



Issue 21 – December 2010

# WOMEN IN FISHERIES

## information bulletin

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### Editor's note

Welcome to the 21<sup>st</sup> issue of the *Women in Fisheries Bulletin*, which highlights gender roles in coastal fisheries, women's fishing activities in urban and rural communities, and gender issues in development.

In this edition, there are two papers on seaweed farming, from Solomon Islands and Fiji. In the case study from Solomon Islands, Mecki Kronen et al. describe the results of socio-economic household surveys carried out on Wagina Island, Choiseul Province. The surveys indicated that seaweed farming was done as a family enterprise and the annual labour input was dominated by men (68%). There were reductions in men's fishing activities because of their involvement in seaweed farming. The number of women participating in seaweed farming positively correlated with households' revenue from seaweed farming. In the article on seaweed farming in Fiji, Lal and Vuki review seaweed farming's historical development and challenges. They also briefly explain the roles of men and women.

In 'Women's fishing activities on Aniwa Island, Tafea Province, South Vanuatu', Raneva and Vuki describe the contributions of men and women to household fish consumption. The types of fishing gear used by different genders and species targeted by each type of fishing gear are also mentioned. It seems that over the years, fishing activities on Aniwa have not changed dramatically and although it may seem ineffective, fishing has provided a sustained protein source for most households on the island. In the article 'Sources of help in how to gather gender disaggregated fisheries data', Meryl Williams raises an important issue about the need to collect gender disaggregated data. She provides some useful sources of information that can be used and adapted to fisheries and aquaculture.

A paper by Vuki et al. on people's perceptions of marine reserves in Guam shows strong support for the establishment of marine reserves. The Chamorro people from the southern part of the island indicated their support for community-based conservation restrictions on harvest of certain species of fish and restrictions on fishing gear types.

Three papers have been reprinted from *Yemaya* with permission. The article 'Climate Troubles' discusses the challenges of climate change in the Philippines and how women have coped. In the paper 'Behind every boat, a woman, a family and a community', Brian O'Riordan et al. noted that the European Network of Women's Organization in Fisheries and Aquaculture (AKTEA) is rapidly growing and the participation of women in formulating policies is important in fisheries management. This paper

challenges the absence of women's contributions to European Commission policy consultations on fisheries. The article by Veronica Yepez 'Painting the Diversity of Mangroves' discusses the challenges women in Ecuador face as a result of the destruction of mangrove habitats. She describes in detail women's stories about how mangrove destruction has affected women and their families.

The 'Letters and news from around the region' section consists of a letter from Dr Tim Adams commenting on an article by Thomas Malm in the 20<sup>th</sup> issue of the bulletin. This section also includes an article by Felix Chaudhary on a fish pond in Fiji that dried up. The article describes the impact of drought on tilapia aquaculture.

Lastly, the cartoon called Yemaya Mama expresses clearly the need not to exclude women from community fisheries or aquaculture meetings. Women are often left out, although they are expected to take active role in fisheries and aquaculture development and management.

I welcome any feedback on the articles in this issue of the *Women in Fisheries Bulletin* and encourage you to submit articles on women and community fishing issues from your country or your region.

**Veikila Vuki**

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Cover picture: *Recording data during a socioeconomic survey in Palau, 2007. Image: Mecki Kronen.*

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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 Pacific Islands Forum Fisheries Agency (FFA), the University of the South Pacific (USP), the Pacific Islands Applied Geoscience Commission (SOPAC), and the Pacific Regional Environment Programme (SPREP). This bulletin is produced by SPC as part of its commitment to PIMRIS. The aim of PIMRIS



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.

## Gender and seaweed farming on Wagina Island, Choiseul Province in Solomon Islands

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### Summary

A field survey on the socio-economic dimensions of seaweed farming was carried out on Wagina Island, Choiseul Province in Solomon Islands. Given the geographical and socio-economic conditions, seaweed farming on Wagina was found to be a viable, non gender-based income option, with women having equal chances to benefit from the cash revenues sourced from this aquaculture.

Results from a survey of 58 households (28% of all households), 40 of which were engaged in seaweed farming, showed that (a) the average annual cash income for seaweed farming households was about 52% higher (surplus of SI\$10,400) than non seaweed farming households; (b) members, particularly men, of more than half of all households surveyed have either abandoned or reduced their finfishing and bêche-de-mer (and trochus) fishing; (c) 38% of all respondents believe that seaweed has improved social networking and social services in the community.

Seaweed farming was found to be essentially a family enterprise although men accounted for most (68% of total annual labour) of the annual labour input. Women and men contribute similar amounts of labour to most processes in seaweed production. A positive and statistically significant correlation was found between the number of women per household participating in seaweed farming and the household's revenues from this income source.

A number of issues, including women's roles as mothers and child educators, and certain environmental, financial and managerial problems, are highlighted and need to be addressed, to assess the future sustainability of seaweed farming on Wagina, and possibly in other communities in Solomon Islands.

### 1. Introduction

#### 1.1 Objectives and background

The central aim of this paper was to demonstrate the gender-related effects of seaweed farming. This topic was one of numerous socio-economic and institutional elements addressed in a comprehensive evaluation of the socio-economic dimensions of seaweed farming in Solomon Islands, as part of a Food and Agricultural Organization (FAO) global review (Kronen et al. 2010). The Wagina seaweed farming community in Choiseul Province, one of the four major seaweed production areas in Solomon Islands, was selected for an in-depth field survey in November 2009 (Figure 1). Members of the survey team included senior

and junior staff members from the Aquaculture Section of the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR), a socio-economist fisheries consultant, village elders and a former project leader of the European Union funded Commercialisation of Seaweed Production in Solomon Islands (CoSPSI) Project. The survey was financed by FAO in cooperation with the Secretariat of the Pacific Community's (SPC) Aquaculture Section.

Further results obtained in the framework of the socio-economic survey have been used to provide background information on geographic, demographic and socioeconomic conditions on Wagina, and on the historic development of seaweed farming in Solomon Islands.

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**Figure 1.** Location of Wagina, and existing and future possible seaweed farming sites in Solomon Islands

### 1.2 Wagina's cultural and demographic features

Solomon Islands are believed to have been inhabited by Melanesian people for thousands of years. In the 1890s, the United Kingdom established a protectorate over Solomon Islands. The British administration resettled people from the overcrowded Gilbert Islands (Kiribati) to the islands of Wagina and Titiana in Western Solomons during the 1950s and 1960s. By 1980, these people and their descendants numbered around 3000.

The 2009 census indicates that the total population of Wagina may not exceed 1500 people. The island population is divided into three communities, the

largest, Tengangea-Kukutin (about 600 people), followed by Aririki (about 400) and Nikumaroro (about 390). While Tengangea-Kukutin – often referred to as Kukutin – is Catholic, the people of Aririki and Nikumaroro belong to the United Church. The two communities of Tengangea-Kukutin and Arariki are adjacent to each other, while Nikumaroro is located further to the east on the island.

Based on the socio-economic survey results, using fully-structured, closed questionnaires, and including 58 households, the average household size is large, ranging from six to eight people, and today, most households in the three communities are engaged in seaweed farming (69%) (Table 1).

**Table 1.** Sampling details of socio-economic survey undertaken in Wagina, Solomon Islands

	Arariki	Tengangea/Kukutin	Nikumaroro	Wagina
<i>Data (estimated) from 2009 census</i>				
Total number of households	70	79	60	209
<i>Data from FAO seaweed socio-economic survey November 2009</i>				
Number of households surveyed	19	22	17	58
Number of seaweed farming households (surveyed)	14	14	12	40
Number of non-seaweed farming households (surveyed)	5	8	5	18
Average household size (surveyed)	6	8	7	7
Total population estimated	399	593	390	1382
Total population surveyed	108	164	110	382
Population and household survey sample (%)	27	28	28	28

### 1.3 Access to resources and income

The Gilbertese people of Wagina and a number of communities from Santa Isabel and Choiseul have access to the islands of the Arnavon Marine Conservation Area (AMCA), which lies midway between the islands of Santa Isabel and Choiseul. The creation of AMCA began in 1995 with support from the Nature Conservancy (The Nature Conservancy 1998) to preserve diverse marine resources, including bêche-de-mer, other invertebrates and key species, all subject to increasing “boom and bust” cycles of harvesting since the 1980s. The islands are for instance the most important rookery in the western Pacific for the endangered Hawksbill sea turtle and home to one of the world’s largest nesting populations of this species (SPC 1996). The management plan for AMCA included the provision of viable alternative marine enterprises.

Alternative income opportunities for people living on Wagina are limited. Copra production is no longer viable. Bêche-de-mer resources are considered exhausted in the close vicinity of the island, and no longer provide a reliable or promising income source. Income from fisheries is restricted to finfish and lobster tails, which are exported to Honiara. Survey respondents reported that the total catch and average size of lobsters harvested had decreased visibly over time. Respondents believed that the resource would be exhausted within the next years. While a total weekly production of 300 kg of lobster tails was still possible at the beginning of 2000, today’s catch was reported to be down to about 40 to 50 kg per week. The lobster operations are linked with spear diving finfishing groups. Speardivers and other fishing groups sell their catch to the fishery centre which has been privately operated since October 2009. The centre buys about 400 to 500 cleaned or filleted finfish from local fishers for fortnightly export to Honiara using the inter-island cargo boat service.

Other local income opportunities are restricted to a few small island stores, a few people receiving salaries from government and church services, and the occasional selling of handicrafts (mats), garden produce or pigs. The survey showed that only one couple on the island gained their main income from gardening.

### 1.4 Seaweed farming in the Solomon Islands and on Wagina

Seaweed farming is regarded as one possible alternative source of income, which would reduce pressure on wild caught coastal resources in remote rural coastal communities with few income opportunities, but serviced at reasonable frequency and cost by inter-cargo boat services. Given the physi-

cal, environmental and socio-economic conditions necessary for seaweed farming, this activity is possible and likely to be economically viable in several areas in Solomon Islands.

Seaweed was first farmed in Solomon Islands in 1988 by the UK Overseas Development Agency (ODA) at Vona Vona Lagoon and Rarumana village in the Western Province using *Kappaphycus alvarezii* imported from Fiji (Tiroba and McHugh 2006). In 2000, Solomon Islands Aquaculture Division of the Ministry of Fisheries and Marine Resources (MFMR) collected seed stocks remaining from the 1988 growth trials in Vona Vona Lagoon, and used these to start growth trials in Rarumana.

Towards the end (2000) of the European Union funded Rural Fisheries Enterprise Project (started in 1994), which aimed to link the fisheries centres established earlier with Japanese aid in four provinces, seaweed farming was considered an option for these centres. This initiative was unsuccessful, because the location of fisheries centres was unsuitable for seaweed production. The idea was again taken up by the CoSPSI Project. Favourable physical conditions, and the existence of the fishery centre on Wagina, enabled the building of a seaweed warehouse in 2004 on the island to provide storage facilities, and to help market the seaweed. The People First Network (PFnet) broadband, e-mail system enabled communication between producers and buyers.

In 2005 about 130 seaweed farmers were working in Rarumana and the Shortland Islands (Western Province) and another 300 were working on Wagina. Seaweed farming had also expanded to Malaita Province and Makira-Ulawa Province. About seven export licences were approved, although only one was renewed in 2006. This licence holder is now the sole current seaweed exporter in Solomon Islands.

Seaweed is a low-value product and therefore sensitive to beach prices, international market developments and production costs, notably transport costs. The relationship between costs and prices, access to alternative sources, financially more attractive sources of income (in Wagina particularly the opening and closing of the bêche-de-mer fishery), losses due to fish grazing, outbreaks of the filamentous epiphyte *Polysiphonia*, or ‘ice-ice’ caused by stress due to poor salinity and high water temperatures, and loss of production sites due to sedimentation effects after a tsunami, explain the sharp fluctuations in national seaweed production between 2003 and 2009. During this period, annual production and export volumes fluctuated between a minimum annual production of 40 tonnes and a maximum annual production of 400 tonnes of dried seaweed.



## 2. Results

### 2.1 Increased cash income

One major finding from the socio-economic survey in Wagina is that seaweed farming households gain on average about 52% (SI\$10,400 per year) more cash income than those households that do not participate. Income from seaweed accounts on average for 42.5% of a farming household's total annual cash revenue. The life improvements such as better food, and food security, made possible by this increased income, are the most important changes for households farming seaweed, as well as a focus on seaweed farming rather than other household responsibilities, or gardening.

### 2.2 Impacts on coastal resource exploitation

While most respondents believe that the responsibilities and activities of their household members have not changed with seaweed farming, the reduction or abandonment of finfishing and bêche-de-mer fishing were reported by over half (53.7%) of all seaweed farming households. Reduced fisheries activities applied mostly to men rather than women (Table 2).

### 2.3 Social changes at community level

Respondents reported a variety of perceptions of change in community social structures and institutions as a result of seaweed farming. More than half (57%) of those interviewed generally reported no major change. Social networking, and a tight family system with expectations of mutual support were considered traditional values, and these have persisted since seaweed farming began on Wagina. However, 38% of respondents thought that seaweed had improved social networking, contributed to the formation of stronger groups of families sharing the same interest, and at times even resulted in families operating more independently. Frequently, improvement of social services in the community, including school, church and youth was quoted.

Most believed that seaweed has triggered positive competition among farmers and families.

Some (17%) respondents indicated an increase in jealousy, and complained about people stealing ropes, seaweed and other materials. However, overall such negative effects associated with the production of seaweed were not considered to be major issues.

### 2.4 Labour requirements and gender participation

Seaweed farming is done as a family enterprise and includes women, men and children. However, men account for most of the reported annual working time, i.e. 68% compared with women (32% of total annual working time). As shown in Figure 2, on average women invest about half of the annual time needed for harvesting, replanting and maintenance, and drying compared with men, however, men are mainly responsible for packing and selling.

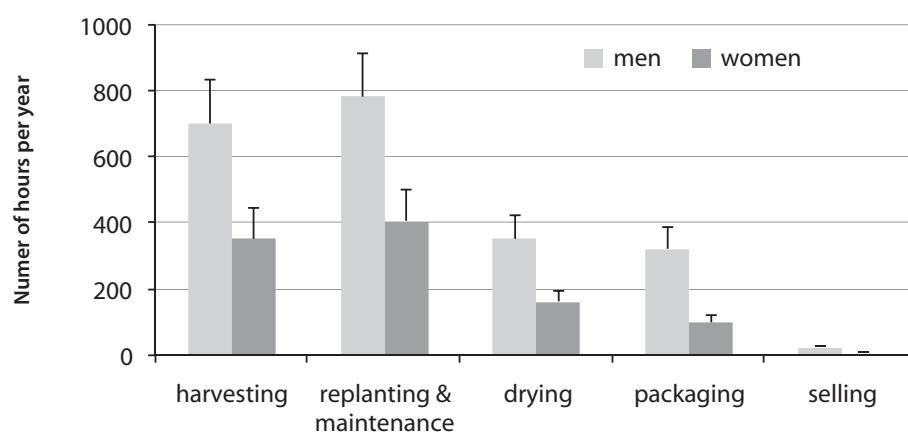
On average, most of the time invested by men in seaweed farming is dedicated to replanting and maintenance (36%) and harvesting (32%) (Fig. 3). Time spent drying and packaging account for 15%–16% of total annual labour. Least time is required for selling (1%).

Similarly, most of the time invested by women in seaweed farming is dedicated to replanting and maintenance (40%) and harvesting (34%) (Fig. 4). Time spent drying and selling is also similar to that of men (16% and 1% respectively) while only 10% of the total annual labour of women is spent in packaging.

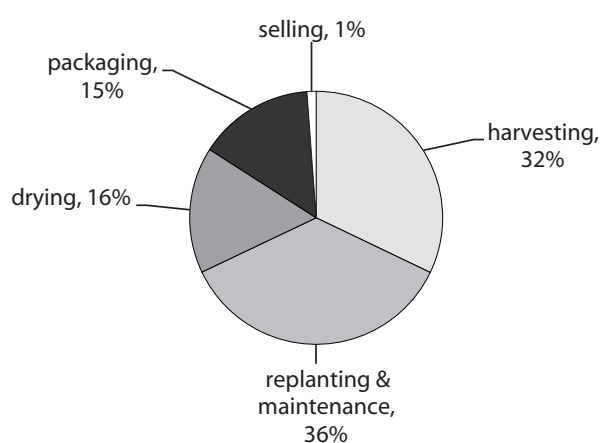
The importance of gender in seaweed farming is highlighted by the positive and statistically significant relationship between the total number of women in a seaweed producing household and its annual income – the more women, the higher the income, pinpointing the important contribution of women to the annual household income in this sector (Fig. 5).

**Table 2.** Changes in personal activities with the introduction of seaweed farming.

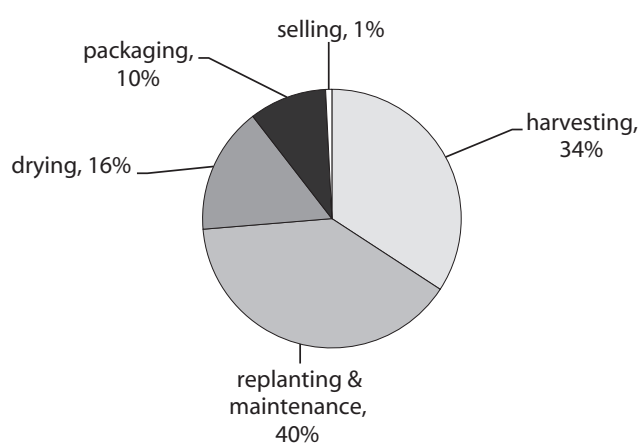
	Activities have been reduced by:				Numbers of fishers concerned	
	100%	75%	50%	25%	Men	Women
Finfishing (% of households)	30	9	39	22	33	5
Bêche-de-mer and/or trochus (% of households)	30	22	26	22	41	5



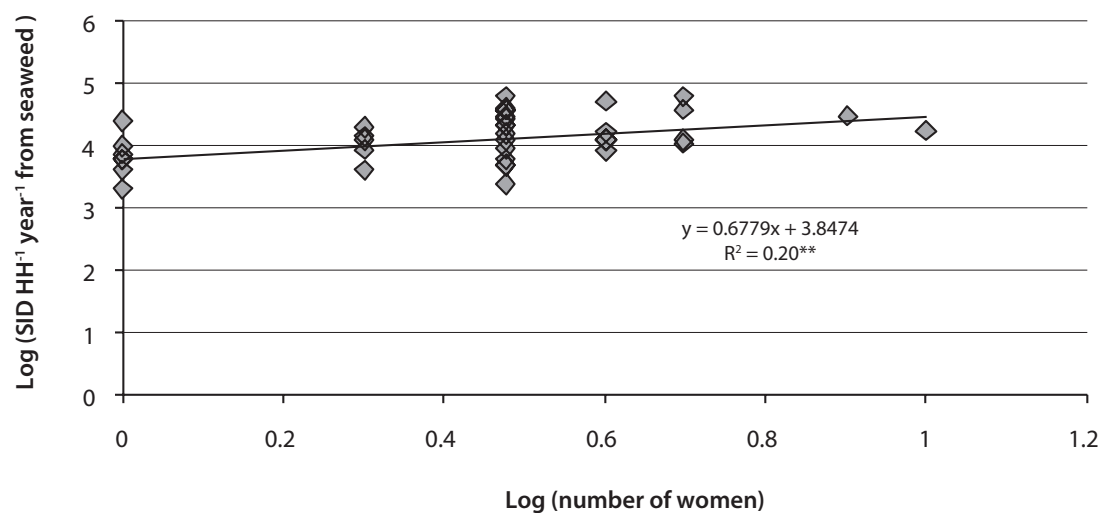
**Figure 2.** Total annual hours spent by gender and activity in seaweed farming



**Figure 3.** Men's annual work (%) input in seaweed farming activities



**Figure 4.** Women's annual work input in seaweed farming activities



**Figure 5.** The relationship between total number of women per household (HH) and total annual income per household (SID/HH) from seaweed farming

## 2.5 Distribution and allocation of cash revenues from seaweed farming

Although comparable amounts of time are spent on selling seaweed, in most cases (45%) women, or both partners (35%) receive the cash rather than men (20%) (Figure 6).

All respondents (100%) agreed that cash revenues from seaweed farming served to cover household expenditure and living costs. However, answers on its use for covering operational and future investment costs for seaweed farming were more reluctant (92.5%), and less frequent. More than three-quarters of all households (77.5%) also use these cash revenues to cover social and church contributions, which is consistent with the general perception that seaweed has improved social services in the community.

## 2.6 Benefits and future potential of seaweed farming for the community as perceived by individual households

In summary, 45.5% of respondents from seaweed farming households were convinced that this aquaculture made a helpful financial contribution to livelihoods, meeting living costs, school fees and other financial obligations. Seaweed farming increased income (27.5% of respondents), to provide a better and regular cash flow than other options (10%), it was considered easy to operate (5%), providing a future for households (17.5%), and was considered an environmentally friendly activity (2.5%).

All respondents emphasised that seaweed farming helped the community to pay for the needs of daily life, increased cooperation, strengthened unity in the community and, indeed, was seen as the future for the community. Only a few respondents (5.2%), however, mentioned the participation of women in particular, in income generating activities.

## 2.7 Problems and solutions

Physical constraints due to bad sea and weather conditions, fish and turtle grazing, epiphytic outbreaks and lack of space for future expansion of existing or new farming sites were considered as limiting factors where little could be done. Areas subject to regular strong currents would always involve a high loss of production, as seaweed would be washed off lines. Severe fish grazing does not allow the establishment of farms in the area, while seasonal fish grazing may be acceptable within limits.

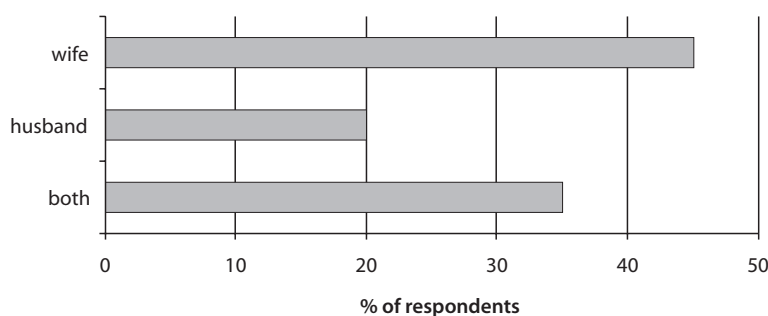


Figure 6. Recipients of cash from seaweed sale

Seaweed farming is an income option for rural coastal communities with little cash flow and capital. Thus the need for motorised boat transport to reach farming sites and to transport harvests to selling points will continue to be a problem. Seaweed farmers need to reach a considerable level of production (> 3 tonnes/month) before the individual purchase and maintenance of motorised boat transport was an option. Community owned transport of this kind, which could be made available on a loan or fee system, or by agents charging for the provision of transport of harvest to selling points may be possible solutions.

Further problems voiced included unfair distribution of farming materials provided free-of-charge by the seaweed project, lack of water tanks on islands where farms are established, increased frequency of sickness among farmers, particularly pneumonia, and the stealing of ropes and seaweed. Other problems observed concerned the cutting down of local mangroves and native trees to obtain the necessary materials for pegs, poles, and drying tables.

The fact that seaweed farming was introduced in Solomon Islands within the framework of technical cooperation projects and governmental aid, furnishing materials, seedlings and training all free of charge to farmers may have contributed to the lack of financial management by farmers. Rural populations have had little need to develop financial management skills in general, however, as livelihoods are basically determined by subsistence production, and a non-monetary exchange system between community members, complemented by more or less occasional activities to earn income when needed. Training and assistance are required to acquaint seaweed farmers with the fact that seaweed farming requires a certain cash flow to cover material and operating costs, to provide for times when production is unfavourable, and to meet annual household and farming needs in relation to income earned.

Government plans call to ensure a continuous supply of high quality farming materials even at remote



sites such as Wagina, include establishing a knowledge and operational base on seaweed production material suppliers globally (MFRM 2009). The improvement of farming material may also address the substitution of local mangrove and native tree resources by imported material, or at least training and advice to improve efficiency in the use of local wood resources. Future plans should also address the safe disposal of old farming materials on isolated production sites.

In addition, a number of observations were made during the survey that need attention, to make future improvements in Wagina and possibly other seaweed farming communities. Family members involved in seaweed farming are often away from their family and community for extended periods, if they decide to have their children benefit from school education. In that case, either children are placed under the care of another family member, and separated from their parents, or the mother stays behind to care for the school children. But caring for school children then competes with the mother's participation in seaweed farming, and may reduce the family revenues. Families may also decide that children can participate in seaweed farming, which means that they leave school at an early stage, and no longer have access to secondary and perhaps tertiary education.

Gardening, a socially not highly regarded activity among Gilbertese, and culturally not an important component of the lives of people in mainly atoll environments, was easily abandoned when cash flow was improved with seaweed farming. The reported perceived benefits of substituting grown garden vegetables and fresh fish, with canned and processed food are highly questionable, financially, however. Prices paid for canned fish and pork meat at the local shops, compared with a local average price for fresh fish (average between farm-gate price paid for commercial finfishers by Kauai Tete family and at the local market on Wagina) are between 6.7 to 7.7 times higher than fresh finfish. By comparison, a pack of local cigarettes cost between SI\$21 and SI\$25, and smoking, as well as the chewing of betel nut, is common among men and women.

### 3. Conclusions

Seaweed farming has proved a viable source of income for households on Wagina Island taking into account that alternative and competing income opportunities are limited. While farm sizes and consequently annual production vary considerably, an average annual production of > 3 tonnes is considered as a production level that may allow the investment in motorised boat transport. Experiences since 2004, when activities of the CoSPSI Project started, have demonstrated that the opening

of a potentially high value fishery (bêche-de-mer) prompts the exit of seaweed farmers, particular those with small annual production capacity. But experiences have also shown that with the decline of bêche-de-mer resources, limited capacity of commercial coastal finfisheries, little if any commercial copra production potential and declining lobster resources, continuity of participation and the proportion of households engaged in seaweed farming have both increased. In fact, recent information confirms that seaweed farmers in Wagina reached their target production of 50 tonnes of dried seaweed for the first time in October 2009 (Solomon Star 2010). Given the current socio-economic conditions on Wagina, and taking into account that local commercial fishery resources have significantly declined if they have not been exhausted, the future potential for continuous and increasing seaweed production on the island is likely (Preston et al. 2009).

Results obtained from the socio-economic analysis suggest that seaweed farming is a non-gender biased activity that involves all members of the household in all production and marketing activities. The study also revealed that women have equal chances to benefit from the cash revenues from dried seaweed sales, as this income is mainly allocated and advocated by the couple heading the household, or by women rather than men. Positive correlation suggests that the more women of the household are involved in seaweed production, the higher the income.

While seaweed farming has also triggered reduction in finfishing and bêche-de-mer fisheries, mostly accounted for by men in the community, it has also helped to reduce women's gardening activities. The reduction of fishing pressure on wild-caught coastal resources is among the desired effects of aquaculture projects. However, it may be argued that a reduced supply of garden produce, and substitution of fresh crops with canned or processed food items may have negative nutritious consequences for seaweed farming households.

The fact that traditionally, women are charged with family and households chores, may explain that on average, women's total annual time input in the household's seaweed farming activities is almost 70% less than that of men. While no gender difference was found in participation in all farming activities, men account for a higher proportion of the physically demanding packing of the dried seaweed crop.

The most obvious social constraints associated with seaweed farming on Wagina arise from the role of parents, in particular mothers and formal schooling of children. The geographical distance between family homes on the island, and production sites

that require seaweed farming household members to spend extended periods away from home, limit women's participation in the farming, or separate children from their parents, or deprive children from schooling as they become engaged in seaweed farming if accompanying their parents to production sites.

Overall, long-term socio-economic stability on Wagina also requires improved financial management for seaweed producing households to ensure continuous production and cash flow, to effectively address environmental problems, in particular use of local mangrove and native timber resources, and the environmentally sound disposal of farming material waste by communities. The sound provision of high quality farming material and guaranteed inter-cargo shipping services at acceptable cost, stability of beach prices for dried seaweed crops, provision of training in improved farming techniques, and export marketing stability, are the required prerequisites on a national scale for successful seaweed production long term.

### Acknowledgments

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# The historical development of seaweed farming, including roles of men and women, and prospects for its future development in Fiji

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## Introduction

Aquaculture is a relatively new development in the South Pacific. Many aquacultural techniques are still at an experimental stage. Though Pacific Island countries have sheltered areas of reefs, lagoons and mangrove swamps for aquaculture development, they lack money and technical knowledge. However, with foreign aid, aquacultural techniques for tilapia, milkfish, grass carp, pearl oysters, fresh water prawns and seaweeds have progressed well.

Seaweeds have been used for centuries as a supplement to human food, feed for livestock, fertiliser and recently as a source of chemicals known as phycocolloids, which include agar, alginate and carrageenan. They also provide habitats for the spawning of many marine organisms (e.g. fish, molluscs, crustaceans).

Over 200 seaweed species occur naturally in Fijian waters (Chapman 1977). Three seaweed species were particularly important in traditional subsistence fisheries; these were recorded by Ohno and Critchley (1993) as *Caulerpa* spp. (Nama), *Gracilaria* spp. (Lumi cevata) and *Codium* spp. (Sagati). However, most of these species are not cultivated in Fiji.

This report presents an overview and assesses the historical developmental of seaweed farming in Fiji since 1976. Particular reference is given to *Kappaphycus alvarezii* (still referred to in the industry as *Eucheuma cottonii* species), as it has dominated the Fiji seaweed industry. Statistics were limited in some areas, especially after 1988; nevertheless, through interviews, surveys and literature review, information on the seaweed industry in Fiji was gathered and assessed. Seaweed farming was initially introduced to Fiji in 1976 from the Philippines, and was re-introduced in 1984. The first commercial production began in 1986. In this report, we provide historical details on areas of where farming took place, numbers of farms, marketing, farming methods, production, exports, prices and assistance provided. We also provide an overview of the current

status of Fiji's *Kappaphycus* industry and the relative roles of men and women in rural seaweed farming.

## History of seaweed farming and marketing

The Fiji government sees seaweed farming as a potential source of income and employment in the rural areas (Ram 1991). It requires a low level of technology and investment and can be undertaken as a family activity. It has little environmental impact and is normally compatible with traditional fishing and other subsistence uses of the inshore marine environment (South 1993).

Seaweed cultivation was introduced in Fiji in 1976 (Ram 1991), when *Kappaphycus* seed stocks were imported from the Philippines (Solly and Booth 1977). The trials were carried out and maintained for more than two years at Telau Island, near Suva (Prakash 1990). These farms failed due to destruction by a cyclone in 1980 (Ram 1991).

*Kappaphycus* was re-introduced in 1984 by the Fiji Fisheries Division with the cooperation of Coast Biologicals (NZ) Ltd., with funding support from the Commonwealth Fund for Technical Cooperation (CFTC). The seed stock of *Kappaphycus alvarezii* was imported from Tonga and the trials were conducted at Tavua, Rakiraki and Verata in Tailevu (Ram 1991; South 1993).

The trials were successful, which encouraged Coast Biologicals to assist in the development of the seaweed farming industry in Fiji in collaboration with the Fisheries Division and the Fiji Development Bank, by providing loans to interested farmers.

The first commercial production began in 1986 at Tavua, Rakiraki, Kaba, Kiuva and Rewa. Considerable expansion took place in 1987, with farms established in new areas like Moturiki, Ovalau, Bua, Batiki, Vanuabalavu, Fulaga and Ogea (Ram 1991; South 1993). Coast Biologicals had planned to establish a semi-refined carrageenan (SRC) processing plant in Fiji once the target production of 600

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tonnes (t) was reached. This did not occur for several reasons.

There were substantial setbacks after 1987. The two military coups in 1987 led to trade bans in New Zealand. Banks refused to give credit to farmers. Cyclone Bola in early 1988 destroyed nearly half the crop and the New Zealand dollar strengthened against the US dollar. All of these factors led to near collapse of the industry and, consequently, Coast Biologicals ceased its Fiji operations in July 1988, as economic viability did not appear possible, removing the market as well as the assistance programmes (Robertson 1989; Ram 1991). Coast Biologicals focused its attention instead on operations in Indonesia (South 1993). However, village level seaweed production continued with the help of Fiji Fisheries Division Extension Officers and with marketing arrangements operated by the National Marketing Authority, which is run by the government.

Later, the efforts of UN Food and Agriculture Organization South Pacific Aquaculture Development Project (FAO SPADP) and the Fisheries Division with financial assistance from the New Zealand government revived the industry. The Fisheries Division established a revolving fund with part of the New Zealand aid money so that it could assist farmers to market their seaweed. The National Marketing Authority and the FMC Cooperation, Marine Colloids Division, assisted in marketing seaweeds until the end of 1989 (Ram 1991; South 1993).

From the beginning of 1990, seaweed marketing was carried out by a joint-venture company with local, Australian and New Zealand shareholders called Seaweed (South Pacific), which also provided technical assistance and free planting materials to farmers. The company undertook several activities in a bid to revive the Fiji seaweed industry (Robertson 1989). It set up a farm at Nanuca, Savusavu and planned two more farms at other locations in Fiji. It also planned to start an SRC processing plant in Lautoka once the supply became steady. Unfortunately, Seaweed (South Pacific) withdrew after only a short time in mid-1990 due to the effects of bad weather conditions on cultivation and losses of crops due to damage by cyclone-induced high tides and heavy swells (Pickering 2005). After the withdrawal, the National Marketing Authority took over the marketing of seaweed again. Then Oceania Trading Company handled the collection and marketing of seaweed from 1991. It closed its operations in 1993 due to severe losses after cyclone Kina (S. Mario pers. comm.). The company also suffered because of high moisture content of seaweed and quality control problems which resulted in several of its consignments being rejected by importers. This caused further cash flow problems and discouraged farmers from pursuing seaweed farming.

Additional trial cultures of seaweed farming were carried out in 1997. A joint project by the Fisheries Division, FAO SPADP Phase2 and the University of the South Pacific was set up in February 1997 for the trial culture of *Meristotheca procumbens* in Rotuma. The project aimed to assess the possibility of culturing this seaweed – including assessing its viability and potential for commercial farming, and to select potential culture sites in Rotuma. However, the project concluded in July 1997 due to sedimentation in the netted baskets, which was a result of the trial site being too close to the shore (Arulampalam 1997). At around the same time, the trial culture of *Caulerpa racemosa* was done on Naviti Island.

In 1998, seaweed farming in Fiji took a new turn. Under the Commodity Development Framework to assist economic development, the government expressed its commitment to re-establishing *Kappaphycus* farming. In early 1998, existing farmers in Kiuva were assisted. *Kappaphycus* farming also commenced in areas close to Suva, Nausori and Lami. Planting materials were available in Cakaudrove, Macuata, Lau and Bua. Initial assistance was provided to farmers to purchase boats, engines, raffia and ropes worth FJD 4,000. These items were later transferred to farmers at no cost once they had sold 20 t of dried *Kappaphycus* to the Fisheries Division at a flat rate of FJD 500/t (FJD 0.50/kg). The Fisheries Department came up with the scheme because it was very difficult for the farmers to arrange for capital to start cultivation. Under the scheme, the Fisheries Division recovered money used for farming in less than three years and was also able to make some profits by exporting the seaweed at a higher price (S. Mario pers. comm.).

The Fisheries Division actively trained farmers by conducting workshops on sites and also provided technical advice. The Fisheries Division also planned an SRC processing plant if the target of 12,000 t per year was reached. This plant would have generated employment for about 1400 people (S. Mario pers. comm.).

### Cultivation methods

The cultivation methods for seaweed have gone through a number of changes: from the raft or floating method to the long line method and the fixed off-bottom or mono-line method (Ram, 1991). When the trials of *Kappaphycus* cultivation were introduced in Fiji in 1976, farmers used the raft or floating method. This produced a faster growth rate because the seaweed was cultivated closer to the water surface (Solly and Booth 1977) but the method was difficult to manage and the seaweed was easily damaged by rough weather and motor driven boats (Prakash 1990).



The most widely used method in Fiji now is the mono-line or fixed off-bottom method (Ram 1991). This method was used in seaweed farming because it is simple to construct, easy to manage, and less costly, and the farms are easily accessible at low tide. Initially, *Kappaphycus* cuttings, each weighing about 200 grams, were tied to mono-filament nylon lines (80 kg test), 10 meters long and fastened to stakes at each end. The technique was later modified to use 3 millimetre polypropylene rope in lengths of about 5 to 7 meters (Prakash 1990), and was eventually further modified to use 10-meter lengths of rope (S. Mario pers. comm.).

### Production and exports

*Kappaphycus* grows very fast, maturing in about 8 to 10 weeks. This allows for about four to five harvests per year. April to November is the best growing season. In October production reaches its peak because of the suitable climatic conditions. After November, production slows. In addition, farmers are advised not to invest much due to the danger of cyclones (S. Mario pers. comm.).

During harvesting, everything is removed from the sea: the stakes, the rope and the seaweed. Pruning is not done. Ten per cent of the harvest is used as seed stock for the next season. One 10-meter mono-line can produce more than 5 kg of dried seaweed in a season (S. Mario pers. comm.). After harvesting, the seaweed is sun dried on racks, usually constructed along the coastal areas, for three to four days until the water content is reduced to no more than 35 per cent (Prakash 1990; Ram 1991).

In 1985, a year after the re-introduction of *Kappaphycus* in Fiji, 30 t of dried *Kappaphycus* were produced by the 35 farms. When commercial production commenced in 1986, the farms increased production to 240 t in 1987, exporting about 200 t of *Kappaphycus*. By mid-1988, about 260 farms had been established but the sudden withdrawal of Coast Biologicals resulted in exports declining to about 60 t of dried seaweed by the National Marketing Authority. The lack of marketing and declining world seaweed prices discouraged farmers, and this resulted in a decline in the number of farms.



**Figure 1.** Lines prepared on shore. The lines are 10 m long and have raffia tied at intervals.



**Figure 2.** Rope with *Kappaphycus* propagules bundled up to be taken to sea.



**Figure 3.** *Kappaphycus* on drying racks.

Only about 80 t of dried seaweed were exported in 1989 and about 87 t in 1990. By 1991, only 33 farms remained and 32 t were exported. In 1992 and 1993, 48 t of *Kappaphycus* were exported each year from 33



farms. All exports of *Kappaphycus* seaweed ceased after 1993.

Though there were no exports after 1993, small-scale production did take place. The Fisheries Division bought dried *Kappaphycus* from farmers and stored it. In 1997, *Kappaphycus* production was about 50 t. A local enterprise, the Makosoi Soap Factory, had an agreement to buy 300 kg of *Kappaphycus* every 3 weeks for the manufacture of soap (S. Mario pers. comm.).

During the first five months of 1998, 2.2 t of dried *Kappaphycus* was bought from the farmers by the Fisheries Division and stored in the bulk store at Lami. By the end of July, 20 t of seaweed were collected and exported to Copenhagen Pectin Company in Denmark (S. Mario pers. comm.).

A resurgence in seaweed farming occurred in 1998 thanks to the Fisheries Division's work to revive the industry. At the end of 1998, there were 37 fully operating farms at Kiuva alone. These farms produced up to 40 t of dried *Kappaphycus* per month (S. Mario pers. comm.). The target for the Fisheries Division was to establish 12 main sites, with each site producing 400 t per year by the year 2000. To help reach this goal, the government provided a subsidy of FJD 176,000 annually until the year 2000 (E. Ledua pers. comm.).

### Seaweed prices

During the trial production of *Kappaphycus* in 1985, Coast Biologicals bought the dried seaweed directly from farmers, paying different prices for different grades, depending on the moisture content.

The price at which dried *Kappaphycus* was exported varied after commercial production began in 1986. In 1986, Coast Biologicals marked up the price of grade-1 seaweed by 42 per cent, buying from farmers at a price of FJD 550 per t. This large mark-up was mainly due to high transportation costs and other setup costs.

In 1987 the mark-up was reduced to 15 per cent, and farmers were again paid FJD 550 per t of dried grade-1 *Kappaphycus*. After withdrawal of Coast Biologicals in mid-1988, the export price fell to FJD 350 per t, but the Fisheries Division bought seaweed from the farmers at a flat rate of FJD 450 per t. At the beginning of 1990, Seaweed (South Pacific) bought dried seaweed from farmers. The farm-gate price in 1991 was FJD 0.40 per kg (FJD 400 t<sup>-1</sup>) and in 1992 it was 35 c per kg (FJD 350 t<sup>-1</sup>).

The Makosoi Soap Factory signed an agreement to buy 300 kg of dried *Kappaphycus* every three weeks at a price of FJD 0.75 per kg for rain-washed sea-

weed and FJD 0.65 per kg for unwashed seaweed. From 1997 to 2002, the Fisheries Division bought seaweed from farmers at a flat rate of FJD 500 per t. The Fisheries Division bought seaweed from as far away as Ono-i-Lau in the Lau Group between 2002 and 2005.

### Seaweed farming assistance

Seaweed farming in Fiji has always been subsidised. A lot of financial assistance comes through aid funds to develop the industry. The seaweed project received aid from New Zealand from its inception until the end of 1992. Initially, farmers received the planting material with the equipment at no cost.

The Fisheries Division, through its technical and extension staff, assisted farmers in negotiating with the marketing companies. The Fisheries Division often provided transportation of dried seaweed from the outer islands. They also facilitated the loans provided by the Fiji Development Bank under which farmers paid an initial deposit of 33 per cent and got 2/3 financed by the bank at an interest rate of 8 per cent (Ram 1991).

In 1988, when the world price of seaweed declined to FJD 350 t<sup>-1</sup>, the Fisheries Division bought seaweed from farmers at a flat rate of FJD 450 t<sup>-1</sup> and then exported it with the help of the National Marketing Authority at FJD 350 t<sup>-1</sup>. This subsidy was provided to farmers so that the fluctuations in the world market prices would not discourage them.

Under the Commodity Development Framework, the Fisheries Division provided FJD 4000 in financial support to individual farmers for purchasing a 15 hp outboard engine, an 18 foot punt, ropes and raffia from the division (Fig. 4). The farmers were provided with free seed stock. Prior to receiving the support, the farmers were required to plant over 400 lines of seaweed and to agree that the punt and the outboard engine would only be used for seaweed farming and not for any other commercial purpose. Farmers who received the support had to have a minimum of 750 lines in place and were required to maintain that level throughout the year. The farmers were also required to strictly follow the drying process and quality control requirements of the Fisheries Division. The agreement also specified that the Fisheries Division or a company approved by it would be responsible for buying seaweed from farmers and that dried seaweed would be purchased at a flat rate. The punts and outboard engines remained the property of the Fisheries Division until the recipients had sold a total of 20 t of dried seaweed to the division.

At the Kiuva farm, the Fisheries Division constructed 20 drying racks measuring 25 m x 8 m. For this



**Figure 4.** Eighteen-foot punts with 15 hp outboard engines provided to farmers.

the farmers provided the posts while the Fisheries Division provided other material as well as labour (S. Mario pers. comm.).

### Role of men and women in seaweed farming

*Kappaphycus* farming requires a low level of technology and is ideal for rural Fiji. Farming is organised as a family activity and run as a family business. Men, women and children are involved in farming seaweed because it is cultivated in inshore areas and these areas are also used for subsistence fishing.

Women play an important role in both farming and processing. Women select planting material before the seaweed is planted. This is an important role because if the planting material is of poor quality then the growth of the seaweed will generally be poor. Women and children also help prepare lines at home. At the farm, the women, children and men attach the seaweed planting material to the prepared lines before they are stretched out under water. On the isolated island of Ono-i-Lau, seaweed farming strengthens family units because all family members take part in seaweed farming from the preparation of materials to planting in the farms. Most of the preparations of farming materials are home-based.

Both men and women harvest seaweed. Plants are either removed from the line or are simply pruned back heavily, leaving some for regrowth. The harvested plants are then air dried on a platform. Women take care of this post-harvest processing. After 3–5 sunny days, the dried seaweed is ready for packing in bags. Women and men do the packing, after which the dried seaweed is ready either for storage or for transportation. In general, women carry out quality control.

### Status and prospects for the future

In 2005, there were four existing sites under cultivation. Two were in the Lau group, on the islands of Ono-i-Lau and Namuka-i-Lau. One was on Kadavu, near Kabariki village and one was on Vanua Levu, near Namuka village. While production is carried out on a commercial basis in these areas, the volumes are very small (less than 20 t). It was projected that production would be around 100 t.

Two companies undertook marketing, paying a farm gate price range of FJD 0.60–0.70 per kg. This price provided

a relatively low income compared to other alternatives available such as fishing. The rise in fuel and transport costs increased the cost of production so much that seaweed farming was no longer lucrative. Dried seaweed was exported to the Philippines by Agro-Marketing Company while a newly established marketing company exported dried seaweed to China.

The government still sees potential in the seaweed industry and assistance programmes remain in place subject to availability of funding. But the future of seaweed farming in Fiji will depend on a number of factors. If markets are available and steady, the production is bound to increase. To achieve this, a stable company is required. This company would need to make an exclusive deal with the buyer to supply the seaweed for a contracted period of time, with a possibility of extension.

The success of this industry will also depend on world market prices, the cost of freight and currency fluctuations. The development of an SRC processing plant would help reduce cost, making the industry more stable. This would substantially alter the economics and feasibility of seaweed cultivation in the longer term (South 1993). The introduction of new uses for carrageenan, such as food, pharmaceutical, medical and industrial products, will boost the seaweed industry. The development of small cottage industry, such as making soap, should be considered in outer islands where transportation are high, as raw materials like virgin coconut oil are readily available in these areas.

The amount of aid given to the industry in terms of finance and technical advice will also affect the industry. More farmers need to be convinced to

go into seaweed farming and provided with the required support to start their own farms. In Fiji, natural disasters and political instability have significantly affected seaweed farming. Preventive measures should be taken to protect the farms from such risks.

## Conclusion

Seaweed farming in Fiji has become very popular because it requires a low level of technology and investment and gets considerable government support. It provides an important source of income to many rural coastal villages and isolated islands.

One of the major problems faced by the farmers is the loss of crops during cyclones. This discourages some farmers and makes it difficult for the Fisheries Division to gain the confidence of prospective farmers. But a major advantage of seaweed farming is that as seaweed takes only a short time to grow, the revival of the industry is quick and easy compared to other aquacultural and agricultural industries. If sufficient manpower is available, farmers can remove their seaweed as soon as cyclone warnings are given.

Another major difficulty faced by farmers is the marketing of seaweed. Even if the seaweed is marketed, there is always a danger that prices will fall due to high freight costs, fluctuations in currency values and the oversupply of seaweed. One way to reduce this risk would be to set up an SRC processing plant in Fiji or somewhere in the Pacific. This would not only increase the yield and improve the quality of seaweed but would also generate employment for thousands of people and would provide another source of foreign exchange for the government.

If the difficulties faced by farmers are addressed, the seaweed industry can be expected to be a viable one. There are extensive potential areas for further cultivation. This will shift the concentration from farms on land to the use of the sea for farming. A major consideration would be to develop larger commercial farms to sustain production. These should take into account customary marine ownership.

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## Women's fishing activities on Aniwa Island, Tafea Province, South Vanuatu

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### Introduction

The Republic of Vanuatu, formerly the Anglo-French condominium of the New Hebrides, consists of 83 main inhabited islands arranged in a 'Y' shape. It is situated between 13 and 21°S and 166 and 171°E in the western Pacific Ocean. Aniwa Island is situated in the southern part of the island group known as Tafea Province, (Fig. 1). Aniwa is a raised volcanic island about 42 meters high with a reef about 500 meters wide.

In 1989, Aniwa Island had a population of 361 people, of whom 179 were female. The majority of the indigenous population are subsistence farmers and fishers. Seafood is a major source of protein for the islanders, and both men and women are active fishers, contributing to the household fish consumption by providing fish and other marine organisms.

We carried out interviews with the women on the island of Aniwa during the months of December to January 1999. In recent years, we have collected follow-up data on their fishing activities to validate the data collected in 1999. Since the island of Aniwa is fringed by reefs, the women's fishing activities are restricted to fringing reefs and to the lagoon areas.

The fishing gear used is all constructed by women. Initially they used local material only, but as technology advances man-made materials (nylon lines and metal hooks) are being incorporated into the construction to improve fishing gear. The targeted species include shellfish and invertebrates on the reef flat and fish species on the reef crest and in the lagoon.

The majority of fish and other marine organisms caught are used for family consumption; however, there are times when the catch is exchanged for other goods or sold.

### Women's fishing activities

Women are the main fishers of the reefs and lagoon areas. Using traditional gear and methods, they

catch fish and other marine organisms to feed their families. Their fishing activities range from collecting shellfish on the reef area to catching fish at the reef crest and in lagoons.

Women's fishing helps bridge the gap in seafood supply when the active male fishers are sick or busy with other activities. The main targeted fish species



**Figure 1.** Map of Vanuatu showing Tafea Province.

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are those in the intertidal reef areas such as *Ourutuki* and *Nanue*. The size of their catch varies according to the natural weather conditions of the area and the length and state of the tides. On the reef they glean a variety of shellfish such as *Riri* and *Karikao*.

The majority of the women interviewed stated that much of their time is spent at home doing household work and weeding in their gardens, leaving very little time for fishing. Strong traditional beliefs relating to sea gods and the division of fishing grounds restrict the women's fishing activities. Women also play a vital role in supporting the fishing activities of men.

### Reef gleaning 'fangota ia fongoma'

The women on Aniwa collect shellfish, clams and trochus mainly for their own family consumption. Reef gleaning, the most common method of fishing, is employed by 90 per cent of the women on the island. At low tide during the day, women visit the intertidal area, where they collect mainly the gastropod molluscs, such as trochus and other edible marine organisms. Older women mentor the younger women and teach them while gleaning. The older women share their traditional knowledge of the reef habitats and their knowledge of the different marine organisms that live in those unique habitats. Since a large number of edible marine species exist in the reef areas, women use different methods to catch them depending on the species abundance and distribution, and the fishing knowledge of the women.

### Collection of shellfish 'faki riri'

The simplest method of fishing used by the woman of Aniwa is the technique employed to collect shellfish such as trochus. When the reef flat area is just about to emerge from the descending tide, the

women cease their gardening and make their way to the reef to collect shellfish. They start the process by weaving fishing baskets from green coconut leaves.

When the reef top is exposed at low tide, they walk out into the reef area very slowly, examining every hole and crevice for the presence of the targeted shellfish species. A species commonly targeted by women on Aniwa is the rough turban snail (*Turbo setosus*). It is sometimes quite difficult to spot them because the outside colour of their hard shell seems to be camouflaged by the surrounding reef substratum. But the older women have no difficulty differentiating them.

Women use their bare hands to pick shellfish attached to the surface of the reef or even in holes. They sometimes use sticks to loosen shellfish and then pick them up with their bare hands and place them in a basket. Women of Ikaukau village, in the southern part of Aniwa, stated that large numbers of shellfish are found at the reef crest. It is very difficult to reach these areas at high tide because large waves break at the reef crest. The period of collection is thus restricted to low tide and also depends on the weather conditions affecting the area. The extreme low tide in the afternoon is especially suitable for collecting shellfish.

### Cephalopod (octopus) fishing 'sara feke'

Fishing for octopus (Cephalopod) is not an easy task and involves only a small number of specialised women. It is a seasonal fishing practice occurring between the months of April and August each year during the period when yams are harvested. Octopus fishing is banned after August when the planting season begins. This enables the women to focus their activities on land to provide food security for their families.

At low tide, the fisher carries her small basket woven from dried banana leaves, a sharpened stick of variable length not more than a meter long and two husked coconuts. She pushes a finger into holes at the reef crest to look for octopuses.

The women involved in octopus fishing cannot tell which holes are occupied by octopuses in the tide pools. If they cannot see the bottom topography well because wave action, they chew coconut flesh and spit it out on the water surface; this improves the clarity of the water. Normally the women do not have goggles.

**Table 1.** Selected shellfish and other marine organisms collected by women on Aniwa Island

English name	Vernacular name	Scientific name
Rough turban snail	<i>Riri</i>	<i>Turbo setosus</i>
Trochus	<i>Karikao</i>	<i>Trochus niloticus</i>
Rugose giant clam	<i>Vasua</i>	<i>Tridacna maxima</i>
Large Pacific jewel-box shell	<i>Visoviso</i>	<i>Chama pacifica</i>
Holder pack lobster	<i>Oura</i>	<i>Panulirus penicillatus</i>
Spotted pebble crab	<i>Noa</i>	<i>Carpilius Maculatus</i>
Butcher land crab	<i>Tupa</i>	<i>Cardisoma carnifex</i>
Octopus	<i>Veke</i>	<i>Octopus</i> sp.



When an octopus is found the sharpened stick is used to immobilise it before it is lifted into the basket. Since octopuses camouflage themselves to blend into the surrounding substrate, they can lie on the surface of the reef unnoticed by the fishers. In a successful fishing trip, a woman can catch up to six octopuses, but this depends on the prevailing weather conditions. Some women believe that it is better to fish for octopus on rainy days because the octopuses are thought to spend more time feeding on reef surfaces instead of hiding in their holes.

### **Tide pool fishing – ‘lama ia fongoma’**

This fishing technique is similar to reef gleaning except that it is done at night using lit dry coconut leaves (*lama*) as lights. The targeted species are spiny lobsters (*Panulirus penicillatus*), fishes and crabs (*Carpilius maculatus*). They are found in shallow reef channels and in tide pools. Lobsters and crabs are collected using bare hands; the women pick them up in special ways to avoid hurting their hands. Fishers use bush knives for many purposes (Paul and Linda, 1994). Women who are skilled in this fishing practice know exactly which months of the year have the best nights to go out fishing; for instance the women of Ikaukau village usually go out to the reef between April and June. The time spent fishing depends on the number of dry coconut leaves taken as a source of light and also the length of the low tide and the local weather conditions.

### **Pole-and-line fishing – ‘teriaki’**

Pole-and-line gear (*koune*) is used by women. A small flexible piece of bamboo about 2.5 meters in length is used as a pole. One end of a nylon string the same length as the pole is fastened to the most flexible end of the pole, and a metal hook is tied to the other end of the string. The string can be longer if needed. The size of the metal hook used depends on the size of the mouth of the target species. If needed, small metal weights or rocks are attached to the line 7 centimeters above the hook.



**Figure 2.** Hand-line fishing.

The women create all of the fishing gear. The most common bait used is the soft part of the abdomen of hermit crabs. These are either found in the bush under leaves and branches of trees, or under rocks on the coast. The best time for fishing is during extreme low tides or high tides early in the morning and late in the afternoon, because most of the target fish species feed at that time.

During the day at very low tide, the women of the different villages can be seen sitting on their respective reefs with their lines in the water at a reef channel and the pole held parallel above the water surface. Each time a fish is caught, the fish is lifted out of the water and transferred into the fishing basket woven from green coconut leaves. The best places to fish are reef channels with a lot of coral growing on the sides and even on the bottom. During pole-and-line fishing women move from one reef channel to the next looking for more fish. At low tide they target reef species such as *ourutuki*, *marari*, *api* and *sumu*.

**Table 2.** Selected fish species caught by the women of Aniwa.

English name	Vernacular name	Scientific name
Topsail drummer	<i>Nanue</i>	<i>Kyphosus cinerascens</i>
Brown cod	<i>Fongomeje</i>	<i>Epinephelus tauvina</i>
Peacock cod	<i>Gnatara maru</i>	<i>Cephalopholis argus</i>
Squirrel fish	<i>Marau</i>	<i>Myripristis berndti</i>
Green trigger fish	<i>Pakau sumu</i>	<i>Pseudobalistes flavimarginatus</i>

Not all the women are very skilled in this fishing practice. Only a few who have more knowledge on how to select fishing sites and know better times to go out fishing can catch a lot of fish. The average weight of fish caught by the women using this method of fishing is about 2.5 to 3.0 kg and this fish is used mainly for family consumption. During high tide,

the activity is the same except that the women sit high up on the rocks close to the high tide mark. Again they move from site to site to try to catch as much as possible. The targeted species are mainly *mutu*, *nanue*, and *api*, with other minor species also caught, such as goatfish (*aso*).

Pole-and-line fishing by women is also very common at night time. They go out onto the reef at low tide on moonlit nights accompanied by members of their families and friends. They fish on the same reef channels but they mainly target squirrelfish species (*marau*). Other species such as *feita* and *papatongo* are also caught. About 90 per cent of the fishers of Ikaukau village said that they prefer fishing at night when the moon is full because the water is well lit and hence there is a high potential for a good catch. The time spent fishing depends on the hours of low tide and also on the local weather conditions. This is also a seasonal fishing method, banned from the month of April to August.

#### **Butcher land crab (*Cardisoma carnifex*) collection – ‘sara tupa’**

This type of fishing is done by young girls and some women and involves walking through muddy mangrove swamps and dense bushes. It can be done either at night or during the day. During the day, it is done early in the morning.

The women go in groups of three or four to the only mangrove forest on the island, which is on the coast of the Icharo lagoon in the northern part of the island. They walk through the mangrove swamps very slowly, looking between the mangrove roots, under dead leaves and in the muddy substrate for the mud crabs. The crabs leave tracks on the soft substrate, so the fishers can follow the tracks. Once a crab is found it is caught with bare hands and placed into a bucket. If the women do not find enough crabs in the mangrove swamps, they use their bush knives to dig up the crabs from their burrow in the sandy substrate close to the mangrove forest.

The majority of women are very skilful in this technique; during a day each can fill up a basket woven from green coconut leaves, which may hold 40 to 50 crabs. All the mature male and female crabs are taken except the smaller ones and the egg carrying females.

At night the same activity is done but it requires a bit more preparation. In the afternoon when the sun is about to set, a group of women go into the plantation close to the mangrove swamp area and split open dry coconut fruit, leaving them out in certain places around the coconut plantation.

At about 9:00 p.m., they go back with their baskets and collect crabs that have come out to feed on the coconut flesh. Coconut crabs are also caught. Crabbing at night usually brings bigger catches than crabbing during daytime. The crabs collected are used for family consumption and are sent to relatives and friends on other islands such as Tanna.

#### **Gill net fishing – ‘fangota ia koupienga’**

Because of the high cost of gill nets, this technique is less commonly used by women. Only 4 per cent of the women own gill nets or any kind of fishing gear. The women usually set their nets in the Icharo lagoon and trap fish such as mullets and goatfish. This may be done during high or low tide either during the day or at night. But it seems to be more common at night as most fish feed at night and more can be caught while they are feeding.



**Figure 3.** Gillnets in a traditional canoe.

#### **Traditional fishing rights**

On the island of Aniwa, the reef areas are owned by landowners whose land boundaries include reef areas, which are the extension of their land seaward into the lagoon and beyond the reef crest. Therefore all fishing rights are under the ownership of the landowners. Members of each family are allowed to fish only in their own reef areas. Women who wish to go fishing in someone else's fishing area must seek permission to go fishing alone or must be accompanied by a female member of the reef owner's family. Anyone who does not seek permission is considered to be fishing illegally in another family's fishing area and is liable to pay a customary fine.

There are also areas that come under the communal ownership of all Aniwa Islanders, for example the Icharo lagoon, where men and women are allowed to fish in the communal fishing ground provided they do not use destructive fishing methods.

The seasonal fishing activities of women must be within the periods agreed to by the chiefs and the leaders of the different clans in the village. Anyone caught fishing outside the allowable period is given a heavy customary fine. The women closely follow these customary laws. They have no opportunity to speak out against these rules set by the male village leaders.

Destructive fishing methods, such as the use of poison fruits and leaves to kill fish and other marine organisms, are not allowed.

### **Utilisation of catch**

The women's catch is mainly for the consumption of their own families and not to be sold. Sometimes the women feed their own family with their catch and share the surplus with the neighbouring families. Occasionally women sell their catch to pay for children's school fees and other family obligations. When fish is sold, it is often cooked and sold within the village. Visitors from other villages may also buy the fish.

Mud crabs they are often sent to relatives and friends on Tanna, where it is considered a delicacy.

Bartering is a common practice in Ikaikau village. The women exchange their catch with other families for goods such as local materials for their houses and in exchange for help with chores. This exchange also strengthens blood ties and personal relationships.

During times of food shortage, women play a very important role in exchanging their catch for agricultural products (taro and cassava) from Tanna. The land crab (*Cardisoma carnifex*) is commonly exchanged for root crops from Tanna as they can survive well during long periods of drought.

### **Role of women in supporting men's fisheries activities**

On Aniwa, the males are the most active traditional fishers but they depend on the women's help. Women play an active role in searching for bait to support men's fishing activities. They also collect rocks to sink lines for bottom fishing. Women pack lunches for men to take during their fishing trips and they also clean their men's catches when they return.

### **Bait search**

The main baits used in bottom line fishing by men are octopus and hermit crab. Since the women are experts on the reef flat intertidal area, they are responsible for catching octopus for bait. A good

catch requires about four to five octopuses, and if the women fail to catch enough octopuses, the men will not have a good catch. The women also collect hermit crabs for bait. This was not traditionally the women's task but has been taken up by women in recent years.

### **Rock collection**

Before the introduction of metal weights to sink lines to the bottom of the ocean, pieces of rock were used. For example, before a husband went fishing, the wife and daughter would go to the beach to collect pieces of rock and leave them in the wooden canoes. The size of the rocks corresponded to the size of the line used; for example a larger fishing line needs a bigger rock to sink it to the bottom. Dried pandanus leaves were also collected by the women for attaching the rocks to the lines. Recently, the use of metal weights has replaced rocks.

### **Fish cleaning**

As the men are tired when they return after fishing for several hours, the women are responsible for the cleaning the fish. If the catch is to be sold, they have to make sure that the intestine, gills and other internal organs are entirely removed. If the catch is for family consumption, they have to remove the scales. For species such as the green triggerfish, in which the scales are modified into a hard skin cover, the women are responsible for removing it before taking the fish home. The majority of women are very skilful in fish cleaning.

### **Pack lunch preparation**

When fishermen go fishing for a whole day, they usually take a lunch packed by the women. The women wake up early to prepare their husbands a lunch consisting of roasted taro, banana, or cassava. If there is any left over fish from the evening meal then it is also usually included. This lunch is wrapped in *bura*o leaf (*Hibiscus tiliaceus*) and is put into the fisherman's basket woven with dry pandanus leaves.

### **Discussion**

Women's fishing plays an important role in sustaining families on the island of Aniwa. Traditional knowledge is passed from one generation to the next. Information on the best time of day to go fishing, how to use the different phases of the moon to determine different fishing activities and where to go fishing on the reef flat are all forms of traditional knowledge required for women's fishing trips. This traditional knowledge may be described by Western scientists as 'empirical' or 'anecdotal' evidence, but it is vital to women's sustainable fishing on Aniwa.



Women's catches tend to be very small, averaging 2.5 kg. They target different species of fish at low tide. If the conditions are not good they will have a small catch. This is different from gill net fishing, which tends to result in consistently larger catches.

### ***Factors affecting the fishing activities of women***

Several factors affect the fishing activity of women on the island of Aniwa. According to the community's traditions, women are responsible for looking after their homes and nurturing children. This includes preparing meals for their families and weeding the gardens. Men's role is to go fishing, clear bush for new gardens and plant crops. This is one of the major factors that reduces the chances of women to go out fishing to supplement their family's protein and for recreation. Therefore, if the workloads at home are distributed evenly and the pressure on women is reduced, the result may be an improvement of their fishing activities because they have more time for fishing.

Another factor affecting the fishing activities of women on Aniwa Island is strong traditional beliefs. For example according to one belief, when a woman who spends a lot of time fishing becomes pregnant, her baby will be killed by the sea gods and will be born dead. Similar beliefs exist on other islands in Vanuatu. For instance on the island of Maewo in the north of Vanuatu, it is believed that when a mother goes out fishing often, her baby will have a lot of sores after it is born. These traditional beliefs about women being punished by sea gods are likely to affect their fishing activities.



**Figure 4.** Old man in his traditional canoe going out fishing.

Since the island of Aniwa is very small, its fishing grounds on the reef and lagoon areas are very small. The island has only one lagoon and the reef areas are subdivided among the different owners, leaving very little reef area under common ownership on the island. Therefore the women cannot expand their fishing activities because their small fishing grounds support only a minimum number of fishing habitats. In addition, women have no access to the large fishing grounds beyond the reef due to a lack of motorised boats. Therefore, the women's fishing activities are restricted to lagoon and intertidal reef areas and they cannot expand further offshore.

Despite these limitations, the women's fishing activities also help support the fishing activities of the men. For example the knowledge they have on how to find octopus on the reef helps the men by providing bait for fishing. In addition women support men's fishing by preparing all the things that the men need for their fishing trip. For example women collect rocks to sink the lines and also fish for bait-fish.

### **Conclusion**

Women's traditional fishing activities on the island of Aniwa play an important role in maintaining the supply of animal protein for their families. Women's knowledge and fishing activities have been passed from one generation to the next and are still relevant in managing and sustaining fishing on the island of Aniwa.



**Figure 5.** New technologies threaten to upset the balance in sustaining small island fisheries.

## Some sources of help in how to gather gender disaggregated data

Meryl J. Williams

Last year was the 30<sup>th</sup> anniversary of the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW). In the 30 years since this convention and other international agreements on development were signed, development approaches have grappled with how to raise the status of women, children and people with little power. Action – and results – have been slow, however, and have varied from activism, national policy prescriptions, research and capacity building to apathy. In their iconic 1995 paper, Ravazi and Miller analysed the conceptual shift then underway from ‘women in’ to the broader ‘gender and’ approaches in economic and social development, perceiving that ‘what the two approaches share is a gender-disaggregated analysis of roles and access/control over resources’. Indeed, whether you are interested in women and gender from a strong feminist, social justice or pragmatic economic perspective, you will need gender-disaggregated data and information to get anywhere.

This conclusion on the need for gender-disaggregated data applies just as much to fisheries and aquaculture as to any other sector, but gender-disaggregated data are nearly non-existent. Many national statistics barely identify fishing sector participation, let alone gender participation. Occupational studies at household, locality, ethnic group or other social level rarely delve into gender roles.

Indeed, when preparing this article, I emailed Joni Seager, Professor of Global Studies at Bentley University in the United States, to request a copy of a paper she wrote on the topic of gender disaggregated statistics. When she found out why I sought her paper, she remarked: ‘the whole question of sex-disaggregated data is vexing, in just about every field. ... I ... have written an international atlas on the status of women (Seager 2009) and in the most recent edition tried to include something on women in fisheries – and found ... slim pickings’.

So when we stress that fisheries and aquaculture research and development professionals should be collecting (and analysing) gender disaggregated data, this raises the question of how to do it. In other economic sectors, recent expert meetings have addressed this question and gone on to develop guidance on gathering and using the data.

Most started with how to ensure the basic national, industry and occupational statistics address gender and then ventured into how to gather gender data in research, diagnostic surveys, development projects, advocacy campaigns and evaluation and impact assessment.

Water, sanitation and energy are among the more advanced sectors in developing guidance manuals. Agriculture and natural resource management are improving but still have some way to go. While we await and agitate for a revolution in collecting gender disaggregated data in fisheries and aquaculture, here are some sources that might be useful and that can be adapted for fisheries and aquaculture work.

Agriculture, rural development (including fisheries and aquaculture)

- *Gender in agriculture sourcebook*, FAO, IFAD and World Bank, 2008. <http://worldbank.org/genderinag>. The sourcebook contains various types of advice, especially on impact assessments in Module 16 on Gender Issues in Monitoring and Evaluation.
- *Types of gender analysis in natural resource management and plant breeding*, Nina Lilja and Jacqueline A. Ashby, 1999. Consultative Group on International Agricultural Research, Participatory Research and Gender Analysis, Working Document No. 8. <http://www.prgaprogram.org/>. This document contains a useful checklist for ‘assessing the types of gender analysis in each stage of innovation based on who participates’.
- *Gender-disaggregated data for agriculture and rural development guide for facilitators*, FAO 2003. <http://www.fao.org/SD/seaga/downloads/En/GDDEn.pdf>. This guide is targeted at field staff and seeks to help make their work, including in the collection of data, more gender sensitive.
- *Filling the data gap: Gender-sensitive statistics for agricultural development*, FAO 1999. <http://www.fao.org/docrep/X2785E/X2785e00.htm>. This ‘early’ guide is mainly concerned with national level participation statistics and is intended to sensitise policy-makers to the importance and value of having gender disaggregated data.



### Water and sanitation

- *Expert Group Meeting Report on Gender-Disaggregated Data on Water and Sanitation, United Nations Headquarters, New York 2-3 December 2008*, United Nations Department of Economic and Social Affairs and UN-Water Decade Programme on Capacity Development, 2009. [http://esa.un.org/iys/docs/EGM\\_Report.pdf](http://esa.un.org/iys/docs/EGM_Report.pdf). This very useful report contains much that can be applied, albeit with some adaptation, to fisheries and aquaculture. Especially see Chapter 5 'Data collection needs: gender-disaggregated indicators currently unrepresented or under-represented' and Chapter 6 'Summary Indicator Table'.

### Household energy sector

- *Field tools for collection of gender-disaggregated data*, 2009. <http://www.hedon.info/docs/E-MINDSET-Field-Tools-Collection-Gender-Disaggregated-Data.pdf>. This 10-page guide, put out by Hedon, a network in the household energy sector, gives guidance on collecting gender-disaggregated data with a number of social science field tools, many of them from participatory appraisal approaches.

If any reader is aware of good materials on collecting gender disaggregated data in the fisheries and aquaculture sector, please share it with us!

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## People's perception on the establishment of marine reserves: The case of Chamorro villagers in southern Guam

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### Introduction

After the implementation of community-based marine protection areas in the south of Guam, this survey was undertaken to assess people's perceptions on the success of the development and implementation of the project, the challenges faced and the variables involved

Coral reefs play an important role in the lives of Chamorro villagers in the south of Guam. They have strong fishing traditions and heavy use of coral reef resources. Traditionally, the local Chamorro diet included coral reef fishery resources such as fin-fish, invertebrates and sea turtles (Amesbury and Hunter-Anderson 2003).

Because of the decline in the health of Guam's reefs over the past 40 years (Porter et al. 2005),

government of Guam agencies have worked hard to protect and manage Guam's coral reef resources. One of the steps taken to restore Guam's coral reefs was the establishment of several marine reserves. Over 10 per cent of Guam's coastline was incorporated into five marine reserves. They are Tumon Bay, Piti Bomb Holes, Sasa Bay, Achang Reef Flat and Pati Point. Achang Reef Flat Marine Reserve is located in southern Guam.

Interviews were conducted to gauge the attitudes and perceptions of Chamorros living in the south of Guam regarding the establishment of the Achang marine reserve. The surveys were carried out in the villages of Umatac, Merizo and Inarajan, home to the users of the areas surrounding the Achang Reef Flat Marine Reserve area. The survey solicited information on the cultural and ethnic background, gender, education and income of the interviewees.

Demographics together with other variables were used to measure people's perceptions of the marine reserves. The survey was supplemented with key informant interviews and focus group discussions.

From August to September 2005, interviews were conducted with 30 residents of the three villages. The sample population mainly consisted of ethnic Chamorros. Within each neighborhood, streets were randomly selected for surveying and on each selected street, houses were randomly selected. Interviews usually lasted more than 40 minutes and were conducted in both the Chamorro and the English languages.

The survey questions had three main parts. Part 1 addressed demography, household composition and other

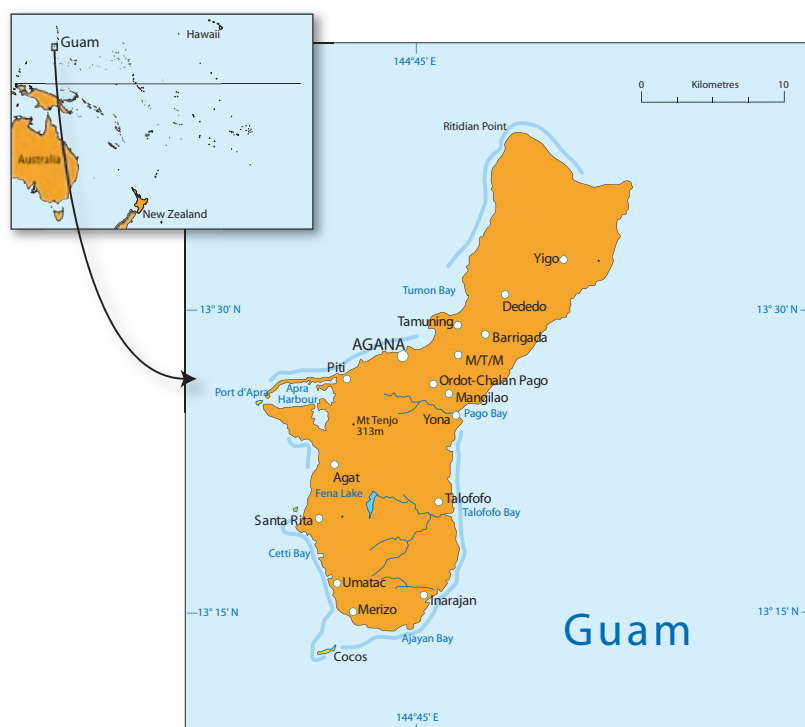


Figure 1. Guam

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general issues such as environmental awareness and the importance of fishing. Part 2 of the survey focused on marine preserve laws, marine environmental stewardships, attitudes and perceptions on Achang Reef Flat Marine Reserve, sense of attachment to the marine preserve and attitudes on the creation of community based conservation areas. Part 3 consisted of closing questions regarding demographics and the education level of respondents.

### Respondents' profiles

All (100%) of the respondents were originally from Guam and were native Chamorros. Thirty (30) respondents were chosen from Umatac, Merizo and Inarajan villages. The majority of the respondents had completed high school and some had finished university studies (Table 1).

**Table 1.** Level of education in southern Guam villages

Level of education	Share in total (%)
Elementary school	0.0
Some high school	10.0
High school	63.3
Some college or university	16.7
Finished college (bachelor's degree)	10.0
Advanced degree	0.0
Don't know/refused	0.0

When asked about their annual gross household income, 10 per cent of the respondents preferred not to reveal this information to the interviewers. The distribution of the remaining 90 per cent of the sample is shown in Table 2. Most of these incomes were from paid employment. A smaller proportion of the income (16.7%) was from agriculture and fisheries.

**Table 2.** Gross household income (USD per year) in southern Guam villages

Income group	Share in total (%)
USD 5,000 or less	16.7
USD 5,000 to 10,000	10.0
USD 10,000 to 20,000	23.3
USD 20,000 to 35,000	6.6
USD 35,000 to 50,000	16.7
USD 50,000 to 75,000	10.0
Over USD 75,000	6.6
No answer	10.0

### Fishing and motivation of fishers

Fishing is traditionally and culturally important to the Chamorro people. A wide range of fishing techniques were used, with the most common being the hand-line method. Spear fishing, gillnetting and trolling were also often used. Fishing was conducted both day and night. Most respondents were skilled fishers and in the process of fishing passed on traditional fishing knowledge and skills to the younger generation.

There were various reasons why people fished (Table 3). They included fishing for leisure while passing knowledge to the younger generation (100%) and fishing as a pastime (93%). There were variations in people's perceptions about catches, with 86 per cent showing preference for catching certain fish sizes and another 86 per cent showing preference for certain fishing seasons.

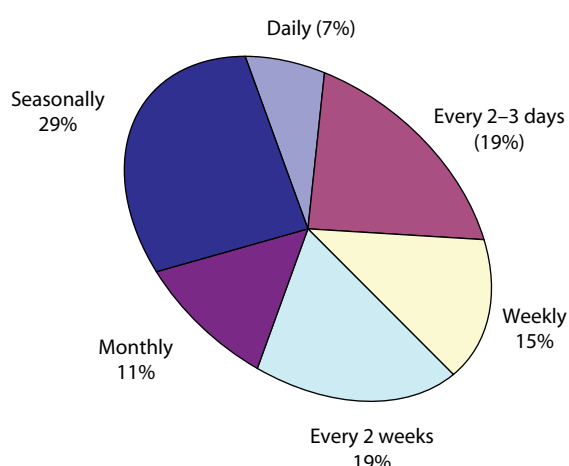
**Table 3.** Motivations and fishing preferences

Motivations	Agree (%)	Disagree (%)
More fish I catch, the happier I am	92.9	7.1
Fishing trip can be successful if no fish are caught	68.9	31.0
Would rather catch one or two big fish than five smaller fish	85.7	14.3
Would rather fish during <i>atulai</i> , <i>tiao</i> or <i>manahak</i> seasons	85.7	14.3
Fish to pass traditional fishing knowledge and skills	100.0	0.0

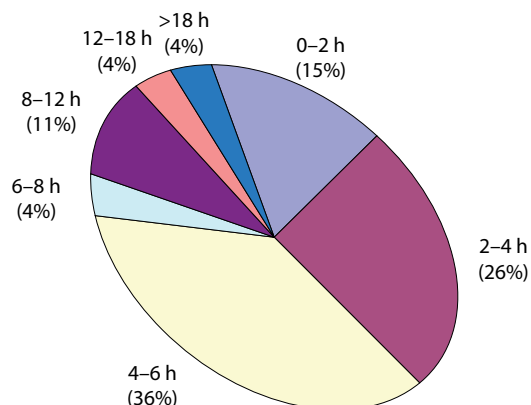
### Frequency and duration of fishing trips and boat ownership

On average, fishers go fishing a few days a week. Some fishers fished every day, while some fished two to three days a week. Some only fished once a fortnight or once a month, while some fished only during certain seasons (Fig. 2). These mostly included fishers from Umatac. More than 50 per cent of respondents fished for between two and six hours (Fig. 3). Fishing duration mainly depended on target species, the tides and fishing seasons.

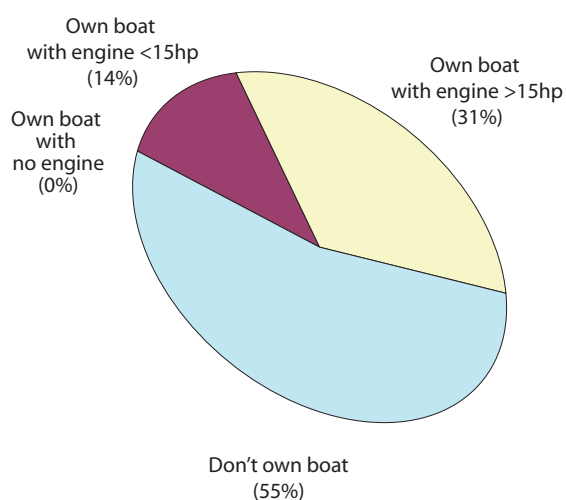
Half (50%) of respondents did not own boats but used boats that belonged to other people. Another 44 per cent of respondents owned boats but these were mainly boats with 15 hp engines (Fig. 4).



**Figure 2.** Respondents' frequency of fishing trips



**Figure 3.** Respondents' duration of fishing trips



**Figure 4.** Respondents' boat ownership

## Marine environment

### *Sources of information on causes of environmental changes*

Nearly all (90%) respondents were well informed on the changes in Guam's marine environment through personal observation (fishing, swimming, snorkeling and diving) (Table 4). Some (6.6%) also obtained information on the environment from friends and family, while a small proportion (3.4%) from Inarajan stated that they got information on environmental change from the government through environmental awareness workshops.

**Table 4.** Sources of information on causes of environmental change in Guam's marine environment –southern Guam villagers

Sources of information	Importance (%)
Personal observation (swimming, fishing, snorkeling, diving)	90.0
Information from friends and family	6.6
Media (television, newspaper, radio)	0.0
Government	3.4

Note: The score represents the average importance that respondents assigned to each source of information to inform them on the causes of environmental change in the marine ecosystems of Guam.

### *Perceptions on changes in the quality of Guam's marine environment*

Respondents expressed strong views about environmental impacts on the marine environment. Most of the respondents confirmed some decline or change in the environment, fish abundance, status and diversity. About 53 per cent of the respondents felt that sedimentation and sewer leaks/surface runoff had worsened in recent years. Only 21.4 per cent of respondents had witnessed improvements in sedimentation and only 16.7 per cent had seen improvements in sewer leaks. Between 10 and 18 per cent of the respondents did not observe any change.

About 45 per cent of respondents noted positive changes in fish sizes. This could be one of the best indicators of the success of marine conservation attempts in the sites studied. Fish sizes, fish abundance and fish species diversity were used to measure the success of marine conservation initiatives. About 37 per cent of respondents noted worse live coral abundance, with 41 per cent noting declining fish abundance. A further 53 per cent of respondents highlighted environmental problems such

**Table 5.** Perception of changes in Guam's marine environment in southern Guam villages.

Environmental problem	Improved (%)	No change (%)	Worsened (%)	Don't know (%)
Live coral abundance	26.7	6.6	36.7	30.0
Fish abundance	36.7	16.7	40.0	6.6
Fish size	45.2	19.4	35.4	0.0
Fish species diversity	32.3	32.3	25.8	9.7
Harmful algal growth	9.7	32.3	29.0	29.0
Sedimentation	21.4	17.9	53.6	7.1
Sewer leaks/surface runoff	16.7	10.0	53.3	20.0

as sedimentation, sewer leaks, or surface run off. It was noted that Umatac villagers were the most knowledgeable on the causes of the environmental changes, and this could be attributed to the increase in marine awareness programmes in that village.

#### **Perceptions on causes of environmental changes in Guam**

When asked about the most five common perceived causes of environmental change, the respondents stated that the reasons were poor development practices (19.7%), improper fishing techniques (18.4%), creation of marine conservation areas (17.1%), sedimentation due to intentionally lit fires (13.2%) and too many fishermen (10.5%). Overall, the respondents listed improved infrastructure (6.6%), improved fishing technology and techniques (6.6%), too many jet skis and motorised craft (6.6%) and too many divers and snorkelers (1.3%) as lesser important causes of environmental change. All respondents (100%) were aware of and had their own perceptions on the causes of environmental change. The details of perceived causes of environmental change from respondents are presented in Table 6.

There are possible management guidelines that could help improve Guam's marine environment. Education and awareness in schools and in the villages are considered priorities and are vital components of sound management of both the terrestrial and the marine environment. Improvement of the sewage system is an important measure to be taken to improve water quality. Changes in law enforcement should include stricter rules for development, enforcement of existing laws and increased penalties for violators. Other factors to be considered by managers are banning the intentional setting of fires that cause sedimentation, prohibiting jet skis in areas where they can damage the reefs, reducing pesticide/fertiliser use at golf courses and hotels, prohibiting the use of gillnets, opening marine

protected areas during certain periods of the year, limiting recreation activities in popular marine sites (i.e. diving, snorkeling), prohibiting spear fishing at night and introducing a user fee for foreign scuba divers and snorkelers.

**Table 6.** Perception of causes of environmental change in Guam's marine environment – southern Guam villagers

Perceived cause of environmental degradation	Importance (%)
Sedimentation due to intentionally lit fires	13.2
Poor development practices	19.7
Improved infrastructure	6.6
Improved fishing technology and techniques	6.6
Improper fishing techniques	18.4
Too many fishermen	10.5
Too many jet skis and motorised craft	6.6
Too many divers and snorkelers	1.3
Creation of marine conservation areas	17.1
Do not know	0.0

Note: The score represents the average importance that residents assigned to each of the proposed causes of environmental change in the marine ecosystems of Guam.

#### **Marine reserves**

##### **Awareness of Guam's marine reserve laws**

Levels of awareness of Guam's marine reserve laws are presented in Table 7. In general, 84 per cent of respondents stated that they understood Guam's marine reserve laws. High levels of understanding



were expressed by respondents from Umatac (89%) and Inarajan (100%). Only 64 per cent of Merizo's respondents stated that they understood Guam's marine reserve laws.

Most (68%) stated they understood why Achang marine reserve was created. Respondents from Merizo expressed the highest level of dissatisfaction with the creation of the reserve area. A large majority of Umatac and Inarajan respondents (78% and 89% respectively) said that they understood why Achang marine reserve was created. They also had lower levels of dissatisfaction.

A higher level (80%) of satisfaction was shown with the allowance of seasonal fishing in reserves. All (100%) of respondents from Inarajan and 89 per cent of respondents from Umatac were satisfied with the allowance of seasonal fishing in reserves. Half (50%) of Merizo respondents were satisfied with the allowance of seasonal fishing in marine reserves.

In contrast, a lower level (57%) of satisfaction was recorded regarding the no take regulations of marine reserves. The highest level of dissatisfaction (63%) was expressed by respondents from Merizo. On the other hand, 78% of Umatac and 60% of Inarajan respondents were satisfied with the no take regulations.

**Table 7.** Awareness of Guam's marine reserve laws in southern Guam

Perceived level of awareness	Agree (%)	Disagree (%)
Understand Guam's marine reserve laws	84.3	15.7
Understand why Achang marine reserve was created	68.0	32.0
Am satisfied with no take regulations of marine reserves	56.7	43.3
Am satisfied with the allowance of seasonal fishing in reserves	79.7	20.3

### **Attitudes and perceptions on Achang Reef Flat reserve**

The attitudes and perceptions on Achang Reef Flat reserve varied (Table 8). In general, 80 per cent of respondents strongly support the establishment of Achang marine reserve. About 83 per cent believe that the reserve will improve the quality of fish stocks in the area. About 67 per cent believe that the reserve will negatively impact the Chamorro culture and tradition. Half (50%) agreed that they would discontinue recreational fishing if doing so would increase fish stock.

**Table 8.** Attitudes and perceptions on Achang Reef Flat reserve in southern Guam

Attitudes and perceptions	Agree (%)	Disagree (%)
Strongly support establishment of Achang marine reserve	80.0	20.0
Achang marine reserve will improve quality of fish stocks	83.3	16.7
Achang marine reserve will negatively impact our culture and tradition	66.7	33.3
Will discontinue recreational fishing if it would increase fish stock	50.0	50.0

### **Sense of attachment to Achang Reef Flat Marine Reserve**

Overall, there were high levels of support and a sense of attachment to Achang Reef Flat reserve by the residents (Table 9). A large majority (89%) of the respondents disagreed that they should have the freedom to do whatever they want in the preserve. Majorities in southern Guam overall (63.6 per cent), Umatac (78%) and Merizo (63%) disagreed that there should be no restrictions in the reserve. Half (50%) of Inarajan respondents stated they would like no restrictions on the preserve. Most respondents (60%) from Inarajan also disagreed that people need to have the freedom to do whatever they want in the preserve.

**Table 9.** Sense of attachment in southern Guam

Sense of attachment	Agree (%)	Disagree (%)
Freedom to do whatever they want in the Achang Reef Flat Marine Reserve	20.7	79.3
No restriction on Achang marine reserve	36.4	63.6
No commitment to the Achang marine reserve	53.7	46.3
Achang Reef Flat means a lot to me	86.7	13.3
Am very attached to the area of the Achang Reef Flat	93.3	6.7

### **Stewardship and community based marine conservation**

#### **Level of stewardship**

The perceived level of stewardship for Guam's coral reefs by the southern Guam respondents was high, with most agreeing that the government should do more to protect the islands' reefs. Nearly all respondents (94%) supported the idea of personally participating in implementation, awareness and

enforcement of community-based marine conservation areas on Guam. Overall, 81 per cent of respondents were satisfied with their personal level of stewardship and contribution to Guam's coral reef.

**Table 10.** Levels of stewardship in southern Guam

Perceived level of stewardship	Agree (%)	Disagree (%)
Guam's reef should be protected	99.7	0.3
Government should do more to protect reefs	99.7	0.3
Would participate in implementation, awareness and enforcement	94.0	6.0
Personal stewardship contributes to Guam's protection	81.0	19.0

### ***Creating a community-based marine conservation area***

All respondents agreed to support the control of water pollution, diving, collection and fishing bans and also agreed that more attention should be paid to habitat restoration (Table 11). Respondents all agreed that they would like to know more about fisheries management tools and agreed to participate in implementation, awareness and enforcement of community based marine conservation areas.

There was also a high level of support for using community based marine conservation areas as a fisheries management tool, and most supported restrictions and prohibitions on certain species (89%). There was a relatively high level of support (78%) by respondents for regulating or restricting types of fishing gear. In contrast, there was less support for discontinuing recreational fishing to increase fish stocks (67%). There was also less support for discontinuing subsistence fishing to increase fish stocks (56%).

**Table 11.** Creating a community-based marine conservation area in the village

Perception of creating a community-based marine conservation area	Agree (%)	Disagree (%)
Conservation as a fisheries management tool	88.9	11.1
Support regulating or restricting types of fishing gear	77.8	22.2
Support restriction/prohibition of certain species	88.9	11.1
Support control water pollution, diving, collection & fishing bans	100.0	0.0
More attention on habitat restoration	100.0	0.0
Support discontinuation of recreational fishing to increase fish stocks	66.7	33.3
Support discontinuation of subsistence fishing to increase fish stocks	55.6	44.4
Would like to know more about other fisheries management tools	100.0	0.0
Would participate in implementation, awareness & enforcement	100.0	0.0

## **Conclusion**

In summary, there was strong support for the establishment of community-based conservation areas, restrictions on harvest of certain species and restrictions on certain gear as opposed to discontinuing recreational fishing or subsistence fishing. This was coupled with a high level of marine awareness and the indication of an interest by respondents to know more about fisheries management tools. The Chamorro communities of southern Guam strongly support the implementation of community-based management initiatives. There was also strong awareness of the environmental factors that affect fisheries resources. Thus in further work on management in southern Guam, practitioners could adopt an approach which includes environmental issues.

## **Acknowledgements**

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## Climate trouble

### *A meeting in the Philippines discussed the challenge of climate change and what women can do to deal with it*

Soledad Natalia M. Dalisay

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**Source:** *Yemaya*, ICSF'S Newsletter on gender and fisheries No. 34, June 2010

How has climate change affected the livelihoods of fishing communities? How have women coped with the challenge? Have government initiatives helped? What can be done to counter the adverse effects of climate change?

A group of 35 women met earlier this year in the Philippines to discuss these important questions. The occasion was the National Workshop on Women in Fisheries and Climate Change, held from 9 to 11 March 2010 in Villa Alzhun Resort in Tagbilaran City, Bohol. It was a diverse group, representing the academic community, non-governmental organisations (NGOs), as well as the local administration. Grassroots women leaders, mainly fishers, representing people's movements from the three major regions of the country – Luzon, Visayas and Mindanao – also took part. The group included six participants from Thailand.

During the workshop, experiences were shared and presentations were made by invited resource persons. The presentations made it clear that climate change might trigger sea-level rise; increase in intensity and number of tropical cyclones and typhoons, floods, droughts and storm surges; changes in rainfall patterns; and rising temperatures. Most participants had already experienced rising temperatures. Fishermen were cutting their fishing trips short on account of soaring temperatures. For women, this meant diminished catches and, therefore, the necessity to look for other sources of income. This in turn was leading to the neglect of children as well as strained family relations. Heat exposure reactions, leading to hypertension, coughs and asthma attacks, were becoming common. Increased violence was reported both in the family and the community.

The presentations highlighted the gender-differentiated impact of disasters. It was pointed out that according to statistics, more women than men drown in floods. Women, being responsible for the home, play a key role in disaster recovery but are rarely consulted when disaster risk reduction strategies are planned. Such strategies would be greatly enhanced if they took into account women's coping abilities as well as risk perception skills.

A few case studies were also presented. The case study of Cavite, for instance, revealed that flooding was occurring in areas that had never known flooding earlier, and extreme weather events were being recorded more often. Two areas in Cavite – Naic and Ternate – were experiencing sea-level rise as well as coral bleaching. The weather calendar that fishers had relied on could no longer be used because the weather had become so unpredictable. Cavite was experiencing non-seasonal rainfall. In Sorsogon, frequent typhoons, prolonged heavy rainfall, flooding and sea-level rise were being reported.

These phenomena translated into multiple problems: periods of food insecurity, increased levels of tension in the household and community, loss of property due to strong typhoons, and reduced income because of dwindling fish catches and economic and social displacement. As a result, people were being pushed further into the margins of poverty. Disease outbreaks were commonly reported, increasing the burden for women, the traditional caregivers within families.

Another case study focused on the region of Zambales, where a very strong typhoon in 2009, and the floods that followed, destroyed most of the structures built along the seashore. Houses, roads and agricultural fields were inundated. Salt water had filled the wells that supplied the community with drinking water. This meant that women had to walk long distances to fetch potable water.

Such sharing of experiences was useful for communities to craft collective strategies for climate resilience. The Thai participants at the meeting realised that the Filipino experience had been very similar to their own and that common lessons could be learnt. Strategies for mitigating climate change impacts included community-based resource management initiatives such as mangrove conservation and reforestation, creating artificial coral reefs, livelihood enhancement opportunities for women, and educational interventions. A multi-sector approach involving local organisations in partnership with academic institutions and the media was considered to be ideal.

## Behind every boat, a woman, a family, a community...!<sup>1</sup>

***The European network of women's organisations in fisheries and aquaculture, AKTEA, challenges the unacceptable omission of women's contributions to fisheries in a crucial European Commission policy consultation paper***

By Brian O'Riordan<sup>2</sup>, Cornelia Quist<sup>3</sup> and Katia Frangoudes<sup>4</sup>

**Source:** *Yemaya*, ICSF'S Newsletter on gender and fisheries No. 34, June 2010

Should the Green Paper on Reform of the Common Fisheries Policy (CFP), developed by the European Commission (EC), contain the word 'women'? Yes, it must, says AKTEA, the European network of women's organisations in fisheries and aquaculture.

The treaty establishing the European Union states that the principle of gender equality must inform every European policy. Its absence in the CFP Green Paper is, therefore, a glaring gap. Despite this, AKTEA's contribution to the public consultation on the CFP reform process was a reminder of how rapidly women's organisations are gaining ground in EU fisheries.

AKTEA notes that women are integral to the fisheries, and they participate in fisheries management at all levels. Women's groups and members of AKTEA have made their presence felt in Regional Advisory Councils (RACs). AKTEA itself plans to participate in the Advisory Committee on Fisheries and Aquaculture (ACFA). It strongly supports the right of a fisher's partner or spouse to participate in fishers' organisations at every level.

According to AKTEA, women understand the importance of protecting the environment and reducing pollution in rivers and coastal waters. They recognise the need to work with the wider fisher community for sound fisheries management. Women are increasingly engaging in active fishing at sea. Their presence in shore-based harvesting is significant in many European countries, particularly as mariscadoras (shellfish gatherers) in Spain and Portugal. According to statistics, women comprise around 26 per cent of the workforce in the seafood industry, representing 4.1 per cent of employment in the harvesting sector. However, there are no gender disaggregated fishery statistics available in the EU, which means that women's contributions remain under-represented or invisible.

The CFP Green Paper contains references to small-scale fisheries, fishing communities and small- and medium-sized enterprises, yet it ignores the crucial part that women play in these. Indeed, family fishing enterprises would not survive without women but their contributions are rarely remunerated or reported. The 'collaborative spouse' status, recognised in EU directive 86/613, has been a major step forward in this regard, but is not uniformly applied throughout Europe.

Further, AKTEA is highly critical of the EC proposal in favour of a regime of individual transferable rights in the industrial fisheries. Such a move would run counter to the principles of economic and environmental sustainability. Stabilising the economy of small-scale fisheries should be the key priority.

In a regime of individual transferable rights or quotas, speculative activities by big companies and interests outside the fishery sector would harm the small-scale fisheries, undermine small enterprises and discriminate against women. Even in its present form, the existing quota system is discriminatory to women, particularly in the event of divorce or widowhood, because neither their contribution to the quota-based fishery nor their claim to the quota is recognised. AKTEA, therefore, urges the EC to ensure legal co-ownership for both members of couples (married or unmarried), of both quota and enterprise.

Finally, AKTEA calls on the EC to undertake a social impact analysis of the individual quota system and to define indicators for monitoring social changes within the communities caused by new fishery management regulations.

Women's roles and contributions are vital for sustaining fishery activities and enterprises, and in maintaining the social and cultural fabric that keeps small-scale fishing communities together. Their absence in the CFP Green Paper is simply not acceptable.

1 Summary of AKTEA's Response to the Green Paper on 'Reform of the Common Fisheries Policy' ([http://ec.europa.eu/fisheries/reform/docs/aktea\\_en.pdf](http://ec.europa.eu/fisheries/reform/docs/aktea_en.pdf))

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## Painting the diversity of mangroves

***Mangroves sustain fish stocks, protect the ecosystem and sustain livelihoods. Women from many mangrove-dependent communities met in Ecuador earlier this year to share their stories and dreams.***

Verónica Yépez

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**Source:** *Yemaya*, ICSF'S Newsletter on gender and fisheries. No. 32, November 2009

*'Mangroves employ those who no-one else can employ.*

*No company can produce what the mangrove gives us to enjoy*

*They guard so many species, species as many can be*

*Food in so much abundance, we never can have any need'*

(The Mangroves are Ours by Reverside Castillo, Bolívar Muisne)

The island of Muisne in the Province of Esmeraldas, Ecuador, witnessed a unique gathering earlier this year, from 29 to 31 May 2009. More than 80 women shellfishers, crabbers, fishers, and oyster and clam gatherers met to share their experiences of life in the mangroves. Women from the mangrove areas met with others from REDMANGLAR International, from Colombia, Honduras, Mexico and Brazil. The three-day meeting captured the historical memory of the women who live in, and struggle to defend, mangrove ecosystems.

'My clamming work has helped me provide my kids with an education, so that they don't have to be like me, so that they can be better. I feel proud that my kids have got a way forward, thanks to my work as a clammer. I haven't left them like my mother left me, with no education', said Jacinta, delegate from Muisine canton, Esmeraldas Province, Ecuador, on the first day of the meeting. These words set off a fierce polemic amongst the participants. Some women appeared to be disconcerted by her words; others were in total agreement.

Julia, from Tumaco, Colombia, protested, 'I don't understand how you can love mangrove work so much and yet say that you don't want your kids to do it. We cannot turn our backs on what we are. We must teach our boys and girls to work hard because that makes them better people. It does matter whether or not they study but what is more important is to know how to work and how to work with honesty.'

The discussion picked up. It's because life in the mangroves is getting harder, said some; others agreed with Julia and said that mangrove work is

dignified, that they are proud to be crabbers and that their entire families, grandmothers down to grandchildren, are in the mangroves, daily.

We split up into groups, by provinces, for more focused discussions on the mangrove ecosystem – to hear each woman's story about her work, about her struggles to survive.

The words of the women painted a picture of the biodiversity of the mangroves, bringing vividly to life images of families working and children playing as the destruction of the mangroves continues. We dreamed collectively of how we would like life to be in the future. We became friends and met many other women like ourselves. Women from El Oro, in the South of Ecuador, felt that society, though it thrived on the labour of women like themselves, did not adequately appreciate the wonders of the mangroves. The mangroves were being run down by the powerful. 'We want to raise our voices so that we are heard and respected,' said the women, 'conserving what is ours, and through which we sustain our economies.'

Women from the Esmeraldas Province in the north of Ecuador work with a cigarette in their mouths. The smoke gets rid of mosquitoes as they gather shellfish in the mangroves.

'We women are suffering,' they said, 'because the mangroves are being destroyed and with that, the livelihoods of our children and our grandchildren are being destroyed too. We have been threatened and attacked. The shrimp farmers have shot us and set dogs on us to chase us out so that they can take over the heritage of the mangroves which is ours.'

But here we are, ready to give up our lives if necessary, because we were born here. Our history is here, our tales, our work, our food, our families and friends are all here. We dream of the day that our community will own the mangroves.'

In the province of Manabi in the central coast of Ecuador, women are struggling in two zones: in the estuary of the river Portoviejo and in the estuary of the river Chone.

'We used to be fisherwomen,' they said. 'We also used to engage in short cycle agriculture. When the shrimp came, we would begin collecting larvae for the laboratories but soon it was all over. Many of us now have no work; a few do, de-heading shrimps for the tanks, but it is hard, the pay is low, and it is not permanent.'

The women from Manabi described how in earlier times, the El Niño used to be a blessing because with it came an abundance of fish and the soil was renewed. 'But,' they lamented, 'ever since the mangroves have disappeared, whenever the El Niño strikes, everything is swamped, houses are lost and people have to leave the area.'

These women dream of the day when their mangroves will be restored to them. Until that day, they promise to march, to struggle, to win.

In Guayas on the south-central Ecuadorian coast, there is still a great diversity of fish, shrimp and molluscs, and large areas of mangroves are being protected by the communities. However, in certain places, like the island of Puná, shrimp farmers are felling the mangroves, and as a result, many shellfishers and crabbers have lost both their livelihood and their food security.

In Santa Elena, also on the south-central Ecuadorian coast, the mangroves have been heavily felled, but the coral reefs survive and some fish stocks are still available. The introduction of industrial fisheries, however, has put the future of traditional fishing communities under threat. The depletion of the mangroves, which are the breeding grounds for fish, is very worrying.



More than 80 women shellfishers, crabbers, fishers, and oyster and clam gatherers met from 29–31 May 2009 in Ecuador, to share their experiences of life in the mangroves.

The women of Santa Elena said, 'We want the shellfish back in the mangroves so that we too can make daily catches of 1,000 or 1,500 shells like our mothers and grandmothers used to, 20 years ago. We dream of the mangroves becoming healthy once more so that men continue to work there, so that we can make charcoal and mangrove wood houses.'

The final day of the meeting saw a wonderful act of restoration. The workshop participants reforested two hectares of mangroves in Casa Vieja in the parish of Bolívar. This area had been steadily destroyed by a shrimp farmer, whose illegal shrimp ponds occupy nearly fifty hectares of mangroves. Thereafter, the women petitioned Ecuador's Environment Minister to formally register the area in order to protect it and enable it to come to life once more.

## Letters & news from around the region

### Letter from Nauru

I would just like to salute Thomas Malm for his article in the last bulletin (“Searching for clues in the lagoon: Is marine gathering a reflection of our evolutionary past?” *SPC Women In Fisheries Information Bulletin* 20: 10-16. ([http://www.spc.int/coastfish/news/WIF/WIF20/WIF20\\_10\\_Malm.pdf](http://www.spc.int/coastfish/news/WIF/WIF20/WIF20_10_Malm.pdf))).

Ever since I read Elaine Morgan’s book “The Descent of Woman” as an undergraduate I kept the (semi) aquatic ape hypothesis in the back of my mind. As a non-anthropological fisheries scientist I lacked the training to follow it up, but later, as a research manager, I felt that it ought to be followed up, and in 1996 I corresponded with Elaine Morgan with the intention of writing a brief article in an SPC Bulletin, similar to Malm’s, that brought the possibility to the attention of the Pacific Island research community.

Sadly, I never got around to writing that article, so I’m very glad that Malm has now raised the same issue, and in a much more authoritative and lucid fashion that I could have mustered.

Fifteen years ago the Aquatic Ape Hypothesis was anathema to the community of professional researchers who studied human origins, and anyone who raised it was likely to suffer severe attrition of their reputation. Even Sir Alister Hardy, who originally proposed it in 1960, never followed it up, and it was left to Elaine Morgan to bring it to the world’s attention — the beginning of a fight for recognition that lasted through several decades of scorn.

However, the hypothesis has never been convincingly debunked. It has withstood the test of academic criticism, as all hypotheses must, and is finally beginning to achieve recognition as a potentially valid explanation of part of the adaptive history of the human race. Indeed it has now entered the mainstream to the extent that Sir Richard Attenborough recently made a two-part radio broadcast in the UK (“The Scars of Evolution” which can be obtained from the BBC Radio 4 website).

Why is this important? It is obviously important in the study of human origins, and in unravelling the story of how we populated the globe, but I feel that it is also important in the fisheries world — to understand the primal significance of shallow-water fisheries and in explaining some of the deeper motivations underlying the way we interact with marine resources.

Fisheries conservation and management may have far more ancient roots than any of us realise, and women must have played a seminal part in that process.

**Dr Tim Adams**

Nauru Fisheries and Marine Resources Authority (NFMRA)

### Villagers rescue fish as pond dries

*By Felix Chaudhary*

*Source: Fiji times online, Wednesday, 29 September 2010*

Two months ago this was a pond full of tilapia at Drauniivi, Ra, Fiji. Villagers of Draunivi, Rakiraki, made an unprecedented fish evacuation last week to save hundreds of threatened tilapia hatchlings from certain death.

The operation occurred as the village lost a vital source of food and income when prolonged heat completely dried up its only tilapia farm. Villagers noticed that water in the freshwater fish pond began receding in July.

“We noticed the fish struggling to stay alive in the little water that was left, so we got buckets and moved the remaining fish to a nearby river to give them a chance to live,” said farmer Savenaca Mamasavou. There was only a few hundred fish left compared to the thousands that were there before the drought,” Mr Mamasavou said.

He said the drought-like conditions had also impacted on their only source of drinking water, a borehole that was partially funded by Fiji Water, which operates a water bottling plant just a few kilometres from the village. “We receive assistance for the pumping of water from the borehole from Fiji Water but because of the cost of pumping we only have access to water for one hour in the morning and one hour in the evening.

“During that time we have to collect enough to cater for our drinking, bathing and washing needs.” Mr Mamasavou said the village was struggling to cope with only one source of water available to the 700 residents.

“We used to get water that was piped from a catchment up in the hills and a spring near the village but they have all dried up now. Things were better then, because we had a few sources of water,” the farmer said.



*Yemaya mama... feels left out*

**Source:** *Yemaya*, ICSF's Newsletter on gender and fisheries No. 32, November 2009.

<http://icsf.net/icsf2006/ControllerServlet?handler=YEMAYA&code=viewPubn&issueno=32>

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