Chapter 15. Social and Economic Aspects of Sea-Based Food and Fisheries

Contributors: Ratana Chuenpagdee, Patrick McConney, and Gordon Munro;

Beatrice Ferreira, Enrique Marschoff, Jake Rice, Andrew Rosenberg (Group of experts)

1. Introduction

Fish are one of the most internationally traded foods, and the value of global fish trade exceeds the value of international trade of all other animal proteins combined (World Bank, 2011). In 2012, international trade represented 37 per cent of the total fish production in value, with a total export value of 129 billion United States dollars, of which 70 billion dollars constituted developing countries' exports (FAO, 2014). Estimates indicate that small-scale fisheries contribute about half of global fish catches (FAO, 2014; HLPE, 2014). When considering catches destined for direct human consumption, the share contributed by the subsector increases, as small-scale fisheries generally make broader direct and indirect contributions to food security through affordable fish and employment to populations in developing countries.

This chapter, in addressing the economic and social aspects of marine fisheries, examines both macro and micro issues. The macro issues considered are some aspects of the economics of marine capture fishery. Among the micro issues explored are local to regional socioeconomic effects, competition for space between various ocean activities and user groups, the relationship between capture fisheries and aquaculture, and gender issues in fisheries and aquaculture.

The contribution of small-scale fisheries has been increasingly recognized as a major factor for food security and livelihoods at household and community levels, particularly for poor communities around the world. Information on small-scale fisheries is often not captured in national statistics as a result of difficulties due to many factors, including their socioeconomic complexity and the highly dynamic nature of their operation (Chuenpagdee, 2011). Numerous initiatives around the world reflect their importance, including those led by FAO in the development of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries.[1]

2. Marine Capture Fisheries Social and Economic Value

The global marine capture fisheries harvest expanded rapidly from the early 1950s, and is currently estimated to be about 80 million tons per annum (see Chapter 11 and FAO,

[1] The Guidelines have recently been adopted at the 31st Session of the Committee on Fisheries, June 2014. The final text is available at www.fao.org.

2014). This harvest is estimated to have a first value (gross) in the order of 80 billion US dollars (World Bank and FAO, 2009). Although it is difficult to produce accurate employment statistics, capture fisheries provide, direct and indirect employment, for at least 120 million persons worldwide (*ibid*.).

Global and regional fishery catch statistics in most cases do not distinguish between large scale and small-scale fisheries, so the small-scale sector is often poorly covered in official statistics and chronically under-evaluated in general. The Big Numbers Project (BNP)[2] carried out case studies in populous developing countries and the results from these case studies, together with other available information, formed the basis for a first disaggregated review of the fisheries sector as a whole (WorldFish Center, 2008). Tentative estimates were calculated for developing countries at 28-30 million MT/year for marine fisheries. This represents half of the catch in those countries, of which 90-95 per cent is destined for domestic human consumption. Those figures highlight the importance of small-scale fisheries for food security in developing countries.

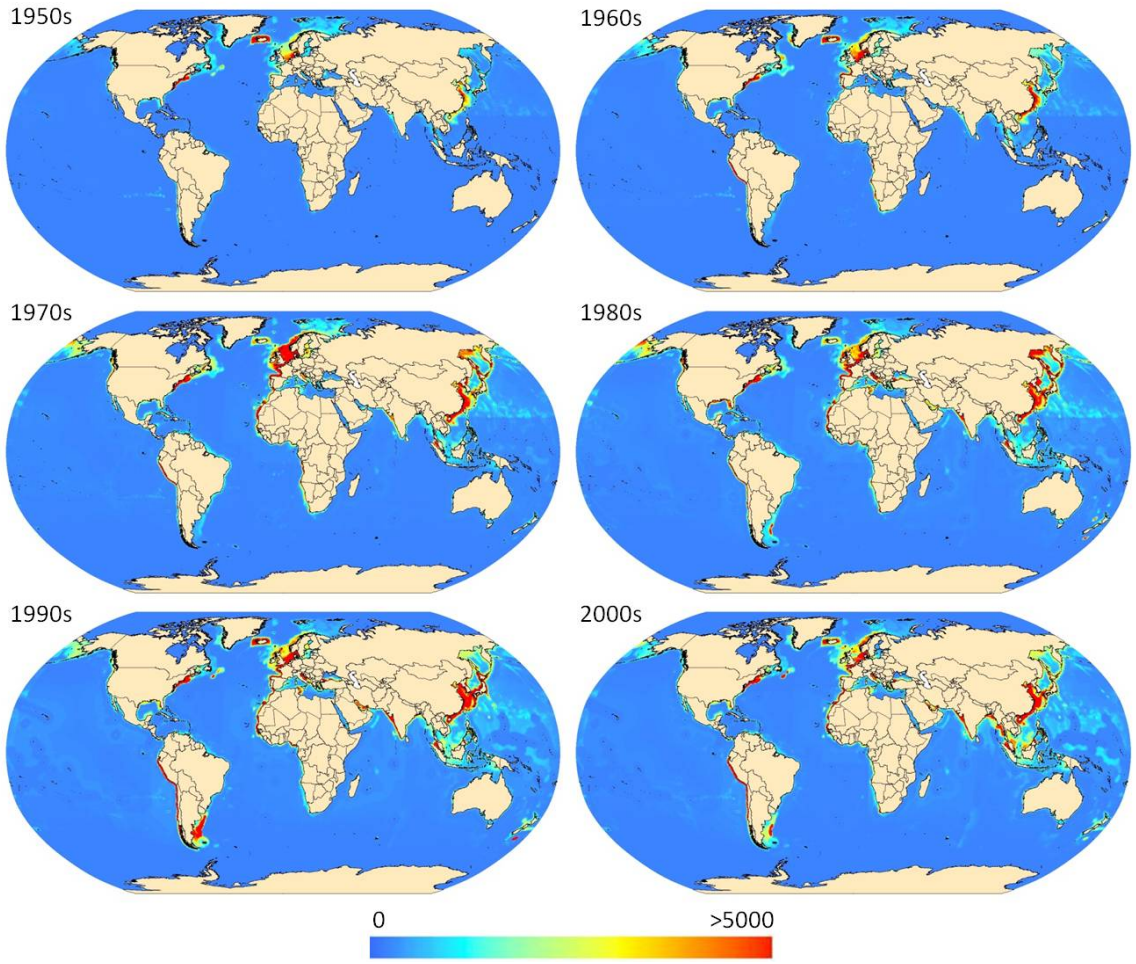
Small-scale fisheries employ more than 90 per cent of the world's capture fishers and fish workers, about half of whom are women. In addition to employment as full- or part-time fishers and fish workers, seasonal or occasional fishing and related activities provide vital supplements to the livelihoods of millions. These activities may be a recurrent sideline activity or become especially important in times of difficulty. Many small-scale fishers and fish workers are self-employed and engaged in directly providing food for their household and communities as well as working in commercial fishing, processing and marketing (FAO, 2014).

The quality of such employment is increasingly seen as an important social and economic aspect of fisheries as attested to by the attention to decent work in the FAO Voluntary Guidelines on Securing Small-Scale Fisheries (SSF Guidelines) that draws from several international instruments concerning, gender, child labour, workers' rights and the like. Much of this labour is linked directly, through short value chains, to providing critical income along with food and nutrition security, especially in rural coastal communities.

Over time, there has been a shift in the relative scale and geography of capture fisheries. In the 1950s, capture fisheries were largely undertaken by developed fishing States in the northern hemisphere. Since then, developing countries increased their share of the total. Consider Figure 1, which presents geo-referenced distributions of decadal averages of annual landed values of the world's fisheries and highlights the southward and offshore expansion of the fishing grounds over time (Swartz et al., 2013). Although the two hemispheres do not reflect developed vs. developing fishing States precisely, the figures are, nonetheless, indicative. In the 1950s, the Southern hemisphere accounted for no more than 8 per cent of landed values. By the last decade,

[2] This is a joint activity of FAO and the WorldFish Center and funded through the World Bank's PROFISH1 Partnership.

the Southern hemisphere's share had risen to 20 per cent of the total. This change likely resulted from a combination of factors including transfer of fishing effort from north to south, overall increases in fisheries in the south and improvement in reporting systems. Nevertheless, the relative contribution to global landings from the two hemispheres has changed.



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 1. Spatial distribution of average annual landed values (2005 United States dollars per square kilometre per year) by decade (from Swartz et al 2013; with permission of Springer).

In terms of volume, the shift seen in Figure 1 is even more striking; as shown in Figure 2, the top ten capture fisheries producers include seven developing countries[3].

Indeed, net exports of fish and fishery products from developing countries have grown significantly in recent decades, rising from 3.7 billion dollars in 1980 to 18.3 billion

dollars in 2000, 27.7 billion dollars in 2010, and reaching 35.1 billion dollars in 2012. For Low-Income Food-Deficit Countries (LIFDCs) net export revenues amounted to 4.7 billion dollars in 2010, compared with 2.0 billion dollars in 1990 (HLPE, 2014). The share of exports from developing countries is close to 50 per cent (value) and 60 per cent (in volume of live weight equivalent) of global fish exports (FAO, 2012).

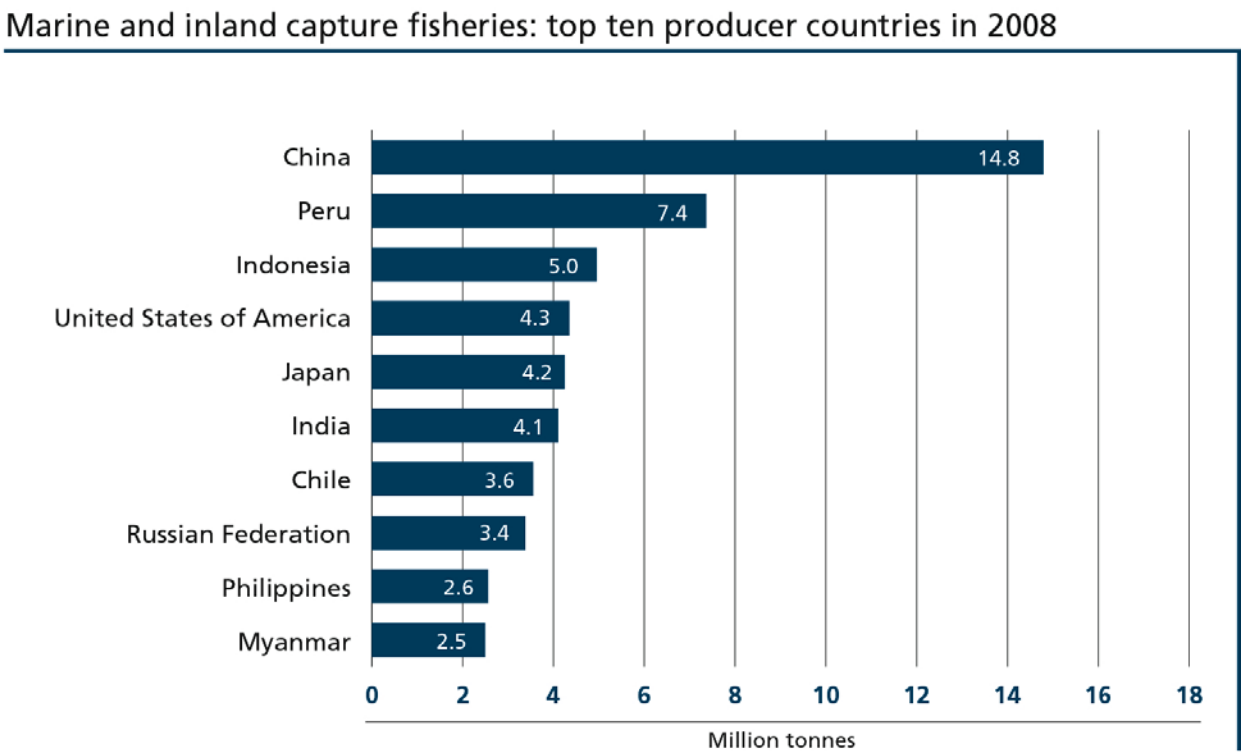


Figure 2. From FAO, 2010.

This also reflects the impacts of globalization of fish markets, which have grown at an accelerating rate in the last decades. This has been viewed either as positive or negative, depending on the value systems used (Taylor et al., 2007). Although fish trade contributes to food security through the generation of revenues, adverse effects by international trade on the environment, small-scale fisheries culture, livelihoods and special needs related to food security are a matter of concern. Articulation with global demand may provide incentives to overexploit or waste resources, endanger the lives of fisherfolk, change cultural traditions and more – much of which can be unintended – shark finning, spiny lobster dive fisheries, and sea cucumber fisheries are examples. Small-scale fisheries stakeholders cannot often adapt to, and benefit equitably from, opportunities of global market trends (FAO, 2014-consultation). Also, there have been evidences that when global figures are considered, although there is quantity equivalence in trade, a quality exchange also takes place, with developing countries

exporting high-quality seafood in exchange for lower quality seafood (Asche et al., 2015).

Regarding the trends in world marine capture fisheries, production has levelled off as the capacity of the ocean to produce ongoing harvest is approached (FAO, 2014- SOFIA). Overall production might be increased however, if overfished stocks are rebuilt and fisheries and ecosystems are used more sustainably. This requires overall reductions in exploitation rates, achievable through a range of context dependent management tools (Worm et al., 2009).

As noted in Chapter 11, global fisheries agreements and the FAO generally utilize the concept of Maximum Sustainable Yield (MSY) as a reference point for gauging whether a fishery resource is fully exploited, overexploited, and less than fully exploited. According to this reference point, FAO classifies the status of marine capture fishery resources (Table 1).

Table 1. Status of World Marine Capture Fishery Resources 2011. Source: FAO, 2014, p.7.

Status	**Percentage**
Less than fully exploited	10
Fully exploited	61
Overexploited	29

In the beginning of the 1950s, fully exploited and overexploited fishery resources *combined* accounted for less than 5 per cent of the total. Over 95 per cent fell into the less than fully exploited category (FAO, 1997, p. 7).

Over the following 25 years, the percentage of overexploited marine capture fish stocks rose to 10 per cent of the total. The percentage of these overexploited stocks then increased alarmingly from 10 to 26 per cent between the mid-1970s and the end of the 1980s. That percentage has continued to increase, but at a much slower pace (FAO, 2014).

The FAO states that:

> "[…] the declining global marine catch over the last few years together with the increased percentage of overexploited fish stocks […] convey the strong message that the state of world marine fisheries is worsening […] which leads to negative social and economic consequences" (FAO, 2012, p.12).

Further, these analyses of individual stocks do not fully account for the broader, ecosystem-level effects of fisheries exploitation that may be hindering future productivity in various ways, such as loss of habitat, or impacts on food webs and ecological functions needed to continue to produce desirable fish for harvest. There are

two inter-related general considerations regarding management of these ecosystem-level effects: 1) the potential impacts of fisheries themselves on the ecosystems, in order to maintain overall ecosystem function including productivity, usually referred to as ecosystem-based fishery management (FAO, 2003); 2) the interaction of fisheries with other sectors of human activity and consideration of the cumulative impact of all sectors on marine ecosystems, usually referred to as ecosystem-based management (McLeod and Leslie, 2009).

The discussion here and in Chapter 11 on full exploitation and overexploitation of capture fishery resources was essentially cast in biological terms. When examined in economic terms, the situation portrayed in Table 1 implies a loss in the potential of economic returns accruing to society from capture fisheries compared to the situation where all fisheries were managed to maximize economic benefits. The maximum economic yield (MEY), when adopted as a reference point, is more conservative and reached at lower fishing effort levels than the MSY, the latter argued to be used as an upper limit rather than a management target (Worm et al., 2009; Froese and Proelß, 2010).

Translated into monetary terms, the figures in Table 1 have been estimated in some analyses to cost to the world economy in the order of 50 billion dollars per year in lost resource rent (World Bank and FAO, 2009). This implies that, the economic return from marine capture fisheries could be improved compared to the current situation. If other incentives such as subsidies of the fisheries sector are taken into account, there are some estimates that this global economic return amounts to *minus* 5 -12 billion dollars per year (World Bank and FAO, 2009; Munro, 2010; Sumaila et al., 2012). Some estimates of world fishery subsidies are in the order of 25-30 billion dollars per year (Sumaila, et al., 2010). Other estimates are of lower levels of subsidies (Cox and Schmidt, 2002). The differences may be largely due to definitional issues with regard to what is considered to be a subsidy in the different analyses.

This is not to say that all world capture fisheries are yielding negative economic returns. Clearly several capture fisheries are yielding positive, and in some cases large positive, net economic returns. From a global perspective, however, the positive returns from these fisheries are more than offset by those yielding negative net economic returns. No clear divide between developed and developing fishing States is observed. (Sumaila et al., 2012, p.3).

From an economic standpoint, the extent of the capture fishery's resource depletion shown in Table 1, which was due to the rapid expansion of the world capture fishing industry over several decades, involved the running down of world's stock of the capture fishery's natural capital.

Rebuilding capture fishery resources requires reducing harvests below the net growth rates of the fish stock. As the resources grow, potential resource rent can be expected to emerge, which must go unrealized in all or in part, if the resource investment is to continue – hence the cost. Using a 50-year time horizon, Sumaila et al. (2012) estimate that after 12 years of resource investment, the net economic returns from the

investment would begin to outweigh the costs. Over the 50-year period, the returns would far outweigh the costs[4] (Sumaila, et al., 2012). Economic and technical considerations that arise in rebuilding fisheries were explored in additional detail in an Organisation for Economic Co-operation and Development workshop (OECD, 2012).

3. Issues in Regulation of Marine Capture Fisheries

It has now long been recognized that the inherent difficulties in regulating marine capture fishery resources are a problem of scope and management objectives in the decision-making process, and are often framed as the well-known "Tragedy of the Commons" (Hardin, 1968). When access is open to all for exploitation, incentives are created that promote inefficiencies, including: (1) loss of economic "rent" because of the "race to fish", (2) high transaction and enforcement costs incurred to reduce overuse and (3) low productivity, because no one has an incentive to work hard in order to increase their private returns (Ostrom, 2000). All of these factors reduce the net economic return from fisheries. The management of common property requires a minimum set of rules, defining access conditions and conservation measures to ensure sustainability and economic returns.

Where social, economic, and governance circumstances allow effective management of entry into a fishery and effort by those allowed to participate, substantial progress can be made at improving both the ecological and economic performance of a fishery, but often at the cost of few people receiving employment. On the west coast of Canada, for example, a move to Individual Transferrable Quotas in a complex, multispecies fishery for rockfish (*Sebastes* spp) resulted in improved stock status for the entire complex, and particularly reduced catches of the stocks most in need of reduced fishing mortality, while improving economic returns to the fishery. However, the fleet size and employment dropped by nearly half from the period before the programme was introduced (Rice, 2003; Branch, 2006; Branch and Hilborn, 2008).

In the context of fisheries, management efforts also need to take into consideration how the legitimacy of rules and regulations may be perceived differently when applied to large- vs. small-scale. The majority of the world's fisheries comprise small-scale, multi-species, multi-gear, commercial fishing vessels, operating in all bodies of water (inland, brackish and marine), both near urban centres and in remote areas. Their operation involves family members, in pre-harvest, harvest and post-harvest parts of the fish chain. Women and children often participate in the fisheries. Small-scale fisheries catches are landed relatively close to where fishing occurs and are distributed through various channels. A certain portion is generally sold to local markets or to intermediaries by family members and some remains for household consumption. These characteristics of the fisheries imply that they require different management approaches than large-scale, industrialized fisheries. As at least half of the world's fish

catches derive from small-scale fisheries, success in fisheries management needs to be demonstrated, not only where large-scale fisheries dominate, but also in the small-scale sector, with its high potential to address global food security.

Community-based resource management has been shown to be effective in establishing fishery rules (Berkes, 2005). Cinner and Aswani (2007), however, found that customary management was effective in smaller, remote communities with high levels of equality, but it is susceptible to economic pressures and by fishermen who do not practice customary fishing traditions.

4. Impacts of Illegal, Unreported, and Unregulated (IUU) fishing

There are additional economic and social considerations related to IUU fishing (see also Chapter 11). It is a complex phenomenon involving vessel owners, vessels, crew, flag State authorities and logistics. Often IUU vessels are related, through ownership, to authorized vessels obtaining cover to sell their catches.

Marine Resources Assessment Group (2005) states that the most obvious impact of IUU fishing is direct loss of the value of the catches that could be taken by the coastal State if the IUU fishing was not occurring. This is mostly from vessels operating without licences and licensed vessels misreporting catches (quantity, species, fishing area, etc.) and illegal trans-shipment of catches. Secondary economic impacts from the loss of fish to IUU vessels may include reduced revenue from seafood exports and reduced employment in the harvest and postharvest sectors. Reduced fishing port activity has a ripple or multiplier effect across economies, adversely affecting labour and transportation as well as the manufacturing sector.

IUU fishing may also increase poverty and reduce food security and food sovereignty. Conflict between authorized, compliant vessels and IUU vessels is common in some fisheries and can become violent with threats to both life and livelihoods on a large scale. Armed resistance to surveillance and enforcement is increasing in some locations with the potential to undermine all monitoring, control and surveillance (MCS) as resources are allocated to address what may be seen as a threat to national security rather than fisheries management. It can be noted that conflicts and IUU fishing generally occur between vessels of any size. There may also be gender and socio-cultural effects, depending upon the composition of the harvest and post-harvest labour forces.

5. Space-use conflicts: industrial capture fisheries vs. artisanal capture fisheries; aquaculture vs. artisanal capture fisheries

Due to recent improvements in technology and affordability, vessel monitoring systems (VMS) are increasingly available for both large- and small-scale fishing vessels, and thus can provide geo-referenced data that accurately describe fishing areas on geographic scales applicable to MSP. Combined with validated logbook data, rich time-series data are potentially available from intensely fished and monitored sea areas in developed countries. The data situation is slowly improving in developing countries. Land tenure systems that extend to parcels of seabed and water for aquaculture also provide clear boundaries. Superimposed on these spaces are increasingly sophisticated layers of information on the interactions among fisheries, and between aquaculture and fisheries. Although not all fisheries conflicts concern spatial use, or can be managed through MSP, many are potential candidates for spatial conflict management.

Sources of conflict between large and small-scale fisheries are a well-reported concern (FAO, 2014). Spatial components of conflict concern:

- Sea tenure and territorial use rights
- Fishery resource allocations by site
- Fishing gear and method interactions
- Ecosystem (species) interactions
- IUU fishing (several aspects)
- Port access and market transactions
- Management jurisdiction and governance

Sources of conflict between fisheries and aquaculture with spatial components concern:

- Sea tenure and territorial use rights
- Natural resource allocations by site
- Fishing interactions with infrastructure
- Ecosystem (species) interactions
- Area access and market transactions
- Management jurisdiction and governance

The lists are quite similar, although the specific nature of the conflicts varies greatly between the lists and site-specific situations. The next section looks more closely at fisheries-aquaculture conflicts (see also Chapter 12).

Cataudella et al. (2005) note that the FAO (1995) Code of Conduct for Responsible Fisheries (CCRF) defines the global framework in which marine aquaculture and capture

fisheries are to be considered as interactive parts of the same system. The assessment of such interactions is crucial for implementing the CCRF, especially in areas where the use of the coastal zone results in conflicts between many resource users competing for space (e.g. fisheries, aquaculture, tourism, shipping, energy). The CCRF treats aquaculture as an important part of the fisheries system to be responsibly developed and managed for sustainability (FAO, 1999), but in the nearly two decades that have intervened, this has proven to be challenging.

The relationships between marine aquaculture and capture fisheries can be complex, operating at multiple levels of governance and crossing several spatial and temporal scales, affecting different points along value chains, as well as ecosystems or target and culture species in a variety of ways. Cataudella et al. (2005) categorize the conflict interactions as old and new, somewhat based arbitrarily on the currency of the topic.

Old interactions are issues generated by the:

- Allocation of public financial resources
- Likelihood of disease spreading and new outbreaks
- Environmental pollution
- Employment threats and opportunities
- Introduction of exotic or invasive species
- Need for stocking programmes
- Ownership of resources and of confined environments
- Use of wild seed to supply aquaculture
- Use of fishery products to supply the fish-feed farming industry.

New interactions are issues concerning the:

- Stocking and restocking models
- Genetic origin of cultured organisms
- Biodiversity conservation and value
- Genetic improvement through breeding programmes and genetic engineering
- Development of aquaculture in sensitive environments
- Direct impact of farmed products on markets and prices
- Growing role of aquaculture in meeting the demand for fishery products
- Product quality and labelling
- Feasibility of capture fisheries and aquaculture within a sustainable system.

The above interactions are most in need of conflict management through legislation and policy related to planning for integrated coastal zone management and marine spatial

planning. However, considerable guidance is available on appropriate approaches that include conflict management (e.g. Ehler and Douvere, 2009) as well as enabling policy (e.g. EU Marine Strategy Framework Directive).

Marine spatial planning (MSP) is the public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process (Ehler and Douvere, 2006). It is linked to ecosystem-based management (EBM) (see McLeod and Leslie, 2009), the ecosystem approach to fisheries (EAF) (see FAO, 2003), marine protected areas (MPAs) (FAO report on MPAs and Fisheries, 2011) and similar endeavours that have the potential to assist in managing conflicts through participation among diverse stakeholders (Ehler and Douvere, 2009). Managing space use conflicts between large- and small-scale fisheries and with other sectors is an increasingly important issue in many parts of the world.

6. Gender in fisheries

On a global level, fisheries are often perceived as male-dominated, laden with culturally stereotypical images of fishermen. The term “fishing industry”, for example, conjures an image that focuses attention on harvest and men’s work more than the term “seafood industry” which is more equitable (Aslin et al., 2000). The involvement of women is now reflected by the increasing use of gender-neutral terms such as “fisher” and “fisherfolk”, and more international discussion of gender (Williams et al., 2005). Yet recent global investigation has shown that if post-harvest (e.g., fish processing and trade) and ancillary activities (e.g., fishing inputs and financing) are taken into account, then the gendered image is quite different. Overall, women may be in the majority in fisheries, or nearly so (FAO et al., 2008). This does not take into account the growing number of women engaged worldwide in fisheries policy, planning, management, science, education, civil society advocacy and other activities related to fisheries that were previously more male-dominated.

The post-harvest situation is particularly inequitable. Women outnumber men in fish processing and trading across the world, but their informal sector activities are often not recorded, and they are invisible in national labour and economic statistics. Thus the socioeconomic contribution of women to fisheries is underestimated at national and global levels. Only a few countries in the developing world collect and use gender-disaggregated statistical data and other information data for fisheries policy and planning (Weeratunge and Snyder, 2009). Without comparative data for women and men, it is difficult in most places to determine the disparity between female and male socioeconomic activities and well-being. This scarcity of gender-disaggregated fisheries data constrains gender-sensitive policies and mainstreaming, with little action taken to address the disadvantageous position of women (Sharma, 2003).

It is widely accepted in the developing world that women strongly influence the social, economic and cultural aspects of fishing households and the industry as a whole. There are increasing numbers of women in technical, scientific and managerial fisheries jobs around the world, but this varies markedly by region. In some societies where men engage in the most conspicuous fisheries-related socioeconomic and political activities, the women are labelled “fisher wives”, but the implied subordination is misleading (Weeratunge and Snyder, 2009). In Ghana, “fisher wives” or “fish mammies” support the entire small-scale fishing industry as they invest in fishing boats and gear, and provide loans to husbands and other fishers while running small socioeconomic empires without formal political power (Walker, 2001). Although addressing gender-inequity is critical, interventions need to be carefully designed. ‘Women in development’ projects have contributed to reducing the real power that women held, for example, by introducing poorly designed credit and fish marketing schemes that exacerbate unsustainable fishing for short-term monetary gain or loan servicing.

Small-scale fisheries in developed and developing countries have striking similarities. In both, gender issues are often overlooked or misunderstood because of an analytical focus that looks at the fisheries sector in isolation from the broader society, and is concerned primarily with narrow ecological and economic factors such as maintaining fish stocks to ensure a viable long-term harvest. Interventions have been directed more at men harvesting at sea, rather than at women engaged in postharvest on shore, or at the interconnections between harvest and postharvest (Weeratunge and Snyder, 2009). Although this narrow, male sectoral perspective is changing as the EAF becomes more widely adopted (FAO 2003), gender is not yet mainstreamed into this approach despite advances in incorporating other social, cultural and institutional dimensions (De Young et al, 2008). EAF is just one facet of the changing face of fisheries governance. Gender issues are more appropriately considered in the wider context of fisheries governance than fisheries management.

Gender remains a key governance issue in both developed and developing countries. Its many interconnected dimensions relate to vulnerabilities, assets, opportunities, capabilities, coping strategies, outcomes, food security, empowerment and more. With new attention to sustainable development goals based on blue and green economies, gender in fisheries should feature more prominently. State and civil society agencies realize that well-being will not be improved and poverty will not be reduced if gender is not adequately addressed. Gender mainstreaming should be an integral part of fisheries, but this is not occurring, because gender research to support fisheries policy is insufficient. As the links between gender in fisheries and poverty, climate, health and other major developmental issues become apparent (Bene and Merten, 2008; Bennett, 2005; FAO, 2006; Neis et al., 2005), more attention will need to be paid to gender in fisheries in the context of the development post-2015 agenda.

Certain issues, particularly at the micro level, demand additional research. The state of small-scale fisheries throughout the world, and gender issues in fisheries are particularly prominent. A further issue that has been seriously under-researched is that of the relationship between capture fisheries and aquaculture.

7. Climate change and small-scale fisheries

Pollution, environmental degradation, climate change impacts and natural and human-induced disasters pose serious challenges to fisheries sustainability. Because of the heavy reliance on fisheries for food security, employment and livelihoods, these factors become additional threats facing small-scale fishing communities (FAO, 2011-2015).

Expected impacts of climate change include increase in the severity and intensity of natural disasters and changes in the local distribution and abundance of harvested fish and shellfish populations (Barange et al., 2014), with consequences on the post-harvest and trade (FAO, 2011-2015; HPLE, 2014). Impacts of climate change are predicted to be more severe where the relative importance of fisheries to national economies and diets is higher and there is limited societal capacity to adapt to potential impacts and opportunities (Allison et al., 2009). The severity of threats increases due to combined effects of climate change and ecosystem degradation and overfishing, highlighting the importance of appropriate co-management measures (HPLE, 2014).

A comprehensive understanding of how communities respond to these threats and other global change, in their environmental, social and political contexts, is required (Bundy et al., 2015). These issues are also treated in the Summary (under Impacts of the Climate Changes).

8. Specific additional issues raised in regional workshops for the World Ocean Assessment

Fisheries management requires time-consuming and dedicated human resources and failure to meet or prioritize these efforts is a widespread problem, leading to poor fisheries management. During the regional workshops for this World Ocean Assessment it became apparent that lack of data, including difficulties in maintaining data collection and conducting stock assessments, as well as obtaining fishery-independent data, was an issue for all developing countries. Problems with databases and data integration, due to different methods of data collection and lack of long time-series, were raised in all regions. Lack of data on the small-scale, as well as recreational fisheries, was a problem in developed and developing States. In particular, catches from subsistence fishing are often missing from national catch statistics, leaving a gap in the ecological, social and economic aspects of fisheries. Ecosystem-based management is seldom applied due to the lack of practical examples and applications, and difficulties in assessing ecosystem impacts.

Fish is one of the most internationally-traded foods. This has an impact on the infrastructure needed to commercialize the product, especially given the fact that fish is a perishable commodity. The difficulties to adapt to international-market requirements -

including means to abide by regulations - and the lack of fish preserving and processing facilities was a recurring issue, especially in developing countries that are near, or trade often with, developed countries.

Contamination of fish products as well as the effects on catches caused by pollution and habitat degradation were raised at the workshops. Developing countries reported difficulties in assessing those risks and monitoring those impacts. The main focus of fish certification has been eco-labelling that addresses environmental sustainability issues. With limited exceptions, certification concerns predominantly developed countries and large-scale fisheries. Fish certification is progressively moving to include social responsibility and labour considerations, but it is unclear whether food security and nutrition considerations can or will be included in future.

9. Conclusion

Fisheries around the world are deeply embedded in the issues of food and economic security, livelihoods for large numbers of people, gender equity and poverty alleviation. Both large and small-scale fishery operations provide essential economic and social benefits to society. Small-scale fisheries, in particular, constitute half of the world's total catches and involve more than 90 per cent of total fishing population (in harvest and post-harvest activities). The significant contribution to food security, livelihoods and local economic development means that small-scale fisheries can no longer be overlooked. Instead, management and governance of fisheries needs to incorporate key features distinguishing small-scale fisheries from their large-scale counterpart. This implies changes in information systems, fisheries assessment, monitoring and surveillance, and research and development. Importantly, issues related to fishing rights, tenure and access to resources, health and safety, gender and social justice, among others, deserve special attention in policy and decision-making. Finally, it is worth noting that small-scale fisheries governance would have different priorities, focusing for instance on stakeholder participation and subsidiarity principles. Tension and conflicts between different scales of operations, and with other marine activities, will continue to challenge policy-makers in many areas. They can be overcome, however, with an attempt to create policy coherence through a holistic and integrated approach to fisheries governance. During the regional workshops the need to improve the capacity of States to more effectively manage these critical resources, and in particular in regions where sustainability of fisheries needs to be improved, was recognized. The need to build capacity is also essential to address issues of equity and broader sustainable development efforts.

References

Allison, E.H., Perry, A. L., Badjeck, M.-C., Adger, W. N., Brown, K., Conway, D., Halls, A.S., Pilling, G.M., Reynolds, J.D., Andrew, N.L., and Dulvy, N.K. (2009). *Vulnerability of national economies to the impacts of climate change on fisheries*. Blackwell Publishing Ltd, FISH and FISHERIES. Available from http://www.uba.ar/cambioclimatico/download/Allison%20et%20al%202009.pdf. Accessed on: 14 July, 2015.

Asche, F., Bellemare, M.F., Roheim, C., Smith, M.D., & Tveteras, S. (2015). Fair Enough? Food Security and the International Trade of Seafood. *World Development*, *67*, 151-160.

Aslin, H.J., Webb, T. and Fisher, M. (2000). *Fishing for Women: Understanding Women's Roles in the Fishing Industry*. Canberra: Bureau of Rural Sciences.

Barange, M., Merino, G., Blanchard, J. L., Scholtens, J., Harle, J., Allison, E.H., Allen, J.I., Holt, J., and Jennings, S. (2014). Impacts of climate change on marine ecosystem production in societies dependent on fisheries. *Nature Climate Change 4:* 211-216. Available from http://www.nature.com/nclimate/journal/v4/n3/full/nclimate2119.html?message-global=remove. Accessed on: 14 July, 2015.

Bene, C. and Merten, S. (2008). Women and Fish-for-Sex: Transactional Sex, HIV/AIDS and Gender in African Fisheries. *World Development* 36: 875-899.

Bennett, E. (2005). Gender, Fisheries and Development. *Marine Policy* 29: 451-459.

Berkes, F. (2005). Why keep a community-based focus in times of global interactions? Keynotes of the 5th International Congress of Arctic Social Sciences (ICASS), University of Alaska Fairbanks, May 2004. Topics in *Arctic Social Sciences 5*: 33-43.

Branch, T.A. (2006). Discards and revenues in multispecies groundfish trawl fisheries managed by trip limits on the US West Coast and by ITQs in British Columbia. *Bulletin of Marine Science* 78: 669-689.

Branch, T.A. and R. Hilborn (2008) Matching catches to quotas in a multispecies trawl fishery: targeting and avoidance behavior under individual transferable quotas. *Canadian Journal of Fisheries and Aquatic Sciences* 65: 1435-1446.

Bundy, A., Chuenpagdee, R., Cooley, S. R., Defeo, O., Glaeser, B., Guillotreau, P., Isaacs, M., Mitsutaku, M. and Perry, I. (2015). A decision support tool for response to global change in marine systems: the IMBER-ADApT framework. *Fish and Fisheries*. DOI: 10.1111/faf.12110.

Cataudella, S., Massa, F., and Crosetti, D., eds. (2005). *Interactions between Aquaculture and Capture Fisheries: A Methodological Perspective*. FAO, Studies and Reviews. General Fisheries Commission for the Mediterranean; 78. Rome.

Chuenpagdee, R. **(**2011). A matter of scale: prospects in small-scale fisheries. In Chuenpagdee (ed.). *Contemporary Visions for World Small-Scale Fisheries.* Eburon, Delft.

Cinner, J. and Aswani, S. (2007). Integrating Customary Management into Marine Conservation. *Biological Conservation* 140 (3/4): 201-216.

Cox, A. and Schmidt, C.-C. (2002). *Subsidies in the OECD Fisheries Sector: A review of recent analysis and future directions*. Background paper for the FAO expert consultation on identifying, assessing and reporting on subsidies in the fishing industry; 3.6.

De Young, C., Charles, A., and Hjort, A. (2008). Human Dimensions of the Ecosystem Approach to Fisheries: An Overview of Context, Concepts, Tools and Methods. *FAO Fisheries Technical Paper*. No. 489. Rome.

Ehler, C., and Douvere., F. (2006). *Visions for a Sea Change*. UNESCO, Intergovernmental Oceanographic Commission. Paris.

Ehler, C., and Douvere., F. (2009). *Marine Spatial Planning: A Step-by-Step Approach Toward Ecosystem-Based Management*. UNESCO, Intergovernmental Oceanographic Commission, Paris.

FAO (1995). *Code of Conduct for Responsible Fisheries*. FAO, Rome.

FAO (1997). *Review of the State of World Fishery Resources: Marine Fisheries*. FAO Fisheries Circular No. 920, Rome.

FAO (1999). *Indicators for Sustainable Development of Marine Capture Fisheries*. FAO Technical Guidelines for Responsible Fisheries, Rome.

FAO (2003). *The Ecosystem Approach to Fisheries*. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2, Rome.

FAO (2006). *Gender Policies for Responsible Fisheries*. FAO, Rome. (*See also* links from http://www.fao.org/fishery/topic/16605/en).

FAO (2010). *The State of World Fisheries and Aquaculture 2010*. FAO, Rome.

FAO (2011). *Marine protected areas and fisheries*. FAO Technical Guidelines for Responsible Fisheries, No. 4, Suppl. 4, Rome.

FAO (2012). *The State of World Fisheries and Aquaculture 2012*. FAO, Rome.

FAO (2014). *The State of World Fisheries and Aquaculture 2014*. FAO, Rome.

FAO (2011-2015). Small-scale fisheries - Web Site. Voluntary Guidelines on Securing Sustainable Small-Scale Fisheries [SSF Guidelines]. FI Institutional Websites.In: *FAO Fisheries and Aquaculture Department* [online]. Rome. Updated 15 April 2014. http://www.fao.org/fishery/ssf/guidelines/en

FAO, WorldFish, and World Bank (2008). *Small-scale Capture Fisheries - A Global Overview with Emphasis on Developing Countries: A Preliminary Report of the Big Numbers Project*, Rome and Penang.

Froese, R., and Proelß, A. (2010). Rebuilding fish stocks no later than 2015: will Europe meet the deadline? *Fish and fisheries* 11.2: 194-202.

Hardin, G. (1968). The Tragedy of the Commons. *Science,* Vol. 162 no. 3859: 1243-1248.

HLPE, 2014. Sustainable fisheries and aquaculture for food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2014.

Kronbak, L.G., and Lindroos, M. (2006). An Enforcement-Coalition Model: Fishermen and Authorities Forming Coalitions. *Environmental and Resource Economics* 35: 169-194.

Marine Resources Assessment Group Ltd (2005). *Review of Impacts of Illegal, Unreported and Unregulated Fishing on Developing Countries*, Synthesis Report, prepared by MRAG for the UK's Department for International Development (DFID), with support from the Norwegian Agency for Development Cooperation (NORAD).

McLeod, K.O. and Leslie, H. (eds). (2009). *Ecosystem-based management for the oceans*. Island Press, Washington, D.C. USA. 392p.

Munro, G. (2010). *From Drain to Gain in Capture Fishery Rents: A Synthesis Study.* FAO Fisheries and Aquaculture Technical Paper No. 538, Rome.

Munro, G. (2011). On the Management of Shared Living Marine Resources, *Proceedings of the Danish Conference on Environmental Economics 2011*. Available from: http://www.dors.dk/graphics/SynkronLibrary/Konference%20201/Abstracts/Munro_paper.pdf. Accessed on: 6 August, 2014.

Munro, G., Van Houtte, A., and Willmann, R. (2004). *The Conservation and Management of Shared Fish Stocks: Legal and Economic Aspects. FAO Fisheries Technical Paper* No. 465, Rome.

Munro, G., and Sumaila, U.R. (2011). *On the Curbing of Illegal, Unreported and Unregulated (IUU)) Fishing*. In: Tubiana, L., Jacquet, P., and Pachauri, R., editors. *A Planet for Life 2011 – Oceans*. IDDRI, Paris.

Munro, G., Sumaila, U.R., and Turris, B. (2012). Catch Shares, the Theory of Cooperative Games and the Spirit of Elinor Ostrom: A Research Agenda. *IIFET 2012 Conference Proceedings*. Available at: https://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/33889/Paper%20for%20Dar%20es%20Salaam.pdf?sequence=1. Accessed on: 6 August, 2014.

Munro, G., Turris, B., Kronbak, L., Lindroos, M., and Sumaila, U.R. (2013). *Catch Share Schemes, the Theory of Dynamic Coalition Games and the Groundfish Trawl*

Fishery of British Columbia. Paper presented to the North American Association of Fisheries Economists Conference, 2013.

Neis, B., Binkley, M., Gerrard, S. and M. Maneschy (eds.). 2005. *Changing Tides: Gender, Fisheries and Globalisation*. Halifax: Fernwood

OECD (2012). *Rebuilding Fisheries: The Way Forward.* OECD, Paris.

Ostrom, E. (2000). Private and common property rights. In Brouckaert, B., and De Geest, G., editors. *Encylopedia of Law and Economics, Vol.II: The History and Methodology of Law and Economics.* Cheltenham, UK: Edward Elgar: pp. 332-379.

Rice, J. (2003) The British Columbia rockfish trawl fishery. In *Report and documentation of the International Workshop on Factors of Unsustainability and Overexploitation in Fisheries, Mauritius, 3–7 February 2003*. Edited by J. Swan and D. Gréboval. FAO, Rome, Italy.

Sharma, C. (2003). The Impact of Fisheries Development and Globalization Processes on Women of Fishing Communities in the Asian Region. *APRN Journal* 8:1-12. ICSF: Chennai.

Sumaila, U.R. (2013). *Game Theory and Fisheries: Essays on the Tragedy of Free For All Fishing*. London, Routledge.

Sumaila, U.R., Marsden, D., Watson, R., and Pauly, D. (2007). Global Ex-vessel Fish Price Database: Construction and Applications. *Journal of Bioeconomics* 9: 39-51.

Sumaila, U.R., Teh, L., Watson, R., and Munro, R. (2010). A Bottom-up Re-estimation of Global Fisheries Subsidies. *Journal of Bioeconomics* 12: 201-225.

Sumaila, U.R., Cheung, W., Dyck, A., Gueye, K., Huang, L., Lam, V., Pauly, D., Srinivasan, T., Swartz, W., Watson, R., and Zeller, D. (2012). Benefits of Rebuilding Global Marine Fisheries Outweigh Costs. *PLoS ONE* 7: e40542. DOI:10.1371/journal.pone.0040542.

Swartz, W., Sumaila, U.R., and Watson, R. (2013). Global Ex-vessel Price Database Revisited: A New Approach for Estimating "Missing" Prices. *Environmental and Resource Economics* 56: 467-480. DOI: 10.1007/s10640-012-9611-1.

Taylor, W., Schechter, M.G., and Wolfson, L.G. (2007). *Globalization: Effects on Fisheries Resources.* Cambridge University Press.

Walker, B.L.E. (2001). Sisterhood and Seine-nets: Engendering Development and Conservation in Ghana's Marine Fishery. *Professional Geographer* 53: 160-177.

Weeratunge, N., and Snyder., K. (2009). *Gleaner, Fisher, Trader, Processor: Understanding Gendered Employment in the Fisheries and Aquaculture Sector*. Paper presented at the FAO-IFAD-ILO Workshop on Gaps, Trends and Current Research in Gender Dimensions of Agricultural and Rural Employment: Differentiated Pathways out of Poverty, Rome, 31 March - 2 April 2009.

Williams, M.J., Nandeesha, M.C., and Choo, P.S. (2005). Changing Traditions: First Global Look at the Gender Dimensions of Fisheries. *NAGA, Worldfish Center Newsletter*; vol. 28, No. 1 & 2 (January and June).

World Bank (2005). Hamilton, K., Ruta, G., Bolt, K., Markandya, A., Pedroso-Galinato, S., Silva, P., Ordoubadi, M.S., Lange, G., and Tajibaeva, L. *Where Is the Wealth of Nations? Measuring Capital for the 21st Century*. World Bank, Washington.

World Bank (2011). *The Global Program on Fisheries: Strategic Vision for Fisheries and Aquaculture*. World Bank, Washington.

World Bank and FAO (2009). Kelleher, K., Willmann, R., and Arnason, R., eds. *The Sunken Billions: The Economic Justification for Fisheries Reform*. World Bank and FAO, Washington.

WorldFish Center (2008). "Small-scale capture fisheries: a global overview with emphasis on developing countries: a preliminary report of the Big Numbers Project." *The WorldFish Center Working Papers.*

Worm, B., Hilborn, R., Baum, J. K., Branch, T. A., Collie, J. S., Costello, C., Fogerty, M.J., Fulton, E.A., Hutchings, J.A., Jennings, S., Jensen, O.P., Lotze, H.K., Mace, P.M., McClanahan, T.R. Minto, C., Palumbi, S.R., Parma, A.M., Ricard, D., Rosenberg, A.A., Watson, R., Zeller, D. (2009). Rebuilding global fisheries. *Science*, *325*(5940), 578-585

