate them?
 - Women's point of view
 - Men's point of view

Social structure:

8. Have new social structures been introduced to the community?

11. Have new fishing technologies been introduced to the community (including aquaculture)? And who are the targeted people?
12. How have they influenced people's life and the traditions (income, living condition, women's status, etc.)?
 - Men
 - Women
13. How do people evaluate them?
 - Women's point of view
 - Men's point of view
14. How have fishing conditions changed recently?
 - Amount of the catch
 - Species
 - Income (price of the fish)
15. What is the reason for the changes in fishing conditions (industrialise fishing impact, failure of resource management, etc.)?
16. What impact has the change had on the roles, status, etc. of women?

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New publications

Traditional Marine Resource Management and Knowledge

Life and death of coral reefs

C. Birkeland (ed), 2004. Kluwer Academic Publishers B.V., Dordrecht, The Netherlands. 560 pages

Coral reefs are among the most biologically productive ecosystems in the world. The global potential for coral-reef fisheries has been estimated at 9 million tonnes per year, but they are vulnerable to excessive exploitation and particularly to other human and natural disturbances. During periods of climate change, plant-animal reefs are the first to be affected and their disappearance or substantial reduction is well documented over geological time. At present, with reefs again under pressure, this book is particularly relevant. An excellent summarising introduction is followed by 19 chapters that cover the full spectrum of issues. First the evolutionary and geological perspectives are dealt with, then on the biological side, symbiotic relationships, reproduction and recruitment, the effects of predation and grazing, and diseases are considered. Subsequent chapters cover various types of pollution, emphasising the dangers to corals of eutrophication, sedimentation, and oil pollution, and the management of reef resources is extensively discussed. The overall aim of the book is to examine how the balance in reefs shifts between accretion and erosion, recruitment and mortality, recovery and degradation, and to identify the relevant factors. It is concluded that although moderate subsistence or recreational use of coral reefs could be sustainable if carefully managed, the commercial use of their resources should generally be non-extractive, exploiting the ecological services of reefs through tourism and the production of foods and pharmaceuticals through aquaculture. The topics in the book are well selected to produce an integrated and comprehensive account of coral reefs, and the text is usefully illustrated and backed up with 90 pages of references, which guide the reader to further exploration.

- Chapter 1. Introduction (by Charles Birkeland)
- Chapter 2. Reefs and reef limestones in earth history (by Pamela Hallock)
- Chapter 3. Reef biology and geology: A matter of scale (by Dennis K. Hubbard)
- Chapter 4. Bioerosion and coral-reef growth: A dynamic balance (by Peter W. Glynn)
- Chapter 5. Interactions between corals and their symbiotic algae (by Gisele Muller-Parker and Christopher F. D'Elia)
- Chapter 6. Diseases of coral-reef organisms (by Esther C. Peters)
- Chapter 7. Organic production and decomposition (by Bruce G. Hatcher)
- Chapter 8. Reproduction and recruitment in corals: Critical links in the persistence of reefs (by Robert H. Richmond)
- Chapter 9. Issues in genetics on coral reefs (by Nancy Knowlton)
- Chapter 10. Invertebrate predators and grazers (by Robert C. Carpenter)
- Chapter 11. Reef fishes, seaweeds, and corals: A complex triangle (by Mark A. Hixon)
- Chapter 12. Indirect effects of interactions among species on coral reefs (by Steven C. Pennings and Eric H. Borneman)
- Chapter 13. Geographic differences in ecological processes on coral reefs (by Charles Birkeland)
- Chapter 14. Ecosystem interactions in the tropical coastal seascape (by John C. Ogden)
- Chapter 15. Diversity and distribution of reef organisms (by Gustav Paulay)
- Chapter 16. Disturbances to reefs in recent times (by Barbara E. Brown)
- Chapter 17. Coral-reef fisheries management: An alternative based on local knowledge and the community (by Robert E. Johannes and Kenneth Ruddle)
- Chapter 18. Resource use: Conflicts and management solutions (by Gregor Hodgson)
- Chapter 19. Implications for resource management (by Charles Birkeland)

The book is dedicated to the influence of Robert E. Johannes. A 2–3 page review of his influence on tropical coastal resource management is presented as a frontispiece. Publication is estimated in mid-2004.