



PART 4

OUTLOOK

OUTLOOK

The role of capture fisheries in a global sustainable food production system: opportunities and challenges

In recent editions of *The State of World Fisheries and Aquaculture*, the Outlook section has focused on aquaculture (in 2008) and inland fisheries (in 2010). In this Outlook, while not ignoring their importance (aquaculture is highlighted in Part 3 on p. 172), the emphasis is on how developments in capture fisheries in particular can contribute to ensuring a global sustainable food production system.

CONTEXT

A recent major study of the world's food production systems¹ found that they are unsustainable and that, in attempting to improve the present ones, policy-makers face five major challenges:

- balancing future demand and supply sustainably – to ensure that food supplies are affordable;
- ensuring that there is adequate stability in food supplies – and protecting the most vulnerable from the volatility that does occur;
- achieving global access to food and ending hunger;
- managing the contribution of the food system to the mitigation of climate change;
- maintaining biodiversity and ecosystem services while feeding the world.

The study also concluded that policies affecting agriculture should be developed on the basis of assessments of the whole food chain and that these assessments should include judgements of the extent to which food chains contribute to meeting the above five challenges. The study states that actions are required now to ensure that:

- more food is produced sustainably;
- demand for the most resource-intensive types of food is contained;
- waste in all areas of the food system is minimized;
- the political and economic governance of the food system is improved to increase the productivity and sustainability of food systems.

Therefore, as a part of the whole, those responsible for capture fisheries (and aquaculture) will be expected to play their part in meeting these challenges, initially by implementing the above actions. The following sections examine how they may address the task and contribute to achieving the goal of a global sustainable food production system.

THE PROSPECTS FOR SUSTAINABLE INCREASED PRODUCTION

The latter half of the twentieth century witnessed widespread expansion of capture fisheries supply, and correspondingly positive social and economic impacts associated with the global availability of high-quality aquatic foods.² However, recent decades have been marked by an increasingly uneasy relationship between, on the one hand, the concerns for stock levels and fishing effort, and, on the other, the attempts by commercial fleets and smaller-scale fishers to maintain and improve income and livelihoods. These have interacted with national policy aims of controlling resource access, supporting income and food supply, and meeting local interests in commercial and artisanal fishing, and the related vessel and gear, fishing supplies and post-harvest



sectors.³ Through a combination of inadequate regulatory and monitoring capacity, misguided or misapplied policy aims and interventions, overcapitalization, and short-term profit-seeking by fishing fleets, the global imbalance between stock levels and fishing capacity and effort has grown steadily, and the pressures on key stocks have become increasingly unsupportable.⁴ Based on FAO statistics for 1950–2006, the first overview of marine fisheries resources by country confirmed that, globally, the maximum average level of bottom fish and small pelagic fish production had been reached within the final decade. While data were not available to explore fully the relationship between stock status and global landings, data covering some 75 percent of recent landings (1998–2002) showed that 14.1 percent of world production (about 11 million tonnes) came from underexploited or moderately exploited stocks, 57.3 percent (about 41 million tonnes) from fully exploited stocks, 13.7 percent (about 18.4 million tonnes) from overexploited stocks and 7.6 percent (about 10.2 million tonnes) from depleted or recovering stocks.⁵

These analyses are troubling from a resource exploitation perspective and suggest a global system that is overstressed, reducing in biodiversity and in imminent danger of collapse.⁶ However, total capture fisheries output data over this period suggest that under the management regimes in place to date, or in spite of them, the resource system has been surprisingly resilient in terms of output and food value, although harvesting has been increasingly inefficient in terms of catch per unit of effort (CPUE). There is also a strong societal argument for maximizing beneficial use of natural resources, and the clear need for food, which would justify the fullest possible level of harvesting consistent with the ability for these harvests to be sustained. However, there have been specific instances of serious stock collapse, evidence of historically low biomasses of key stocks, increasing awareness of ecosystem interactions and changing balances towards harvesting lower in the food chain. Together with mounting concern for the possible impacts of climate change on ecosystems and dependent communities,⁷ these have all combined to build the case for more explicit and increasingly urgent strategies to improve the capture fisheries system and to put in place securely sustainable fisheries.

The biological and ecosystem arguments for change have been widely expressed, and they have also been reflected in growing consumer awareness and concern for purchasing decisions related to sustainable fisheries.⁸ An increasingly compelling claim for policy action also arises from the explicit and continuing economic losses associated with the current fishing system. On a 2004 baseline, a joint World Bank and FAO review⁹ estimated global losses of net economic benefit of the order of US\$50 billion, compared with first sale values of US\$80 billion, resulting from a combination of excess capacity and effort, linked with capital and operating-cost subsidies. For 2003, “harmful” subsidies, acting primarily to perpetuate overfishing, were estimated at US\$16.2 billion out of a total of US\$27 billion a year globally.¹⁰ A simulation of subsidy impacts in North Sea fisheries¹¹ showed that, while removing subsidies might reduce total catch and revenue, overall profitability would increase, as would the total biomass of commercially important species. A strategy for fisheries reform would be to reduce the capitalization of fleets, reduce vessel numbers, restore depleted stocks, change key practices and improve efficiency by increasing the CPUE, and by devising resource-access and management approaches to bring this about effectively.¹²

The reasons for change and the prescriptions for action exist, and significant moves can be expected in the next two decades to bring more of the world’s fisheries into a more recognizably sustainable state. This is also reflected in the growing number of commitments for change,¹³ linked also with concerns for effective climate change response.¹⁴ However, as noted by the World Bank/FAO review,¹⁵ fisheries reform would “require broad-based political will founded on a social consensus” with “a common vision that endures changes of governments”, which would take time to build. To further define the potential for change and the future share of landings from sustainable fisheries, distinctions can be made between those parts of the global capture fishing system that are:

- unmanaged – including those outside national jurisdictions and/or fished by fleets not under specific flag state control, characterized by illegal unregulated and unreported (IUU) fishing, and with significant potential for catching and discard of non-target species;
- poorly managed, either because of limited capacity or political will, and may be overfished, have high levels of IUU fishing and have negative ecosystem impacts;
- managed relatively well, with definable processes for regulating fishing activity and monitoring outcomes.

The building of political commitment, even in wealthy economies with adequate financial and human resources for effective management, can take time, and in regionally shared waters, as currently evidenced in the European Union process of fisheries reform, interactions can be complex and conflictual. Nonetheless, a number of processes are under way to bring more unmanaged areas under effective international agreement, to improve the effectiveness of poorly managed systems, to increase the numbers of well-managed fisheries, and to strengthen and make more resilient their potential for remaining so.

The FAO Code of Conduct for Responsible Fisheries (the Code) and its associated international plans of action and technical guidelines¹⁶ have an important role in this process, providing a means for establishing political commitment, a structure within which various contributing actions can be implemented, and a basis for support for strengthening management capacity. Although the challenges of implementation can be considerable, a number of initiatives have, together with market incentives, helped to create the prospects of a “virtuous circle” of systems and actions that can significantly improve the prospects of sustainable fisheries. These initiatives include the Global Record of Fishing Vessels, port State measures to define landing locations and recording of catches, global and national initiatives on control of IUU fishing, and strategies for introducing various forms of rights-based approaches to address constraints of managing open-access fisheries.

While there is scope for reducing fishing capacity across the sector, there are particular challenges in small-scale fisheries, which involve large numbers of people, often in very difficult circumstances of poverty and vulnerability.¹⁷ Low costs of entry and operation allow access to income and food for many, and individual fishing impacts are usually relatively modest. However, cumulative effects are potentially very significant, with numerous examples of excess fishing pressure, yet with few other livelihood options¹⁸ to provide alternatives. Approaches based on fishing rights could potentially rationalize effort and improve returns in small-scale fisheries, and increase resource rent at the national level. However, unless the benefits were broadly shared within fishing communities, these could increase vulnerability in the absence of access to alternative livelihoods or other forms of social support.¹⁹ Although various community-based management approaches have been developed and applied, the effectiveness of reconciling sustainable fishing with human needs varies widely with the resource, social and economic context.²⁰ This aspect of reconciling potentially competing needs is also important in relation to inland fisheries (Box 23).

More positively, across a range of capture fisheries, opportunities may be seen for creating tipping points, which, if well defined and with widely understood ecosystem and social impacts, could bring about an accelerating process of change towards sustainability. Thus, where the costs or other constraints to non-compliance become too great (including sanctions on vessels and fleets and markets, and possible trade or indirect penalties), vessels, fleets and fishing nations may respond more rapidly and definitively. Similarly, where rising fuel costs combine with excess fishing effort, and subsidies are less politically acceptable, incentives will increase for more rational management. The impacts of such change would extend not just to target and bycatch fish stocks but also to secondary impacts such as increased protection for endangered fish, mammalian and avian species. A number of leverage opportunities can be identified – the example already exists for pressures on supermarkets to improve



Box 23

Reconciling sustainable inland fisheries with the needs of other sectors

Although important in many parts of the world, inland fisheries tend to have been overlooked in many development policy perspectives and feature far less in the sustainable fisheries debate. They face significant issues relating not just to fishing pressure but also the impacts of infrastructure development, drainage and land reclamation, continuous or periodic water withdrawals, and water-quality impacts from urban, industrial and agricultural use.¹ Here, the governance of fishing and the associated social impacts are important, and they are now starting to receive more policy attention. However, the achieving of sustainable inland fisheries will also depend on policies and actions in many other sectors, and will require a level of strategic interaction, value trade-offs across specific resource benefits, and a policy response that has yet to be developed. Where there is a convergence of impacts of climate change on hydrological balances, potential increases in related extraction demands for agriculture and other sectors, and greater calls for renewable energy, the case for defending inland fisheries resources and the livelihoods of many millions of dependent people becomes more challenging.

¹ Welcomme, R.L., Cowx, I.G., Coates, D., Béné, C., Funge-Smith, S., Halls, A. and Lorenzen, K. 2010. Inland capture fisheries. *Philosophical Transactions of the Royal Society B*, 365(1554): 2881–2896.

buying practices, and for campaigners to target specific policy issues. Further leverage could also be applied at fleet level, pushing for compliance at the total level of activity (not just in specific fisheries or vessels), and at the national level, whereby all forms of fishing engagement could be made subject to good conduct criteria.

Possible changes by 2030

The current decade and the next are likely to see major changes in economies, markets, resources and social conduct. Climate change impacts will bring about increasing uncertainty in many food sectors, including capture fisheries, and climate adaptation approaches will need to be well integrated with the processes of improving fisheries governance. The size of the shift in balance towards sustainable fisheries will also depend in part on how it will be defined; whether, for example, by conduct (the fishing sector agreeing to specific actions or signing commitments of varying force) or by outcome (where significant measures or indicators are put in place to confirm the consequences of good practice). It will also depend on whether sustainable fisheries are species-based or ecosystem-based, and whether the affirmation of sustainability action or outcome is determined by private-sector monitoring and accreditation or through more broadly defined standards.

Within the policy framework set out by the Code and related instruments, the role of private-sector certification systems, such as those of the Marine Stewardship Council and others, have already been significant in incentivizing better fishing practice and in requiring certification of fleet operations and their management regimes, chain of custody controls and guarantees to customers. However, although their scope has expanded markedly in the last five years, many fisheries are still relatively unconnected with the market or political drivers necessary to create the incentives. There is also

substantial scope for misrepresenting the provenance of fish, and, given the cost of certification and the related benefits of market access, the rewards for doing so can be significant. This might only be countered effectively by the widespread availability of rapid diagnostic tools for species or stock identification and by appropriate levels of monitoring. There are notable challenges in moving outside higher-value global markets, where certification has a role in supply chain competition, towards other markets where there may be far less incentive to adopt certification, much less the resources to do so.

With a view to improving estimates of the potential for sustainable capture fisheries, prospects for enhanced fishing regimes can be divided into broad categories. First, there are well-managed national and regional fisheries with management regimes that have undergone considerable improvement in recent years, support sustainable fisheries and have strong prospects for continuing to do so. A second category comprises national and regional fisheries systems undergoing steady improvement as management measures take effect and bring about greater levels of compliance. A further category includes national and regional fisheries with low management capacity and widespread IUU fishing, commonly with complex fisheries and difficult management contexts. A fourth group contains international high seas fisheries, also including deep-sea fisheries, with varying levels of fleet or national management agreement and compliance. In some cases, responsible fishing practice can be incentivized through market pressures, but compliance is at best partial, actions of non-compliant fleets are difficult to sanction, and, in many instances, effective protocols under international law are as yet developing. A final category is that of new fisheries undergoing possible expansion, for which management systems are only emerging. A more detailed assessment of management change potential is yet to be carried out, but based on the earlier estimates of catch status,²¹ more than 20 percent of output is related to overexploited, depleted or recovering stocks. A moratorium on fishing for all of these is unlikely, but a concerted approach for change might reasonably be expected to reduce this category to 10 percent (some 14 million tonnes). Similarly, a more significant part of the 41 million tonnes from fully exploited stocks could be subject to more secure regimes, and the 11 million tonnes from underexploited or moderately exploited stocks might be expanded, but this would need to be done within a sound management environment.

Policies conducive to an increased share for sustainable fisheries

A number of policy areas can be distinguished, and their potential evolution considered. These can broadly be described as: (i) direct, which specifically affect the way the capture fishing system operates; and (ii) indirect, which change the wider environment in which people, businesses and communities interact, and which can create positive or negative incentives for improving function and behaviour.

Direct policies would include those on resource management and their allocation to specific groups, licensing and regulatory features, capacity development in key agencies, those associated with fuel and energy pricing, capital costs and possible subsidization, and those addressing market management and trade issues (including market access and the use of market sanctions against unsustainable fishing). Where possible, these would be aligned to provide positive incentives for good practice, removal of perverse influences, and adequate deterrence for non-compliance. Although more immediately effective within national jurisdictions, a strong policy environment at the national level can have an important impact on wider application.

A range of indirect policy areas can be noted. Apart from the generic fiscal environment and its effects on investment and earnings, and policies affecting infrastructure investment and maintenance, a number of social policy areas may be relevant. Those addressing broader development issues, including gender and rights, child labour, health, education and social welfare, may help to ease pressures in small-scale fisheries, while various local empowerment policies can provide more positive environments in which community-based management initiatives may be developed.



The clarity and coherence of policies in related sectors will also affect the potential for sustainable fisheries, as noted above in the case of inland fisheries. Climate change response policies with effective resilience building measures are also likely to have an important effect on the stress on capture fisheries systems. Across these policy areas, the role of knowledge and capacity building will be critical, and effective policies for these, including resources for fisheries data and scientific management,²² will be important.

While policy areas and approaches to support sustainable fisheries can be readily identified, their effective implementation is a particular challenge. There have been too many examples of policy formulation that has been unconnected with action and outcome, or in some cases has resulted in perverse consequences. Where existing practices have to be substantially changed, social and political interests challenged, and previously unconnected issues brought together, considerable thought and effort may be required, building support for action across a range of agents.

CAPTURE FISHERIES AS TARGETS OF EFFORTS TO REDUCE RESOURCE USE AND GREENHOUSE GAS EMISSIONS

Bottom trawling and dredging are likely to become double targets, not just because of their potential damage to seafloor habitats,²³ but because of their relatively high fuel use (and hence greenhouse gas [GHG] output) per quantity of fish landed (see also p. 126). Rising energy costs may possibly limit some of the more extreme cases of high fuel use (e.g. with inefficient gear or low-CPUE characteristics). However, if fuel subsidies are maintained or increased to permit their continuation, this is likely to attract more adverse response from the public and non-governmental organizations (NGOs). More generally, the possibility of structuring fisheries reform so that it eliminates “the race for fish” or reduces overfishing more widely has the potential to deliver “triple win” outcomes – better returns to fishing vessels, healthier stocks, and reduced energy use and GHG output per unit of output. For smaller-scale, less-energy-intensive fisheries, the choices may not be so extreme, but rising energy costs may well limit longer trips for low catches and create longer-term disincentives for overcapacity.

There may be more complex interactions if climate change impacts on stock distribution result in fleets having to travel greater distances and fish wider areas, hence increasing energy use per unit of output, even if stocks are relatively healthy. In such cases, a longer-term monitoring approach would be justified, and the balance of preferred types of fishing gear might change.

A further issue may relate to the whole life-cycle assessment of the fishery in question, as investment in new vessels and gear, and the associated carbon emissions and energy use, will have to be considered. However, if accompanied by greater fuel efficiency, e.g. through improved hull, propeller and gear design, this investment could quickly be recouped.

Policy trade-offs

In many renewable-resource contexts, there is a presumption that secure access rights together with fully costed operating conditions can bring about long-lasting outcomes that are efficient and able to meet wider social objectives. Appropriate valuing of externalities and a transparent process of internalizing these costs will allow producers to select the most effective means of delivering output commensurate with the returns available from marketed products. Such a system can also be used to incorporate compensatory values associated with mitigation, for example through carbon sequestration in aquatic systems. However, there may be wider social and environmental trade-offs; for example, regarding the need for more fish supply, a balance between fuel subsidy and additional output food value. Another example would concern the need to retain communities and rural economies, where it would be necessary to strike a balance between fuel subsidy, local food security, supply into wider markets, and opportunity costs associated with avoiding social breakdown.

Public pressure

The public pressure exerted by NGOs on approaches in fisheries that are more resource and energy efficient will be an important element in change. However, experience across other policy fields has suggested that independent evidence is also essential in targeting the debate towards realistic, broadly supported and effective policy. Therefore, it will be necessary to build support and intent across a range of stakeholders, particularly for more difficult areas of change.

MINIMIZING WASTE

The current discussions about mandatory landing of catch, particularly in the lead-up to the reform of the European Union Common Fisheries Policy, have helped to highlight the dilemmas of quota management in multispecies fishing, the conflicting views of the range of stakeholders,²⁴ and the increasing role of issue-targeted public campaigns in fisheries policy formulation.²⁵ It is clear also that, under closer public scrutiny, with valuable local markets much more directly influenced by perceptions of fishing conduct, and with increasing technical means to engage in real-time decision-making on stock conditions and fishing activity, much more flexible, responsive and ecosystem-sensitive fishing could start to become more feasible. The processes of discussion themselves are also important examples of greater openness of debate on such issues, and ideally will lead to more mature, fully reasoned and widely sanctioned management strategies and industry responses. Given the wide diversity of capture fishery systems and management regimes, it is unlikely that mandatory landing of catch will rapidly become the norm. However, the arguments are likely to gain traction, and together with a growing appreciation of the practical aspects of ecosystem approaches to fisheries management,²⁶ catch landing practice in more fisheries may be expected to follow suit. In many fisheries, particularly multispecies fishing in tropical waters, substantial quantities of bycatch are already being landed and used.

Policies to promote low-impact fuel-efficient fishing strategies

The development of low-impact fuel-efficient (LIFE) fishing is increasingly seen as a practical response to rising fuel costs and concern for ecosystem impacts, potentially delivering gains in fuel use and GHG outputs, improving selectivity and catch value, reducing habitat damage and improving returns (see also p. 134). Regardless of other factors, a primary element in fuel efficiency is that of fish stock status, and improved stock levels and better effort allocation should lead to substantial reductions in fuel use in many fisheries. In the absence of further subsidies, and their possible phasing out, fuel costs alone may start to shift practice in this direction, although a more strategic approach could permit more effective adjustment, and ensure that the interests of more socially dependent groups were adequately addressed. Ideally, these would involve incentives and transfer mechanisms to enable these groups to access and benefit from LIFE strategies with appropriate investment in improving vessels and gear, and in promoting market and other incentives to change. Energy use and GHG mitigation linkages would also be important, and options could be further explored for raising awareness of the significance of the fisheries sector, and for accessing mitigation funding. Were payments to be made for ecosystem services, more stringent monitoring might be required, linked with the development of benchmarks and best practice concepts. Policy approaches would also need to be expanded to demonstrate the wider impacts of LIFE fishing, their linkages into the larger fishery sector supply and value chain,²⁷ and the means by which LIFE fishing become embedded into normal practice.

IMPROVING GOVERNANCE

In addition to the array of mechanisms for transition to a green economy considered at Rio+20 (see Part 1 sections on Governance and Rio+20), the focus here is on aspects relating to sanctions and small-scale fisheries.



Sanctions

Sanctions for IUU fishing will probably become tougher, to the extent that consensus building for strong and resolute policy action is effective among fishing nations, particularly those engaged in international waters or operating with access agreements or licences. Pressure from international lobbying groups is unlikely to relent, and market sanctions have been shown to have direct effects on a number of fisheries. While IUU fishing remains a serious global challenge, there is increasing evidence that some IUU control measures are starting to “bite”, and there is more potential for better regulated fisheries to become the norm.²⁸ However, sanctions for stock depletions per se may be more difficult to put in place, as the attribution and responsibility issues may be more complex. Nonetheless, as evidenced by the current international concern for management of tuna, particularly for Eastern Atlantic stocks,²⁹ a range of pressures may be brought to bear on the management agencies and individual countries concerned.

As the capture fisheries sector is not commonly a major part of national economies, and may not receive immediate priority for action, the threat of applying wider trade or other sanctions, e.g. in other sectors or for specific interest groups, can also potentially be effective in addressing non-compliance issues at the national level. However, groups within individual nations wishing to resist compliance, by political or other means, may still attempt to hold back wider and more effective management in more complex resource and exploitation systems. Here, careful and sensitive assessments of the political economy of fishing and its beneficiaries may need to be made, and appropriate mixes of incentives and sanctions through a number of routes may need to be considered, in order to bring about change.

Small-scale fisheries and access to public services

There is widespread evidence that many communities engaged in small-scale fisheries exhibit multiple deprivations with respect to income opportunities, market power, access to land-based resources, political access, and inclusion in public services such as health and education.³⁰ This poverty and vulnerability nexus leaves little scope for people to give up the immediate possibilities of fishing income, and little opportunity to move away from fishing, either in the shorter term through livelihood diversification or over the longer term through education and skill building. Improving public services and social support will be an important factor in reducing this negative dynamic, and some specific poverty alleviation interventions, such as improved maternal and child health care, or school feeding programmes, can have very positive effects relatively quickly.³¹ However, for lasting changes and more stable human–resource relationships, this has to be done as part of an integrated approach, one that also includes a fuller understanding of the role of fishing as a “last resort”, the causes and dynamics of people leaving and entering fishing, evolving links between rural and urban populations, markets and economies, and the political weight related to these. Much is now being done within the fisheries sector to raise awareness of the economic and social importance of small-scale fisheries and the need to address wider development issues;³² the challenge will be to move these more centrally into national economic development agendas and investment strategies.

NOTES

- 1 Foresight. 2011. *The future of food and farming: challenges and choices for global sustainability*. Final project report. London, The Government Office for Science. 208 pp.
- 2 FAO. 2009. *The State of World Aquaculture and Fisheries 2008*. Rome. 176 pp.
- 3 Hilborn, R. 2007. Defining success in fisheries and conflicts in objectives. *Marine Policy*, 31(2): 153–158.
- 4 Garcia, S.M. and Grainger, R.J.R. 2005. Gloom and doom? The future of marine capture fisheries. *Philosophical Transactions of the Royal Society B*, 360(1453): 21–46.
- 5 Garcia, S.M. and Rosenberg, A.A. 2010. Food security and marine capture fisheries: characteristics, trends, drivers and future perspectives. *Philosophical Transactions of the Royal Society B*, 365(1554): 2869–2880.
- 6 Pauly, D., Watson, R. and Alder, J. 2005. Global trends in world fisheries: impacts on marine ecosystems and food security. *Philosophical Transactions of the Royal Society B*, 360(1453): 5–12.
Worm, B., Barbier, E.B., Beaumont, N., Duffy, J.E., Folke, C., Halpern, B.S., Jackson, J.B.C., Lotze, H.K., Micheli, F., Palumbi, S.R., Sala, E., Selkoe, K.A., Stachowicz, J.J. and Watson, R. 2006. Impacts of biodiversity loss on ocean ecosystem services. *Science*, 314: 787–790.
- 7 Brander, K.M. 2007. Global fish production and climate change. *Proceedings of the National Academy of Sciences of the United States of America*, 104(50): 19709–19714.
Ficke, A.D., Myrick, C.A. and Hansen, L.J. 2007. Potential impacts of global climate change on freshwater fisheries. *Reviews in Fish Biology and Fisheries*, 17 (4): 581–613.
Cochrane, K., De Young, C., Soto, D. and Bahri, T., eds. 2009. *Climate change implications for fisheries and aquaculture: overview of current scientific knowledge*. Fisheries and Aquaculture Technical Paper No. 530. Rome, FAO. 212 pp.
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. *Fish and Fisheries*, 10(2), 173–196.
- 8 Parkes, G., Young, J.A., Walmsley, S.F., Abel, R., Harman, J., Horvat, P, Lem, A., MacFarlane, A., Mens, M. and Nolan, C. 2010. Behind the signs – a global review of fish sustainability information schemes. *Reviews in Fisheries Science*, 18(4): 344–356.
- 9 World Bank and FAO. 2009. *The sunken billions: the economic justification for fisheries reform*. Washington, DC, The World Bank, and Rome, FAO. 100 pp.
- 10 Sumaila, U.R., Khan, A.J., Dyck, A., Watson, R., Munro, G., Tyedmerset, P. and Pauly, D. 2010. A bottom-up re-estimation of global fisheries subsidies. *Journal of Bioeconomics*, 12(3): 201–225.
- 11 Heymans, J.J., Mackinson, S., Sumaila, U.R., Dyck, A., Little, A. 2011. The impact of subsidies on the ecological sustainability and future profits from North Sea fisheries. *PLoS ONE*, 6(5): e20239 [online]. [Cited 31 March 2012]. www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020239
- 12 Leal, D.R., ed. 2010. *The political economy of natural resource use: lessons for fisheries reform*. Washington, DC, World Bank.
- 13 UN. 2011. *Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments*. Resolution 65/38. New York, USA. 26 pp.



- Stakeholder Forum. 2011. *Monaco message* [online]. [Cited 31 March 2012]. www.stakeholderforum.org/fileadmin/files/Monaco%20Message.pdf
- 14 Hall, S.J. 2011. Climate change and other external drivers in small-scale fisheries: practical steps for responding. In R. Pomeroy and N.L. Andrew, eds. *Small-scale fisheries management: frameworks and approaches for the developing world*, pp. 132–159. Wallingford, UK, CABI Publishing. 247 pp.
- 15 Op. cit., see note 9.
- 16 FAO. 1995. *Code of Conduct for Responsible Fisheries*. Rome, FAO. 41 pp.
- 17 Andrew, N.L., Béné, C., Hall, S.J., Allison, E.H., Heck, S. and Ratner, B.D. 2007. Diagnosis and management of small-scale fisheries in developing countries. *Fish and Fisheries*, 8(3): 227–240.
- FAO. 2009. *Report of the Global Conference on Small-Scale Fisheries – Securing sustainable small-scale Fisheries: Bringing together responsible fisheries and social development. Bangkok, Thailand, 13–17 Octobre 2008. Rapport de la Conférence mondiale sur les pêches artisanales – Pour une pêche artisanale durable: Associer la pêche responsable au développement social. Bangkok, Thaïlande, 13-17 octobre 2008. Informe de la Conferencia Mundial sobre la Pesca en Pequeña Escala – Garantizar la pesca en pequeña escala: Pesca responsable y desarrollo social unidos. Bangkok, Tailandia, 13-17 de octubre de 2008*. FAO Fisheries and Aquaculture Report/FAO Rapport sur les pêches et l'aquaculture/FAO Informe de Pesca y Acuicultura No. 911. Rome/Roma. 189 pp.
- 18 World Bank, FAO and WorldFish Center. 2010. *The hidden harvests: the global contribution of capture fisheries*. Conference edition. Washington, DC, World Bank. 99 pp.
- Mills, D.J., Westlund, L., de Graaf, G., Kura, Y., Willman, R. and Kelleher, K. 2011. Under-reported and undervalued: Small-scale fisheries in the developing world. In R. Pomeroy and N.L. Andrew, eds. *Small-scale fisheries management: frameworks and approaches for the developing world*, pp. 1–15. Wallingford, UK, CABI Publishing. 247 pp.
- 19 Béné, C., Hersoug, B. and Allison, E.H. 2010. Not by rent alone: analysing the pro-poor functions of small-scale fisheries in developing countries. *Development Policy Review*, 28(3): 325–358.
- 20 Béné, C., Belal, E., Baba, M.O., Ovie, S., Raji, A., Malasha, I., Njaya, F., Na Andi, M., Russell, A. and Neiland, A. 2009. Power struggle, dispute and alliance over local resources: analyzing 'democratic' decentralization of natural resources through the lenses of Africa inland fisheries. *World Development*, 37(12): 1935–1950.
- 21 Op. cit., see note 5.
- 22 Mora, C., Myers, R.A., Coll, M., Libralato, S., Pitcher, T.J., Sumaila, R.U., Zeller, D., Watson R., Gaston K.J. and Worm, B. 2009. Management effectiveness of the world's marine fisheries. *PLoS Biology*, 7(6): e1000131 [online]. [Cited 31 March 2012]. www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1000131
- 23 Hiddink, J.G., Johnson, A.F., Kingham, R. and Hinz, H. 2011. Could our fisheries be more productive? Indirect negative effects of bottom trawl fisheries on fish condition *Journal of Applied Ecology*, 48(6): 1441–1449.
- 24 National Federation of Fishermen's Organisations. 2011. *The mixed blessings of celebrity – the fight for fish* [online]. [Cited 31 March 2012]. www.nffo.org.uk/news/mixed_blessing.html
- 25 Young, I.A. 2011. *Change and continuity in Common Fisheries Policy: a case study of the proposed discards ban*. School of Government and Public Policy, University of Strathclyde. (MSc dissertation)
- Suárez de Vivero, J.L., Rodríguez Mateos, J.C. and Florido del Corral, D. 2008. The paradox of public participation in fisheries governance. The rising number of actors and the devolution process. *Marine Policy*, 32(3): 319–325.
- 26 FAO. 2003. *Fisheries management. 2. The ecosystem approach to fisheries*. FAO Technical Guidelines for Responsible Fisheries No. 4 Suppl. 2. Rome. 112 pp.

- 27 Suuronen, P., Chopin, F., Glass, C., Løkkeborg, S., Matsushita, Y., Queirolo, D. and Rihan, D. 2012. Low impact and fuel efficient fishing—looking beyond the horizon. *Fisheries Research*, 119–120: 135–146.
- 28 Agnew, D.J., Pearce, J., Pramod, G., Peatman, T., Watson, R., Beddington, J.R. and Pitcher, T.J. 2009. Estimating the worldwide extent of illegal fishing *PLoS ONE*, 4(2): e4570 [online]. [Cited 31 March 2012]. www.plosone.org/article/info:doi/10.1371/journal.pone.0004570
- 29 Convention on International Trade in Endangered Species of Wild Fauna and Flora. 2010. *Fifteenth meeting of the Conference of the Parties Doha (Qatar), 13–25 March, Summary record of the eighth session of Committee I* [online]. [Cited 31 March 2012]. www.cites.org/eng/cop/15/sum/E15-Com-I-Rec08.pdf
- 30 Béné, C. 2003. When fishery rhymes with poverty: a first step beyond the old paradigm on poverty in small-scale fisheries. *World Development*, 31(6): 949–975. Op. cit., see note 17, FAO.
- 31 FAO. 2006. *Microfinance helps poverty reduction and fisheries management – policies to support microfinance*. New Directions in Fisheries – a series of Policy Briefs on Development Issues No. 4. Rome. 8 pp.
Shepherd, A. 2011. *Tackling chronic poverty: the policy implications of research on chronic poverty and poverty dynamics* [online]. Chronic Poverty Research Centre. [Cited 31 March 2012]. www.chronicpoverty.org/uploads/publication_files/Tackling%20chronic%20poverty%20webcopy.pdf
- 32 Op. cit., see note 17, FAO.
Béné, C., Macfadyen, G. and Allison, E.H. 2007. *Increasing the contribution of small-scale fisheries to poverty alleviation and food security*. FAO Fisheries Technical Paper No. 481. Rome, FAO. 125 pp.



THE STATE OF WORLD FISHERIES AND AQUACULTURE

2012

In addition to striving to meet the United Nations Millennium Development Goals, the global community is also grappling with other pressing and complex challenges such as the widespread economic crisis and the effects of climate change. It is in this context that this edition of *The State of World Fisheries and Aquaculture* highlights the vital role of fisheries and aquaculture in both food and nutrition security as well as economic expansion. The sector remains a major supplier of high-quality animal protein and supports the livelihoods and well-being of more than ten percent of the world's population. International trade in fish has reached new peaks as overall production has continued to rise. Yet, as the document underlines, an array of problems – ranging from the need for more effective governance to that of ensuring environmental sustainability – threatens to undermine the sector's valuable contribution to alleviating hunger and reducing poverty.

Using the latest available statistics on fisheries and aquaculture, this edition presents a global analysis of the sector's status and trends. It also examines broader related issues such as gender, emergency preparedness and the ecosystem approach to fisheries and aquaculture. Selected highlights, from ecolabelling and certification to the effects of fisheries management policies on fishing safety, provide insights on specific topics. Finally, the document looks at the opportunities and difficulties for capture fisheries in the coming decades.

To cite

FAO. 2012.

The State of World Fisheries and Aquaculture 2012. Rome. 209 pp.

ISBN 978-92-5-107225-7 ISSN 1020-5489



9 789251 072257

12727E/1/06.12