



## Women and fisheries: Contribution to food security and local economies

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### ABSTRACT

The substantial role of women in fisheries is overlooked in management and policy. Fortunately, it is gaining recognition despite a lack of quantitative data describing the scale of participation and contribution. This work summarizes existing knowledge on women's participation in marine fisheries globally, and estimates their contribution in the Pacific. While women's role varies between geographic regions, in the Pacific, women account for 56% of annual small-scale catches, and resulting in an economic impact of 363 million USD (total revenue: 110 million USD). Recognizing and quantifying the role of women in fisheries has profound implications for management, poverty alleviation and development policy.

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### 1. Introduction

The term 'fisherman' implies that fishing is performed by men. Closer inspection of fisheries globally, however, indicates that while certain fishing activities are more commonly undertaken by men, others are dominated by women. Women are involved in the capture, processing and sale, as well as finance aspects of fisheries, yet many of these roles have been overlooked and continue to be under-acknowledged in fisheries management and policy development [1–5]. The traditional roles of men and women within societies have contributed toward the notion that women participate minimally in fisheries economies. Men are typically regarded as the providers (i.e., hunters, fishers) while women stay at home and look after the home and family—as the caregivers. Such dichotomous division of labor is somewhat dated, as women have become heavily involved in the workforce in many sectors of the economy, and thus act both as providers and caregivers. Yet, despite technological advances in fisheries, many of the traditional ideologies with respect to gender roles in fisheries have remained relatively un-changed, and governance has failed to recognize the unequal division of labor.

A lack of gender equity in fisheries, particularly in Africa and the Asia-Pacific region [2] is, in part, due to limited gender specific data on fishing activities and the under-representation of small-scale

fisheries in fisheries catch statistics [6]. It is also largely driven by traditional perspectives on what constitutes 'fishing', namely, catching fish using specialized gears (e.g., nets, lines, etc.) from fishing vessels. Provisioning of food via 'collecting' seafood from shorelines, in contrast, has rarely been deemed 'fishing' by male fishers, and tends to fall under 'gathering' and general food provisions, and is/was generally undertaken by women. The implications of this marginalization, which adds to the marginalization of small-scale fisheries [6], are a substantial under-estimate of fishing pressure in coastal areas and an under-valuation of the economic and societal benefits that women in fisheries provide. Consequently, both positive and negative aspects of women's fisheries-related activities are overlooked [7]. The issue is largely that "most fisheries social science research is descriptive, lacking both an analytical framework and documented methodology. Furthermore, the research style and reporting language of the social scientists do not naturally endear them to fisheries managers" [8]. Social scientists have done great services in describing fishing communities and capturing the roles of women in fishing and non-fishing activities. However, their findings are generally not incorporated into policy and decision-making because their data are mostly qualitative and managers do not know how to deal with these data (R. Chuenpagdee, Memorial University of Newfoundland, pers. comm., March 19, 2012). Overcoming this barrier requires a multi-disciplinary approach, which utilizes descriptive accounts, local knowledge and limited quantitative data to derive generalizations of a quantitative nature [6], as well as mechanisms to incorporate these different types of data and knowledge into management and decision-making (R. Chuenpagdee, pers. comm.).

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Until recently, fisheries science and management have been largely male-dominated [9,10]. While many more women are becoming involved in fisheries governance, the majority of high level positions, which include key policy- and decision-makers, continue to be held by men. As women filter into more of the strategic planning and capacity building roles in fisheries, greater gender equality will hopefully be achieved.

Small-scale fisheries play a crucial role in poverty reduction and food security [11], yet are often overlooked and undervalued in management and policy [6,12–15]. By extension, women, as major participants in small-scale fisheries and aquaculture, have a fundamental role in development and production. Inclusion of women in the decision- and policy-making process is key to developing appropriate strategies for poverty alleviation and food security in light of changing global conditions. Reducing vulnerability and building resilience in communities at national, regional and global scales requires the consideration of and contribution by women to security [16]. For example, climate change will have a considerable impact on fisheries, both in terms of increased participation in fishing activities, and decreased productivity, due to changing species distributions and generally declining catch potential [17–19]. Women have a fundamental, but under-valued, role in food and nutritional security, however, their contributions to national economies have been largely overlooked due to their dominance in the informal economy [20,21].

This study aims to review much of the available literature and data on women's participation in the fisheries sector in order to assess their contribution to the economy and to food security. First, the study takes a global look at the various roles women have in fisheries and related sectors by geographic region. Then, with a lens on the Pacific region, it estimates the contribution women make to the total fisheries catch and to nutrition, and then analyzes the socio-economic aspects of this contribution—notably participation rates (e.g., numbers of fisherwomen and jobs in the processing and marketing sector) and value to the economy (i.e., direct and indirect value of the catch). The implication of these findings for fisheries management and development policy are then discussed with a particular focus on gender equity.

## 2. Regional descriptions of women in fisheries

An assessment by the WorldFish Center estimated that women represent between 5 and 73% of the total capture fisheries workforce (including full-time and part-time; fishing and post harvest activities) in nine major fish producing countries [2]. This translates into an average participation rate by women of almost 50% for all fisheries-related activities [2,22]. A recent global estimate of marine fisheries employment (in 144 coastal countries) suggests that approximately 260 million ( $\pm 6$  million) people are involved in global marine fisheries, including full- and part-time jobs in direct and indirect sectors, men, women and children [23]. Interestingly, Asia and Africa contributed the most to worldwide fisheries employment, likely because of the limited job opportunities in parts of these two continents. In terms of reporting of fisheries catches, these regions are likely the most inadequate. This is, in part, because of subsistence sectors being largely unaccounted for in the official data and artisanal sectors often being under-represented (e.g., Mozambique, Tanzania, Madagascar, Mauritius; [24–26]). Although participation varies considerably from one region to the next, if one were to crudely combine these two estimates, this would mean that 130 million women contribute in some way to global marine fisheries. Women may participate less in catching fish, particularly large fish. However, they have a disproportionately high participation

rate in the collection of invertebrates, the processing and marketing of catch, and they make up the bulk of laborers in seafood processing plants in many parts of the world, such as Asia, Africa and the Pacific [2,27,28]. Yet, in most countries and regions, these contributions are barely recognized.

A recent study on small-scale fisheries summarizes much of the existing data on women and fisheries; however, quantitative information on participation and/or contribution to total catch, was available for only some countries [7]. The considerable body of literature that exists on the topic of women and fisheries, or gender and fisheries, highlights substantial efforts in the past couple decades to raise the profile of women's role in fisheries. Many of these studies point to the lack of gender-disaggregated data in fisheries-related activities and suggest that this is a major constraint to improving gender equity. To establish the global scope of their role in fisheries, the various fisheries-related activities that women are involved in around the world follows.

### 2.1. Europe

In Europe, women have had a substantial role in the processing sector since the 19th century, particularly important during the peak of the herring fishery [29]. The WorldFish Center estimates the participation by women in the fisheries sector in the European Union to be 6% and 59% for marine fishing and processing, respectively, with a total of over 65,000 women employed in these two sectors combined [29]. Women in this region play a relatively minor role in capture fisheries (aside from gathering shellfish) compared to their role in support, marketing, processing, trading and other fisheries-related activities [30]. The full extent of women's participation in these activities, particularly their role in supporting fishing operations, fisher-families and communities is currently unknown [31,32].

Despite greater gender equality in Europe<sup>1</sup>, women are still largely excluded from fisheries management systems, such as fisheries cooperatives and policy development [29]. While in some countries such as France, women legally obtained the right to be fishers in 1963, much of the informal work that they do to support family fishing businesses goes unrecognized. Some legal recognition was afforded to women indirectly involved in fisheries with the adoption of European Council Directive (816/613/EEC) in 1986 on “the application of the principle of equal treatment between men and women engaged in an activity, including agriculture, in a self-employed capacity, and on the protection of self-employed women during pregnancy and motherhood” [31]. Further EU legislation has extended the legal status of women who assist their husband fishers, with an entitlement to social security and benefits such as old-age pensions, health care and maternity benefits. However, such legal status exists in only some EU member states such as in France, and to a lesser degree in Spain and Portugal [31]. This has allowed some recognition and legal status to women who do much of the administrative work and support roles in fisheries (e.g., book-keeping, mending nets, auctioning fish, etc.) [31]. Women,

<sup>1</sup> In 1995, the United Nations introduced the Gender-related Development Index (GDI) and the Gender Empowerment Measure (GEM), which aimed to measure gender equity across countries and regions. GDI is essentially the human development index, adjusted downwards for gender inequity, while GEM estimates the progress in improving women's participation in economic and political life, and in decision-making, based on estimates of women's relative economic income, participation in high-paying positions with economic power, and access to professional and parliamentary positions. In 2010, the Gender Inequality Index (GII) was introduced as a composite index, which combined aspects of the two previously used indices. Europe has the lowest Gender Inequality Index score compared to other regions of the world, meaning that they have achieved the greatest gender equity [33].

themselves, often do not see this as work, as it can be done at home while undertaking other household and child rearing activities. The economic value of this role is the opportunity cost of hiring someone else to specifically fulfill this role. To date, this has not been quantified but needs to be considered in the valuation of women's role in fisheries.

Women, by way of anecdote, mention that summer rentals in fisher families' homes in Western Europe (e.g., Germany) are organized by fishermen's wives as a way to supplement family income, thus providing an indirect 'subsidy' to their husbands, allowing them to continue fishing activities, which are no longer profitable (D. Pauly, pers. obs., March 22, 2012). A recent study on women's participation in fisheries in the UK, further supports this claim that women have a substantial but under-valued role in the hidden workforce, as unpaid support to fishing enterprises. The study suggests that while women contribute significantly to the fishing industry, they are under-recognized, either unpaid or under-paid, and are limited in participating in management and policy making [34].

## 2.2. Africa

Africa has gained considerable attention in terms of the contribution of small-scale fisheries to poverty reduction and food security [11]. In addition to the primary sector of fishing, processing and trading have been recognized as adding substantial value to the economy, which was previously under-estimated. With respect to gender and fisheries, some recent work has highlighted the roles of women in African fisheries. The fisheries sector provides income generating opportunities for women, often considered among the poorest and most marginalized groups in developing countries [35]. For example, in the Congo, 80–90% of fish traders are women [11]. In parts of Mozambique, women's involvement in the trade of fish has been highly integrated into the culture both as a way to supplement meager household incomes and because the majority of male laborers were increasingly employed in South African mines, while in other parts of Mozambique women are minimally involved [36]. In coastal communities around the Comoros islands, women have long been engaged in the harvest of marine species at low tide. Here, the women typically sell half of their catch and keep the rest for family consumption, thus contributing directly to household income and food security (M. Hauzer, University of Victoria, pers. Obs., March 28, 2012). In West Africa, women play a key role in the processing and financing of fisheries [37–39]. However, women's role in processing has changed with the increased demand for fresh fish on the international market. Fish are increasingly sold fresh to retailers supplying European markets, transferred directly to boats destined for Europe or to factories designed with European health specifications in mind. While providing economic opportunities to some, this expansion came at the expense of many women involved in the fishery sector (D. Belhabib, University of British Columbia, pers. comm., March 18, 2012). Market women in West Africa provide monetary credit to fishermen and maintain well-defined client–patron relationships [40]. Although women in West Africa tend not to catch fish, they have a key role in distributing it, which determines economic returns to the family, and in support activities such as supplying provisions (e.g., ice, bait and salt) and repairing fishing gear [40]. In East Africa, on the other hand, women glean from the intertidal zone in Mozambique [41], while in Tanzania, they engage in seaweed farming, octopus trapping and netting small fish in the intertidal zone [42]. However, as octopus has become a valuable commodity on the international market, women are being increasingly displaced by men from this activity, which previously provided them with both an income and food.

While women are fundamentally involved in fishing activities for survival and for livelihood, their contributions go largely unseen. Consequently, women are excluded from fisher organizations, ignored by creditors and receive little training to improve fishing techniques, opportunities and conditions [35]. As a fundamental component of food and income security planning in rural African communities, gender considerations must be addressed, particularly as globalization threatens the domestic availability of primary resources such as fisheries [42–44].

## 2.3. Americas

Literature on women in fisheries in Canada and the US is limited. However, considerable attention has been given to the role of women in fishing communities in Newfoundland and Nova Scotia, particularly during the height of the Atlantic cod fishery [45]. Women played an important role in the processing of cod for export to Europe and the Caribbean—major trading partners in this fishery [46]. Furthermore, women in Canadian indigenous northern communities have had a role in fisheries, but have largely been excluded from decisions affecting the resources that they are exploiting [7,47].

In Latin America (Mexico, and Central and South America), women participate directly in fishing-related activities and indirectly in supporting fisher families and communities [48]. Women in this region are more involved in processing, aquaculture and marketing than in capture fisheries [49]. However, much like in other regions of the world, their work goes un-noticed and rarely appears in fisheries sector statistics and/or in socio-economic valuations [48]. Women are starting to organize themselves and find a collective voice in fish worker cooperatives in order to raise their profile within fishing communities and at the level of government. Through participation in workshops and conferences, women are starting to contribute to discussions on the link between sustainable fisheries and healthy fishing communities [48].

## 2.4. Asia

The changing role of women in Asian fisheries can be attributed to several factors, including increased aquaculture production, movement of labor between countries and evolving social status of women. As the largest aquaculture producing region in the world, Asia has an increasing number of women involved in this sector. Despite a greater labor contribution by women to the aquaculture sector compared to men, women are largely excluded from decision-making processes [5]. In China, which generated 62% of reported world aquaculture production in 2008 [50], women represent 33% of the rural aquaculture labor force, while in Indonesia and Viet Nam this contribution is between 42% and 80% [2]. Furthermore, women's traditional role in reef gleaning and shoreline collection of food is being superseded as women move across borders to work as laborers in neighboring countries or the Middle East [51] (M. Palomares, pers. comm., March 21, 2012). The role of women as regular and stable household food providers in places such as the Philippines is changing, and without proper recognition of this role, nutritional security may be threatened. Some effort has been made by the United Nations to establish microcredit programmes in fishing communities to assist in poverty reduction and empowerment of women. This microfinance approach, which provides loans, savings and insurance provisions has been successfully applied in parts of Viet Nam [52] and the Philippines [53]. Women in Goa, India, have gained considerable economic independence and empowerment through their work as fish vendors, raising living standards and increasing opportunities for their families [54]. In Peninsular

Malaysia, environmental degradation and unsustainable resource extractions have reduced livelihood diversity, which may jeopardize gender equity within households and communities where women previously worked alongside men in fishing activities [55]. The transformation from subsistence economies to global market economies, dominated by trade, has resulted in shifting social and economic roles of women in Bangladesh [56,57] and likely throughout much of Asia. Innovative microcredit programs in Asia have increased access for women to economic opportunities and employment [58]. These shifting roles require careful investigation to understand their implications on fisheries, women and development [2,59].

## 2.5. Oceania

Traditionally, women in Oceania have had an important role in providing regular and stable food supplies to their families, including contributing significantly to marine-derived household protein through their collection of nearshore fish and invertebrates, known as reef gleaning [1]. While the role of women in fisheries in the Pacific has historically been restricted to these nearshore subsistence activities, this role is changing. In Fiji, for example, this role has shifted from primarily subsistence as the target to subsistence as surplus, with much of the catch being sold on the market [60]. With the expansion of pelagic fisheries for foreign markets, processing plants were established in many countries (e.g., Fiji, Papua New Guinea, Vanuatu, Solomon Islands, Federated States of Micronesia, Samoa, Cook Islands, Marshall Islands and Kiribati [61]). Women provide the major labor force for this sector. The large body of work done on women and fisheries in the region over the past couple of decades suggests that the role of women in the Pacific is much better recognized than in other regions of the world. Early work by Chapman [1] and later by Matthews [28] highlight the diverse and changing roles of women in Pacific Island fisheries with accounts from many communities and countries throughout the region. The Secretariat of the Pacific Community (SPC) has made tremendous efforts in raising the profile of women in fisheries, with their monthly *Women in Fisheries Information Bulletin*, which highlights, “gender roles in coastal fisheries, women’s fishing activities in urban and rural communities and gender issues in development”<sup>2</sup>. Despite these major steps forward in bringing women’s activities into the spotlight, the quality of information is inconsistent from one country to the next, with many countries lacking data completely, despite evidence of women’s presence in fisheries-related activities [1].

While fisheries participation rates by women vary from one country to the next, approximately 20% of fishers in French Polynesia, Federated States of Micronesia, Samoa and Tuvalu are women, while in Fiji, Papua New Guinea, Wallis & Futuna and Vanuatu, approximately equal numbers of men and women participate in fishing activities [63]. In American Samoa, women make up 17% of those engaged directly in fishing. However, in many countries, women are involved indirectly in fisheries activities (e.g., processing, trading, financing, etc.), with only some of these roles being quantified. In Fiji and in the Solomon Islands, 90% of cannery workers are women and in other processing plants in the Pacific Island region, women represent 30–80% of the labor force [63,64]. In Papua New Guinea, an estimated 7000 women work in the tuna industry, according to a 2008 study, which translates to 3.3% of all formally employed women in the country

[63]. The same study provides information on participation of women in fisheries for other Pacific Island countries. However, for the 22 countries and territories mentioned, only 9 included quantitative information [63]. Combined, these provide a participation estimate of over 140,000 women involved in fishing activities in the Pacific region out of a total female population for the region of roughly 4.8 million [65]. However, much of the data presented on women in fisheries represented only certain activities, and often for one community or region. Using marine employment estimates by county [23] and assuming a 20–50% participation rate, we derive an estimate of between 135,000 and 340,000 women involved in fisheries-related activities. As employment numbers were only available for Fiji, Kiribati, Marshall Islands, Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu, this estimate is likely low. The tuna processing sector alone is thought to employ approximately 130,000 women [61]. This further highlights the need for gender disaggregated participation data for the Pacific—a region which has made considerable efforts over the past 15 years to reveal the importance of women in fisheries.

## 3. Contribution and value

### 3.1. Marine fisheries catches by women

Although women’s involvement in fisheries is widespread, occurring throughout the world, here we focus our quantitative assessment on the small-island developing countries of the Pacific—a region long recognized for their reliance on food from the sea, and where women are known to be heavily involved in fisheries activities [1]. Despite fisheries being a recognized activity for women to participate in, fisheries statistics often fail in capturing this contribution. The most common activity that women engage in is reef gleaning, which involves shore collection of invertebrates (crabs, shellfish, octopus, echinoderms, etc.) and fish [1]. This activity is done primarily by women, and supplies a considerable portion of the local, daily diet (see Section 3.2). Women also participate in boat-based fishing activities beyond the reef in offshore areas using nets, lines and hooks—often considered techniques restricted to men (e.g., Fiji, Solomon Islands and Northern Marianas [3]).

Activities such as reef gleaning are not properly reflected in most officially reported fisheries catch statistics or at least not to the extent suggested through direct observations [66,67]. National data supplied to and presented by the Food and Agriculture Organization of the United Nations (FAO) give some estimates of invertebrate catches, but generally only for those caught and sold for export. The subsistence component has been largely overlooked in most cases [24,68,69]. However, in some countries, such as Fiji, the fisheries department has made considerable efforts in recent times to estimate subsistence catches, recognizing that this is one of the dominant domestic fisheries sectors [70]. Despite these efforts, subsistence catches remain under-estimated in the officially reported data for Fiji [71]. While often overlooked or underreported in the official catch statistics, subsistence fisheries and unreported artisanal catches have been accounted for in the reconstruction of fisheries catches for various countries [72–74]. These ‘unreported’ catch components were, in many instances, estimated using per capita seafood consumption rates from household surveys [63], which would have accounted for food items provided by women, as these form a substantial portion of the household diet [1].

The contribution by women to the total catch differs by cultural group [75] and by sector. Subsistence activities, particularly in Melanesia, are dominated by women, representing over

<sup>2</sup> This bulletin regularly provides in depth articles from leading researchers in the field of women and fisheries in the Pacific with topics ranging from fishing techniques to food security and policy [62].

80% of the subsistence catch, whereas in Micronesian and Polynesian cultures, women caught between 20 and 25% of the subsistence catch. The contribution by Melanesian women to the commercial, artisanal catch was 20%, while in Micronesian and Polynesian cultures women contributed only 10% to commercial catch. Combining these culture-specific contributions by women [75] with reconstructed small-scale fisheries catches [72], we were able to estimate the approximate contribution (in metric tonnes) by women to fisheries catches.

For all the countries with presently published reconstructed catch data (American Samoa, Fiji, French Polynesia, Guam, Nauru, New Caledonia, Niue, Palau, Pitcairn, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Northern Marianas and Wallis & Futuna Island [71,73,74,76–79]<sup>3</sup>), the dominant ethnic group within each country was identified. Using estimates of the contribution by women by ethnic group and the reconstructed small-scale catches (annual averages for the 2000s), the contribution by women to small-scale fisheries was conservatively calculated to be over 40,000 t. The combined estimate for all countries considered here represents 56% of total estimated small-scale fisheries catches. Thus, women contribute more small-scale catches than men, illustrating the significant role played by women in Pacific Islands' food security. This contrasts sharply with the traditional view that women play a relatively minor role in capture fisheries. If this preliminary estimate is representative of the region as a whole, the fact that over half of all small-scale fisheries catches (i.e., catches that dominate domestic consumption demands) are caught by women has serious implications for fisheries management, food security policy and development.

### 3.2. Contribution to nutrition

Fish (here to include invertebrates) represent an important and often fundamental component of the diet in many parts of the world, making major contributions to protein demand and providing crucial micronutrients to the diets of men, women and children. Fisheries and aquaculture for local consumption contribute considerably toward household nutritional security, particularly in the developing world. Proper nutrition is fundamental to immune function, childhood growth, cognitive development and function, and to reproductive success [80]. While fisheries-related livelihoods, in particular small-scale fisheries, have been linked to household nutritional security [80], more work is needed to understand the relationship between nutrition and small-scale fisheries. Women's contribution of fish and shellfish to Pacific Island diets has been under-estimated, but is likely more important than that of men, due to the regular and frequent inputs by women's fishing activities compared to that typically carried out by men [3]. Furthermore, most of the catch taken by women goes to feeding their family, whereas catches by men go mostly to markets. In Kiribati and Western Samoa, 16% and 17%, respectively, of household protein demand is met through reef gleaning activities by women alone [1].

Throughout the Pacific, the traditional diet, which includes a high proportion of locally caught seafood, has been significantly degraded by imports of cheap and often unhealthy protein alternatives and the adoption of a western diet [81]. In many places, this is a fairly recent phenomenon; yet, diet-related health issues are already beginning to emerge. This includes increasing rates of obesity and diabetes, as previously inaccessible foods are introduced to the diet. Without adequate information on the role

and contribution of fish to nutritional security in the region, diet-related health issues may continue to increase, adding costs to society.

### 3.3. Value to the economy

Using the catch estimates from fishing activities undertaken by women as derived above, in combination with country specific ex-vessel price data [82], total revenue (i.e., landed value) of the catch taken by women was estimated. Then, using country-specific output multipliers [83], the economic impact, through the value chain, which includes direct and indirect impacts from fisheries, was calculated. Output multipliers are one way to account for the economic activity derived through the various secondary linkages to the fishing industry [83].

Ex-vessel prices were available for only some of the taxa for which reconstructed catch estimates existed. For those without taxon-specific price data, data for the closest taxonomic category were used. The catch amount estimated to have been taken by women were then combined with 2005 real prices (USD/tonne). Subsistence and artisanal catches were treated equally, assuming that the 'shadow' prices for the subsistence sector are the same as the ex-vessel prices [82]. Economic impact was estimated by applying a multiplication factor of 3.3 to the landed value [83]. The total revenue of small-scale catches taken by women is estimated to be 110 million USD (real 2005 USD), while the economic impact is estimated to be 363 million USD (real 2005 USD). This likely underestimates the overall economic impact, as this is calculated based on women's share of the catch. While women are generally excluded from the capture component of industrial tuna fisheries, they have a key role in gear provisioning and post-capture processing, which were not explicitly accounted for in this preliminary estimate of value.

In terms of wages to female laborers, few studies were available. Most descriptions of women employed in the processing sector suggest that they are considered unskilled laborers and are in the lowest paid wage category [84]. As with participation estimates for women in fisheries, gender disaggregated wage data are also lacking.

## 4. Management and policy

### 4.1. Relevance to fisheries management

The management implications of these findings include the substantial ecological knowledge that women possess due to their reef gleaning and fishing activities, generally passed on from mothers to daughters, which seems to have been largely ignored in fisheries management circles. Success in these activities requires substantial knowledge of the biology and ecology of the species being harvested. Furthermore, the frequency and regularity of women's fishing activities likely translates into valuable insight into the state of nearshore resources and how these may have changed over time. Although often un-quantified, people who rely on the ocean for their livelihood are often able to describe declining yields and the disappearance of species [85]. While many developing countries claim to lack the human resources necessary to properly monitor the marine environment, it seems women's knowledge is an obvious, yet highly under-utilized, asset in fisheries management. The organizational and collaborative abilities of women make them ideal partners in fisheries development and management initiatives. With some training and empowerment, women could participate in monitoring activities, particularly important in mitigating the impact of climate change. However, this must be balanced with support for

<sup>3</sup> Total reconstructed marine catches for all coastal countries of the world are in progress at the *Sea Around Us* Project, and will be completed by 2013, and subsequently available in the literature and at [www.seaarounds.org](http://www.seaarounds.org).

daily activities such as household food provision and child care as to not simply increase their overall workload. Additionally, due to their role in assessing supply and demand on a household level, women could contribute in very meaningful ways to the development of policies specifically addressing fisheries and food security.

In addition to their direct involvement in fishing activities, women also have various indirect inputs into fisheries. In rearing children, caring for the elderly, providing food, maintaining the home, and often earning regular income through marketing fish and homegrown agricultural products, women often subsidize their husbands' fishing activities. Additionally, women's role in household savings further helps to support their husbands (R. Chuenpagdee, pers. comm.). The ability of men to fish for an increasingly unprofitable resource (due to declining stocks or increasing fuel costs) is made possible by women providing food and increasingly cash income to sustain the family through subsistence activities such as reef gleaning and market activities [6]. This role, so often overlooked in both an accounting and management sense, has a considerable economic impact by essentially subsidizing commercial fisheries, especially those for export. "Two-thirds of women in the developing world work in the informal sector or as unpaid workers in the home"<sup>4</sup>. The various pathways through which this shapes the economy must be recognized, particularly in sectors such as fisheries.

In terms of gender and the environment, particularly in developing resilience toward the impacts of climate change, the role of women in fisheries is crucial. Some progress has been made in bringing gender considerations into fisheries research. The many papers, reports, and other sources cited here provide substantive evidence that the role of women in fisheries is gaining attention, particularly in the past 20 years. Indeed, the first ever Global Symposium on Gender and Fisheries was held in 2004 [87]. In Europe, legal frameworks make some efforts to include the status of women involved indirectly, assisting in the fishing operations of their spouses. However, one major stumbling block is the lack of quantification of gender impacts. For full acknowledgement (i.e., rights, responsibilities and protection), women need to be included and considered in statistical data. Until their numbers have been included in fisheries statistics and their contributions more widely recognized, women will continue to have limited participation at all levels of the decision-making process [30,31,34].

To achieve more sustainable management of inshore fisheries resources, the role played by women in all aspects of fisheries must be recognized, and women must be involved in the planning and management process [88]. Women's traditional responsibilities as food growers and caregivers connect them more closely to the availability of natural resources [89]. Therefore, promoting and empowering women as decision-makers is key to successful environmental policy and program development.

#### 4.2. Implications for development policy

An additional major challenge is moving from research on gender and fisheries to policy development and action. Gender considerations should be rooted both in fisheries and development policies. Those working on gender and fisheries over the past decade almost unanimously agree on a need for gender-disaggregated data in fisheries. The collection of such statistics could easily be done by

governments, as a component of regularly conducted national census questionnaires. As fishing cooperatives become more inclusive of women, they too could collect data, not only on the number of fishers but whether they are male or female and the various fishing-related roles (i.e., financing, gear maintenance, processing, marketing, etc). While fisheries policies have yet to fully acknowledge the role of women, development policy does. Aside from widespread acceptance in fisheries management, the next challenge is in linking women in fisheries to development on a global scale. With the role of women in fisheries being better recognized, the link to development will not be so difficult.

Central to the Millennium Development Goals (MDGs) set out by the United Nations in 2000, and used in shaping, guiding and developing policies, are gender equity and poverty reduction (MDG 1 and 3, respectively) [89]. A subset of these goals is recognizing the role of women in fisheries—a substantial yet overlooked contribution in many countries and regions. Here we focused our quantitative assessment on the small-island developing countries of Oceania, and how women contribute to overall food and nutritional security, and the value and economic impact of these contributions. While this represents only one region, and the relative contribution may differ from one region to the next, many of the issues of marginalization are widespread and deserve attention not only on a regional level but on the global stage.

Almost two decades ago, the United Nations developed a set of indices for measuring gender equity and estimate progress in narrowing the gap *i*. In many parts of the world, greater gender equity has been achieved; however, in other parts of the world, major disparities exist in both the contribution of women to economies, their recognition and the disproportionate burden women carry [16]. The crucial and unique role women play in health, nutrition, population, and poverty reduction requires that their role be examined in all sectors of society. Here, we have focused on their important, yet under-represented role in fisheries, as part of a larger attempt to reduce gender inequalities. Unlocking the potential of women as full political, economic and social partners in all sectors will undoubtedly contribute positively to development, improving living standards and the health of the global population.

## 5. Conclusion

The contribution women make to fisheries, both directly and indirectly, is often overlooked in fisheries management, economic analyses, and consequently, in policy decisions. Here, women's involvement in fisheries is quantified, focusing on their contribution to total catch and the value added to the economy for Pacific small-island countries. While this quantitative assessment focuses on the Pacific region, and was limited to the capture aspect of fisheries, women's involvement in fisheries is widespread throughout the world. Their roles range from catching and processing fish, to the sale and finance aspects of this industry. In many societies, women contribute significantly to regular protein availability in their families, and/or add substantial economic value to fish caught and landed by men through their control of processing and marketing activities. Quantifying and fully recognizing this contribution will promote the empowerment of women, increase their participation in management and stewardship, and address issues of food security and development.

Some specific management and policy recommendations identified in this paper include better utilization of women's ecological knowledge in fisheries management, particularly in developing policies concerning biodiversity, conservation and climate change; a need to highlight women's indirect inputs to the economy and unpaid work as a way to better understand the overall dynamics of

<sup>4</sup> Although their contributions often go unpaid and unrecognized, women play a fundamental role as caregivers, food producers, etc. With greater gender equality, women are healthier, better educated, have improved access to jobs and financial resources, all of which contribute toward Millennium Development Goals such as poverty reduction [86].

fisheries economies; collection of gender-specific fisheries participation data and improved inclusion of women in decision-making processes; and making the link between women's contributions to fisheries, and development on a broader scale as women play a key role in health, nutrition, and poverty reduction. Women's participation in fisheries, much like their role as gatherers in hunter-gatherer societies, is an often undervalued role. Yet, it is women who provide, on a consistent basis, much of the seafood consumed by their families and in the wider society.

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