Sustainable Diets: The Gulf Between Management Strategies and the Nutritional Demand for Fish

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Abstract

Fish, the largest source of animal protein in the world, has long been one of the most important foods in the history of humanity. Its contribution to nutritional, economic and social well-being has been a pivotal factor in facilitating population growth over many hundreds of millennia. With population growth predicted to exceed 9 billion by 2050, its continued availability will be essential in taking humanity forwards. As far as sustainable development is concerned, a significant number of studies have suggested the more recent history of fishing is one of over-exploitation, pollution, nutritional inconsistency, depletion, local extinctions and imminent crisis. The incentive-driven free market for fish has encouraged efficiency and industrial scale production. Calculations of fish stocks are mostly based on United Nations data, but the accuracy of this data has also been called into question. As international and national governance failed to deliver effective fisheries management, these have largely been replaced by a proliferation of market-based certification schemes. This paper explores the more recent evidence in order to understand the key challenges of producing fish sustainably. The purpose is to understand how sustainable fish consumption is today. Specifically, it will attempt to investigate the scope and size of the challenges facing the sector, and critically appraise the management strategies currently in place to ensure that the Sustainable Development Goal is met. It will then assess the effectiveness of those organisations charged with governing the sector and attempt to ascertain the extent to which the consumer is aware of the challenges and how this influences seafood purchasing behaviour.

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W. Leal Filho (ed.), *Handbook of Sustainability Science and Research*, World Sustainability Series, https://doi.org/10.1007/978-3-319-63007-6_44

Keywords
Sustainable diets · Fish · Management strategies

1 Introduction

Fish has long been one of the most important foods in the history of humanity. Its contribution to nutritional, economic and social well-being has been a pivotal factor in facilitating population growth over many hundreds of millennia. As populations grew, the availability of fish helped shape human geography and influence settlement patterns. Many towns grew up around these natural food sources; Cape Cod, for example, is named after one of the best-known New England fishing grounds. Today, fish is the largest source of protein in the world, the consumption of which is greater than that of beef, sheep, poultry and eggs combined (FAO 2016). With the human population predicted to grow towards a figure in excess of 9 billion by 2050, clearly, the continued availability of fish to meet this growth in demand will be absolutely essential in taking humanity forwards.

Given the relative importance of fish, it is hardly surprising to find a plethora of research in the academic and scientific literature. It appears under a number of disciplines including anthropology/ethnography, aquatic sciences, biology, economics/development, environmental science, ethics, geography, health policy & education, natural sciences, politics/political science, but some observe that the literature is all too often unconnected whereas sustainability requires a more holistic framework (Sovacool 2009). The literature also illustrates the wide range of views that permeate such a complex, global food sector. An overwhelming number of studies would seem to suggest that the more recent history of fishing is one of over-exploitation, pollution, habitat loss, depletion, local extinctions, and imminent crisis (Delgado et al. 2003; Greenberg 2010; Sumaila et al. 2010; Ye et al. 2013; Kalfagianni and Pattberg 2013; Hallstein and Villas-Boas 2013; The Economist 2014; Pitcher and Lam 2015). Early work by Carson (1951) commented on the irony that the sea, from which life first arose, should now be threatened by the activities of one form of that life, seeing the ultimate threat to life itself.

Sovacool (2009), for example, suggests more than 70% of global fisheries have already surpassed their sustainable limits, whereas just four years later Kalfagianni and Pattberg (2013) propose this figure is nearer to 80%. Even the omnipresent Cape Cod fishing ground was forced to close to commercial fishing in 1994. A number of studies suggest both the continued removal of more fish than can be replaced by natural processes and the trend of placing political drivers above scientific ones as being the main contributory causes. Many studies promote the obvious advantages of the rapidly growing trend in aquaculture but, at the same time, others (see, for example, Thurstan and Roberts 2014) suggest that this growth only serves to shield consumers from the consequences that our dependency on fish

continues to cause. Further sustainability concerns are raised with the inherent imbalances in global supply and demand, especially with western consumers aspiring to eat more fish as part of a healthier diet in the world full of undernourished people who depend on fish as the main protein staple in their diet. At the same time, industry bodies such as the *International Fishmeal and Fish Oil Organisation* (IFFO) make statements in the media about harvesting fish stocks sustainably is very much in their members' commercial interest (IFFO 2016).

This paper will explore the more recent evidence in order to better understand the key challenges of producing fish sustainably, with a specific focus on The UN's Sustainable Development Goal 14, which is designed to conserve and sustainably use the oceans, seas and marine resources, all of which are seen as being essential in ensuring a sustainable future. It explores the more recent evidence in order to understand the key challenges of producing fish sustainably with the purpose of understanding how sustainable fish consumption is today. The literature review examines 53 recent peer-reviewed and industry journals covering the technological, scientific, economic, politico-legal, social and governance challenges. Every aspect of the world's oceans, temperature, chemistry, currents and life drive the systems that make the Earth habitable for humans. This includes rainwater, drinking water, weather, climate, coastlines, much of our food, and even the oxygen in the air we breathe, which are all ultimately provided and regulated by the sea (UN 2015). Specifically, it will attempt to investigate the scope and size of the challenges facing the sector, and critically appraise the management strategies currently in place to ensure future sustainability. It will then assess the effectiveness of those organisations charged with governing the sector and attempt to ascertain the extent to which the consumer is aware of the challenges and how this understanding influences their seafood purchasing behaviour.

2 How Sustainable Is Fish Today?

The need to ensure the sustainability of fish stocks has long been a feature of fishing history. Not only is fishing a major source of food for humanity, it also provides employment and economic benefits to the two-thirds of world's population who inhabit coastal areas and depend on coastal environments for their livelihood (Sovacool 2009). It is perhaps for this reason that the literature contains many examples of measures to sustain stocks. Pitcher and Lam (2015), for example, cite the year 1357 when laws were passed to protect herring fisheries in East Anglia. The *Food and Agriculture Organization of the United Nations* (FAO) biennial assessment of the market (FAO 2016) has frequently reinforced the view that all aquatic resources, although renewable, are finite and need to be properly managed rather than being seen as an unlimited gift of nature or, as Probyn (2016) recently described, the anthropogenic threats facing the world's oceans. The generally poor state of global fisheries increasingly reported in both the media and literature alike

has led many observers to suggest such efforts have not resulted in effective measures for controlling fishing (Ye et al. 2013).

There have been many attempts to define the sustainability of fish. For the purpose of this study, the UK's Department for Environment, Food and Rural Affairs (Defra 2011) definition is particularly useful from a consumer perspective:

> Sustainably sourced fish is key to ensuring that stocks do not decline to dangerously low levels and that the ecosystem upon which the fishery depends is maintained. Fish species, fishing method and location of fishing all contribute to whether a fish is from sustainable stock.

Similarly, the FAO (2016, iii) outlines the significant role that fish continues to play in eliminating hunger, promoting health and reducing poverty, and claiming that '*never before have people consumed so much fish or depended so greatly on the sector for their well-being*'. The report goes onto highlight the need to look beyond the economics in order to ensure that environmental well-being is compatible with human well-being if long-term sustainability is to be a reality for all, concluding that promoting responsible and sustainable fish consumption is central to its work and purpose.

Most academic literature cites the FAO data for estimates of global fish consumption. The latest estimates this to be around 158 million tonnes (see Fig. 1), which equates to an average per capita consumption of 19.4 kg and significantly increased from an average of 9.9 kg in the 1960s. Other analyses provide further detail to the picture. Thurstan and Roberts (2014) report the supply of wild capture fish supply has declined by 32% since 1970, with the shortfall being kept in check by the rapid growth in aquaculture during this time. Aquaculture also serves to distort the picture, given the quantities of wild fish caught for the fish-feed industry.

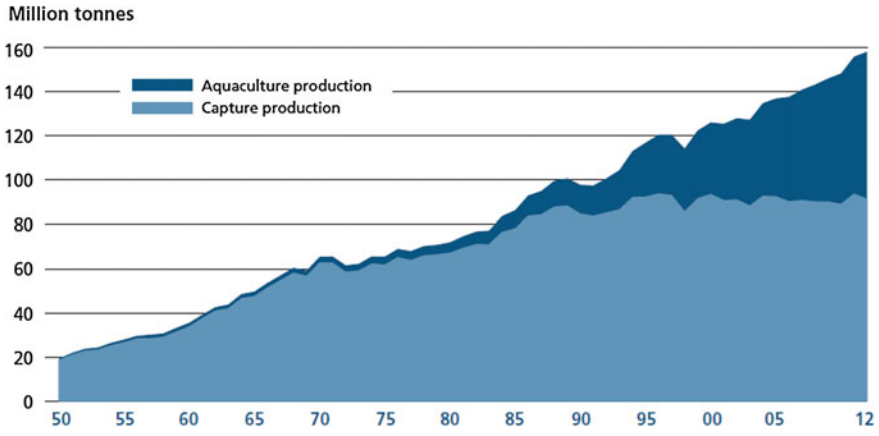

Fig. 1 World capture fisheries and aquaculture production. *Source* FAO (2016)

So, given the long understanding of the need for sustainable fish production and a relatively clear grasp of how much fish is being consumed, why are there so many claims of a sector heading towards crisis? An analysis of the literature suggests a wide variety of challenges that broadly fall into technological, scientific, economic, legal, social, and political, each of which warrants further discussion.

3 Technological Challenges

Since the 1880s, a succession of new technologies has essentially meant greater productivity for the fishing industry. Some of these are best described as indirect to the industry, such as steam-powered, then diesel-powered vessels, developing railway infrastructures and cold storage. Other, more direct advances helped improve the efficiency of capture, including larger drift nets, motorised net drums, freezer trawlers (introduced during the 1960s), and mechanised purse seine vessels (introduced during the 1970s) which enable entire herring shoals to be caught. Further innovations were designed specifically to make it difficult for fish to escape predation, including sonar to track aggregations of fish, radar for navigation, and Global Positioning System to mark specific locations of fish. In the North Sea, for example, Pitcher and Lam (2015) found that herring was rapidly overfished almost to the point of extinction, with catches exceeding by a factor of ten what had previously proved sustainable. This picture was repeated in many of the world's oceans across a number of fish species.

Seemingly unperturbed by both overfishing and destruction of fish stocks and habitats, further technological developments during the 1980s enabled fishing to ever-increasing ocean depths. And with these new depths came a new set of challenges. A study by Villasante et al. (2012) estimated the mean longevity of species increased with depth, from about 13 years for shallow water species to about 25 years for intermediate species and about 60 years for deep-sea species. This is a concern, not only because so little is known about the ecosystem effects of deep-sea fisheries, but also because further studies (Sumaila et al. 2010; Pitcher and Lam 2015) have concluded that the slow-growing, long-lived fish are buffered against climate fluctuations. So, the more the older fish are taken, the more fragile and less resilient these fish populations become, as it takes a long time for the fish to replace what is removed by fishing. Clover (2012) cites North Sea sole maturing at half the body weight they did in the 1950s, and cod reproducing at the age of four where they used to wait until six or seven to reach maturity 40 years ago. Furthermore, Villasante et al. (2012) argue where these stocks were managed under scientifically proposed Total Allowable Catch (TAC) schemes, these levels were not respected in about 60% of the cases investigated. In the European Union, for example, the agreed quotas were exceeded in about 50% of the cases during 2002–2011.

Many of these technological developments helped fish become an international commodity market. By the late 1980s, claimed the FAO (2000), fishing could no longer sustain such rapid and often uncontrolled exploitation and development. The introduction of frozen blocks of seafood commodities helped fuel the demand for consumer food products like 'TV dinners' (Pitcher and Lam 2015). A number of studies have suggested that even with all this expensive modern technology, the amount of cod, haddock and halibut landed in the UK is only 6% of the figure caught with sailing boats in the 1880s (Clover 2012). This was further aggravated by the amount of unregulated fishing on the high seas, in many cases involving straddling and highly migratory fish species (FAO 2000). Hardly surprising then, that many of the world's fish stocks are now seen as overexploited and some are close to collapse (The Economist 2014).

4 Scientific Challenges

The scientific challenges identified from the literature demonstrate an all too common similarity, one when the political and economic factors invariably take precedence over scientific factors. When viewed on a species by species, the pattern is all too similar: Herring is again overfished and showing signs of decline (Pitcher and Lam 2015); many Hake fisheries in both northern and southern hemispheres have collapsed in the past 20 years (Pitcher and Lam 2015); stocks of Bluefin Tuna, following the rapid increase in the global demand for sushi, is estimated at fewer than 10% of its 1970s population and has now imploded beyond recovery (Greenberg 2010); migratory fish such as wild salmon that migrate between the sea and fresh water are especially vulnerable, running a gauntlet of fishing gear as they enter rivers and lakes Pitcher and Lam (2015); North Sea cod stocks, however, may soon be certified sustainable by the Marine Stewardship Council (MSC) after many years of declining fish stocks (Gosden 2016). Overall, the problem seems so acute that Ye et al. (2013) suggest that restoring all overfished stocks may not result in Maximum Sustainable Yield (MSY) for all stocks, owing to the relationships between species and the dynamic nature of ecosystems. Dueri et al. (2016) also found such strategies complex, requiring regular review and updating, with the most appropriate management strategies changing as environmental and socio-economic conditions evolve.

5 Economic Challenges

The economic challenges also present a complex and multi-faceted set of inter-related variables. Sovacool (2009) argues that the behaviour of most fishing activity can be understood, rather obviously perhaps, as a simple economic optimisation. Clover (2012) cites World Bank estimates that fish contributes

£177 billion (EUR 219 billion) to the global economy. However, fishing less would allow stocks to recover and they estimate this would produce 40% more fish very quickly, adding £30 billion a year to the global economy. Also using World Bank data, Anticamara et al. (2011) estimate that the depletion of fish stocks causes economic losses of $50 billion annually, although The Economist (2014) argue that the full cost of damaging the system is not borne by those doing the damage. Earlier work by Sumaila et al. (2007) estimates fishing subsidies at 25% of the total landed value and profits normally not more than 10%. This has led some (Veldhuizen et al. 2015a) to predict that fuel subsidies may prove to be the Achilles' heel of some fishing fleets. The FAO (2016) raises concern by the inherent imbalances in supply and demand for fish, and the social problems that this imbalance causes. Sovacool (2009) highlights the relationship between free markets and the 'tragedy of the commons', especially where property rights are not clearly defined and when the commodity being protected is a particular living organism or part of an ecosystem. The Economist (2014) goes further to suggest that governance of fishing meets none of the essential criteria required.

6 Legal Challenges

Garcia and Rosenberg (2010) estimate that Illegal, Unreported and Unregulated (IUU) fishing, is a major source of undocumented catches, and it varies between 11 and 26 million tonnes and is worth $10–20 billion annually. IUU has long been seen as a cause of depleted fish stocks, destroying habitats, distorting competition, disadvantaging legal fisheries, and weakening fishing communities. With the potential to affect both the unregulated high seas and exclusive economic zones where state control is ineffective, it undermines efforts to conserve and manage fish stocks and inhibits progress towards achieving sustainability. The Economist (2014) argues that: most regional fishery bodies have too little money to combat illegal fishing; there is no register of estimated 4 million fishing vessels operating globally; rules only apply to members with 'outsiders' breaking them with impunity; and over half the countries said they could not even control vessels sailing under their own flags. Work by Veldhuizen et al. (2015b), however, is a little more optimistic, concluding that some of these issues have been partially tackled by policy responses such as TACs, individual transferable quotas, marine protected areas and effort restrictions.

7 Social Challenges

The social challenges are also inter-related variables that, very often, are shielded by governments reluctant to make unpopular decisions which may put pressure on society. Ye et al. (2013), for example, refer to an unwillingness or inability to

accept the short-term socio-economic consequences as hindering progress in rebuilding many fisheries. Thurstan and Roberts (2014) call for commonality to redress the wide discrepancies (ranging from 97 to 550 g) between the various national and international bodies on how much fish consumers should eat to achieve the desired health benefits (see Table. 1).

Other studies (Pitcher and Lam 2015) call for '*decommoditization*' strategies that sustain human and ecosystem relationships with fish beyond their commodity value in order to sustain global fisheries. The argument is that severely depleted fish stocks reflect global markets that value fish as just another consumptive commodity. Recovery of these depleted stocks could take years or even decades. This implies significant immediate and sustained cost, the impacts of which will be painful and felt by society as a whole. Once again, those sectors most dependent on fish for their livelihoods, especially those in the developing world would be particularly affected (Table 1).

Table 1 National dietary guidelines for fish consumption

Country	National guidelines	Recommended amount (g wk^{-1})	Source
United Kingdom	2 portions (140 g each) per week, one of which should be oily	280	Food Standards Agency (2010)
United States	2 average meals (6 oz each) per week, not including species high in mercury	340	U.S. Food and Drug Administration (2014)
Australia	2–3 servings per week (150 g each) not including species high in mercury	375	Food Standards Australia New Zealand (2013)
New Zealand	2–3 servings per week (150 g each) not including species high in mercury	375	Food Standards Australia New Zealand (2013)
Canada	At least 150 g each week	150	Health Canada (2011)
Denmark	200–300 g fish per week	250	WHO (2003)
Iceland	300 g fish per week	300	Gunnarsdottir et al. (2009)
Austria	1–2 portions per week (total 150 g)	150	WHO (2003)
Germany[a]	1 portion of seafood per week	100	WHO (2003)
Greece[a]	5–6 servings per week	550	WHO (2003)
Georgia	12.8–15 g fish per day	97	WHO (2003)
Ukraine	20 g fish per day	140	WHO (2003)
Estonia	2–3 servings per week (50 g each)	125	WHO (2003)
Armenia	30 g fish per day	210	WHO (2003)

Source Thurstan and Roberts (2013)

[a]Specific portion size not provided, it is assumed that one portion equals 100 g

8 Political Challenges

The political challenges discussed in the literature mostly relate to short-termism, the accuracy of reporting and engagement with international treaties. Ye et al. (2013) found governmental reluctance to make unpopular decisions, especially for long-term benefits where they may not gain much credit. Also, there are often limited resources available to implement management plans, particularly during recessionary times. The propensity to sign-up to international treaties is frequently seen as demonstrating a common desire for the goals of the treaties, but it does not always mean that implementation will follow. The accuracy of reporting catch data can also be an issue, especially with a tendency to under-report due to a lack of oversight and/or where high levels of subsistence fishing exist, but new technologies (e.g. Google Earth) are providing opportunities to minimise this (Trujillo et al. 2012).

9 Is Aquaculture the Saviour for the Overburdened Wild Fisheries Sector and an Important New Source of Food?

Aquaculture currently accounts for about half of all of the fish consumed, and it remains one of the fastest-growing food producing sectors (FAO 2016). While there seems little to doubt that aquaculture has great potential to expand and intensify sustainably, the sector has its own set of technological, scientific, economic, legal, social and political challenges. Many studies highlight the unsustainability of current practises (Delgado et al. 2003; Vassallo et al. 2007; Greenberg 2010; Volpe et al. 2013; Kalfagianni and Pattberg 2013; Thurstan and Roberts 2014; The Economist 2014; Hadjimichael et al. 2014; Byelashov and Griffin 2014; Edwards 2015; Alexander et al. 2016), especially the environmental concerns, although the proponents of newer, smarter methods of aquaculture suggest these concerns can be overcome (Earle 2013; Hallstein and Villas-Boas 2013; Thurstan and Roberts 2014). Pollution issues seem particularly challenging (Georgakopoulos and Thomson 2005; Alexander et al. 2016), especially health concerns surrounding the toxin polychlorinated biphenyls (PCBs) and the wide range of chemicals used to treat diseases such as sea lice. The field trials using Wrasse, a native UK fish species and natural predator to lice seem to show considerable promise. The dependency on wild fish for feed is well documented, particularly the projected increases that may require more wild fish for feed (Olsen and Hasan 2012). At the same time, however, research into new and sustainable sources of fish feed such as the genetically modified Camelina trials at Rothamsted would seem to offer real solutions (Hixson et al. 2014). Consumer pressure group Greenpeace (2013), however, argues that

aquaculture is exacerbating the pressures placed on overexploited marine ecosystems. This concern continues to influence consumer behaviour especially in the salmon industry (Whitmarsh and Palmieri 2011).

10 Who is Governing the Fish Market to Ensure Consumer Demand is Met?

The effective governance of a natural resource at a global level is bound to be a monumental challenge. The growing need for healthy food will invariably increase the demand for fish, a sector whose productivity is already highly stressed by excessive fishing pressure, pollution and climate change (Miller et al. 2013; Havice and Iles 2015). How can fisheries governance ensure a sustainable product, without depleting the environment, and adapt to climate change in order to meet this growing challenge? Sovacool (2009) suggests there are currently 22 international treaties in existence, all aiming to protect fish stocks globally. This is in addition to 18 regional fisheries management organisations and a plethora of regional agreements that attempt to regulate the fishing in every region of the world (see Appendix two for examples). Hazen et al. (2016) analyse how fisheries management agencies around the world are shifting from single species approaches towards ecosystem-based management implementation. Certainly, the continued reliance on controls and restrictions seem insufficient to protect global fish reserves. The alternative would be measured to reduce the demand for fish: Ye et al. (2013) for example, recommend a reduction in global fishing capacity of 36–43%, resulting in the loss of employment of 12–15 million fishing jobs and cost $96–358 billion. Kalfagianni and Pattberg (2013) advocate merging standards to bring about sustainability benefits, as standards converge towards higher stringency and strictness. Such a meta-governance system, however, seems unlikely in the foreseeable future. Stoll and Johnson (2015) investigate how non-governmental organisations and the private sector are increasingly using market strategies to drive governance, which they claim both bypasses formal government processes and weakens the power of policy-makers. Martinet et al. (2016) recommend multicriteria evaluation methods that take account of uncertainty be used to rank potential management strategies when there are conflicting economic, ecological and social objectives at stake. The current governance challenge is an increasingly complex one and many of the latest studies suggest the current forms of governance could quickly become obsolete should less traditional and potentially more severe measures, such as closed fisheries, long-term spatial closures or ecosystem approaches be applied (Steadman et al. 2014; Vázquez and González 2015; Yamazakia 2015; Elefterie 2016).

11 Identifying and Addressing the Main Consumer Concerns About Fish Sustainability

Consumers ultimately hold the key to driving the demand for sustainable fish. But, in order to do this, they must first be aware of the multiplicity of issues surrounding sustainability and then be prepared to selectively seek out appropriate products. A number of studies attempt to ascertain both this awareness and willingness to purchase. Verbeke et al. (2007) found the perceived importance of sustainable products was neither correlated with fish consumption frequency nor with general attitude toward eating fish. Defra (2011) found that although seventy per cent of shoppers claimed it was important that their fish came from a sustainable source, sixteen percent of these shoppers did not actually understand what sustainable fishing was. A further study by Clonan et al. (2012) found the number of consumers purchasing fish for health reasons was more than those seeking sustainably sourced fish and concluded that clearer advice should enable consumers to meet nutritional needs while protecting fish stocks. This study also identified not only a lack of awareness but also confusion relating to the MSC label for sustainable fish. Kalfagianni and Pattberg (2013) argue that although there have been some successes with these standards, few measurable environmental improvements have been seen to date. Perhaps the clearest consumer information comes from Greenpeace (2013), who recommend asking questions about where fish comes from in order to send a clear message to the supply chain intermediaries. This advice goes onto include seeking good alternatives, choosing line-caught fish wherever possible, reducing consumption, and sourcing from small local UK fisheries preferably in the south-west UK. But, with over 400 similar standards, certifications and labels related to wild fisheries and aquaculture, it remains an empirical and unresolved question whether such labels actually affect consumer behaviour (Hallstein and Villas-Boas 2013). In addition, there is some evidence to suggest that many retailers are falling behind on the amount of sustainable fish products they stock, despite having the opportunity to remodel supply chains and influence consumers (Greenpeace 2013; Chkanikova and Lehner 2015).

12 Conclusion

The overwhelming impression from studying the recent literature is one of an increasingly important food sector which is far from sustainable. It is clear that sustainability can only be achieved if all the aforementioned challenges are addressed in an integrated way. The need for a multidisciplinary approach to risk assessment and analysis identified within the literature remains an urgent one. The

challenges that the sector faces as it moves toward 2050 are both huge and highly complex; addressing them will require concerted and determined efforts by all the stakeholders concerned. There are, however, many strategic responses that collectively the industry can adopt such as adapting technologies to reflect the changing resources. The problems would seem especially problematic on the high seas, where over-exploitation is often double that of waters under national control. Those countries signing up to bilateral and multilateral agreements to increase the mobility of fishing are showing promising results, as witnessed with arctic cod between Norway and Russia (Veldhuizen et al. 2015a), so more are needed. Management measures need to be more flexible, especially those relating to fishing rights and closing vulnerable seas. More responsive and proactive legal frameworks are needed, ones that incorporate monitoring and early warning systems. This should be coupled with the elimination of harmful subsidies, replacing them instead with economic and social incentives.

Excessive fishing capacity must be reduced and the sector must contribute more to ecological services. All sectors of the industry must become more environmentally friendly and adopt adaptive livelihood strategies. Aquaculture must grow in ways that mitigate against environmental damage by choosing the right species and environments in which to grow them. Improved fishery management and aquaculture technology offer significant scope to improve fish consumption. Market-based initiatives aimed at the consumer have to be clearer and the message consistent across the many standards and certifications. On this latter issue, the move to national rather than global certifications would seem to offer significant benefits, e.g. GlobalGAP benchmarked national Good Agricultural Practice programmes, but the success of such systems is dependent on global agreement on safe fishing levels. Fish has to be taken out of the commodity market, where all stocks are seen as being equal, and the consumer educated accordingly. Good governance will be essential in helping to ensure that future demand for fish is met in an environmentally sustainable way, while at the same time reducing food insecurity and poverty. Further interdisciplinary research is needed because the challenges of fish sustainability intricately affect a diverse range of stakeholders and institutions. The significant variance between the largely optimistic view of fish sustainability published by FAO compared with the majority of more pessimistic academic studies requires further investigation.

The UN's Sustainable Development Goal 14 (to conserve and sustainably use the oceans, seas and marine resources) may provide an opportunity to step up action on the individual ocean-related issues set out in MDG 7 and contribute to the post-2015 development agenda. As one of the criticisms of MDG 7 was that individual communities approached it in isolation, we must assume that for SDG 14 to be successful, it must both have the right targets and be systematically interconnected to the other 16 goals. Further research is needed to ensure fish sustainability be fully realised; it must, therefore, bring together the science, decision-making and institutional structures involved in the implementation of the SDGs.

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