INTERNATIONAL SUSTAINABILITY UNIT

TRANSITIONING TO SUSTAINABLE AND RESILIENT FISHERIES

MORE FISH, MORE PROFITS, MORE JOBS

DRAFT – CONSULTATIVE DOCUMENT

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Executive Summary

This Consultative Document from The Prince's Charities' International Sustainability Unit is intended to help facilitate consensus on how it might be possible to achieve more sustainable wild fisheries. "Business as usual" is leading to the overexploitation and depletion of wild fisheries whereas a transition to sustainably managed fisheries could halt this decline, whilst at the same time dramatically increasing profits, improving food security and providing long-term, secure jobs. With the fishing sector repositioned on a sound economic footing, the need for subsidies would disappear after the transition period. The transition to sustainability would require the adoption of an ecosystem approach, robust fisheries management and sound economics. This interim period could be financed by the redirection of perverse public subsidies and an increase in private investment as fisheries become more attractive investment opportunities, reinforced by an increased demand for sustainable seafood from the market.

Fisheries – a source of wealth and welfare

Fisheries are a vital source of food, employment and economic development. At least one billion people rely on fish as their main source of protein. In the developing world, fish supply about 20 percent of the protein consumed, although in India and Indonesia the figure is about 50 percent and 67 percent respectively. Fish contain essential amino acids that are linked to a range of human health benefits, and fish are promoted across the world as a healthy diet choice, especially oily species.

In addition to food security and health, fishing is vital for employment. It is estimated that since 1970, the number of people fishing has more than tripled. Globally, as many as 200 million people are employed in fishing and post-harvest industries. The reliance on fishing as a means of livelihood is especially marked amongst poor people. Indeed, of the 120 million people directly dependent on fishing for their incomes, 97 percent live in developing countries. Though the reliance on fishing is particularly high in developing countries, it is important not to forget the value of fishing for livelihoods, communities, heritage and cultural identity in many regions of the developed world as well. Globally, the fisheries sector contributed approximately $274 billion to GDP in 2007.

A resource in decline

The increased pressure on fisheries from more people seeking a living in this sector, coupled with rapid technological development and the industrialisation of fleets, has caused a decline in the productivity of many fisheries. According to the UN Food and Agriculture Organisation (FAO) thirty-two percent of fish stocks are now overexploited, depleted or recovering from depletion and a further fifty percent are being exploited at their maximum level, with many of these vulnerable to decline due to poor management.

In parallel with the decline of so many wild fisheries, there has been a steady rise in aquaculture, which supplies about half of the seafood now consumed. Aquaculture does not, however, necessarily present an unlimited opportunity for growth in fish supply. This is not least because a great deal of the feed needed to rear captive fish is derived from wild fisheries, and because a combination of both healthy wild fisheries and sustainable aquaculture production will be required to meet the projected growth in seafood demand over the coming decades. Therefore the sustainable management of wild fisheries remains a priority for food security.

The continued decline of wild fisheries is socially and economically irrational. It is estimated that if fisheries were managed sustainably they could deliver $50 billion per year more to GDP than they currently do. This is particularly unfortunate given that the sector’s underperformance and the destruction of its natural resource base (the ecosystem) is incentivised by the application of $16 billion of public subsidy spent each year to increase fishing capacity.

Among other perverse impacts, these subsidies make wild fisheries artificially profitable when they would otherwise be economically unviable. One example of perverse economic incentives is the lack of property rights in most fisheries. When the number of fishing license holders or the amount of fishing effort that can be applied is not restricted, fishers do not take a long-term interest in the sustainability of their fish stocks, which results in a ‘tragedy of the commons’.

Whilst the presence of perverse economic incentives is one of the main drivers of global fisheries’ decline, the lack of robust management regimes and the lack of an ecosystem approach are also key factors. All three of these underlying drivers would need to be addressed to enable a transition to sustainability.

The recovery of fisheries will not be possible under the current weak management systems which are only too frequently characterised by a lack of transparency and accountability, poor regulation and the weak implementation of those laws that do exist. For example, the widespread lack of enforcement of fishing quotas has led to a situation where illegal, unregulated and unreported fishing (IUU) now accounts for approximately 25 percent of global catch. Fishing fleets have spread to all corners of the world, from the coastal zones out to the high seas. The high seas cover almost 60 percent of the planet’s surface, yet they are poorly known and weakly protected.
Rather than managing fisheries within the ecosystems that provide them, the traditional approach to fisheries management focuses on single species and does not adequately reflect the complex and dynamic nature of marine environments. This, in turn, makes it impossible to ensure the maintenance of the marine ecosystems on which the productivity of fisheries ultimately depends. The single species approach has many adverse effects, including the wastage of approximately 8 percent of global catch through the bycatch and discarding of non-target species.

Unfortunately, massive overfishing in an environmentally destructive way is not the only problem affecting the health of wild fisheries for they are also simultaneously beset by a range of increasingly severe exogenous impacts including ocean acidification, warming sea temperatures and pollution. Fisheries must be managed in such a way that they do not deplete the natural resource base on which they depend; they must become resilient to the exogenous impacts that are inevitable over the next half century; and they must deliver social resilience in the form of food security and livelihoods. Fisheries will only be resilient to exogenous shocks if we minimise the human-induced stresses on the marine environment by taking an ecosystem approach to fisheries management and harvest natures income, not its capital.

The opportunity

Whilst the situation has become grave in many fisheries, there is cause for optimism. Modelling exercises, as well as real world experience, suggest that it is possible for fisheries to recover productivity and increase output if interventions are made to change economic models, implement robust fisheries management and apply an ecosystem approach.

Modelling indicates how a departure from ‘business as usual’ could generate considerably larger profits from fisheries, whilst also increasing food security. This document cites two case studies that the model has been applied to: the North-East Atlantic Bluefin Tuna fishery and the mixed coastal fishery of Senegal. The North-East Atlantic Bluefin Tuna fishery is currently worth approximately $70 million in annual profits (with $120 million of subsidies). However, at current rates of fishing, this species is expected to be commercially extinct within 12-15 years. By contrast, changes to management, including measures leading to fewer boats, a reduction in fishing quotas or a temporary ban on fishing, could secure additional value to society of approximately $510 million per year for an indefinite period, and without the need for subsidies.

In coastal Senegal, modelling also indicated the huge potential to achieve more productive and economically viable fisheries. Sustainable management of this mixed fishery, of importance to both artisanal and industrial fleets, could secure additional value to society of $80 million per year. Although this would require a reduction in employment, the modelling exercise suggests that the wages of fishers would be higher after the transition period and their contribution to GDP would dramatically increase. Again, this outcome could be achieved without the need for subsidies after the transition period and the level of employment would be considerably higher than if the fishery collapses.

Modelling demonstrates the huge opportunity to gain more economic value from fisheries. Using this approach, it was also possible to include some of the environmental externalities and social benefits provided by fisheries. However, it is not only economic modelling that gives cause for optimism.

Practical action is possible

Whilst estimates of the higher profits that could be derived from sustainably managed fisheries can galvanise interest at a broad abstract level, confidence that change is possible also comes from real world examples. Efforts to apply the ecosystem approach to fisheries management have led to considerable environmental, economic and social benefits in many areas. In the Antarctic region, the additional scientific research and data collection enabled two fisheries to gain Marine Stewardship Council (MSC) certification and in Fiji a research and assessment programme led to the development of a new management strategy that has enabled the recovery of fish stocks and coral cover. In Australia, a comprehensive marine spatial plan led to the establishment of the Great Barrier Reef Marine Park, which will now provide over AUS $5 billion per year to Australia’s economy for decades to come.

The implementation of robust fisheries management has also led to considerable benefits in many fisheries. In Namibia, the introduction of a robust monitoring and enforcement programme in 1992 has reduced IUU fishing to negligible levels. As a result of this intervention, the Hake fishery grew from 60,000 tonnes to 195,000 tonnes between 1990 and 2002 and the contribution of fishing to Namibia’s economy grew from $98 million to $372 million per year over the same period. Full stakeholder engagement is vital for the success of new management measures and the South African Hake fishery demonstrates a particularly good consultation process. Stakeholders from this fishery have worked together to agree management rules that are implemented in the event that new data shows declining fish stocks.

The implementation of sound economics has also improved the sustainability of many fisheries. In some instances this been achieved through the introduction of property rights, which provide a positive incentive to fishers to ensure the long-term sustainability of the resource. There are dozens of examples of different forms of property rights that have been used around the world, including those that restrict quota and those that restrict effort. The successful introduction of rights has occurred in many countries and regions including New Zealand, Alaska, Iceland, Vietnam, Chile and the Pacific. Property rights have led to particularly large economic benefits in places like Alaska, where the introduction of an
individual transferable quota (ITQ) system led to an increase in total fishing revenue from $50 million in 1992 to $150-200 million in 2003. Other examples of tools to correct the economics have included the successful reduction and removal of subsidies in Norway and New Zealand, and the numerous examples of positive incentives created by industry initiatives and certification in the seafood supply chain.

All of the examples included in this report demonstrate that progress towards sustainable management can be, and indeed is being, made. They underline that the economic, environmental and social benefits of sustainable fisheries management are attainable and should, as a matter of urgency, be replicated at scale.

Transition finance – the key to success

Having established that the tools required to restore the productivity of fisheries already exist, and that the scale of the economic opportunity arising from sustainable management is enormous, the essential next step is to work out how to provide the finance to enable the transition. Unsustainable fisheries, operating with low profit margins, often lack the cash or collateral required to obtain sufficient equity to embark on such a transition.

As in many other sectors facing similar problems, any interim support package to finance fisheries change is likely to require a combination of public and private finance. To be successful, such a package would need to be based on an understanding of the complex drivers that effect behavioural change, as well as the imperative need for an integrated approach to be taken in the design of sustainable fisheries management plans.

A starting point must be the redirection and removal of capacity-enhancing subsidies. Public incentives should become aligned with sustainable management aims for public goods, whilst in the process contributing to greater food security and ecosystem resilience.

In addition to public finance, once the compelling economic rationale for sustainable fisheries has been understood, they should attract investment from the private sector. The Banking on Cod proposal is one promising model of how finance might be secured for short-term reforms, and paid back via the longer-term financial returns that arise from the greater fishery productivity secured through sustainable management.

A range of not-for-profit initiatives is also being used to fund the conservation of ecosystem services. The Phoenix Island Protected Area and the Great Barrier Reef Foundation are two examples.

Finally, market demand for sustainable seafood will continue to play an important supporting role because there are considerable opportunities for fisheries to benefit from the premium prices often secured for sustainable seafood.

The way forward

This Consultative Document suggests that there are three core principles that are urgently needed to underpin the sustainable management of the world's fisheries: an ecosystem approach, robust fisheries management and sound economics, based upon a restructured financial support system. Taking a longer-term approach to fisheries management, rather than continuing to focus on short-term profits and increasing short-term employment, will require a shift in approach from what might be regarded as a hunter-gatherer mentality to one more like that of pastoralists, who would manage their fishery as an asset, taking annual revenue from the natural resource.

The introduction of an ecosystem approach to fisheries management might be hastened by the development of implementation guidelines, based on field experience, or by initiatives to increase national and regional data collection efforts.

More examples of robust fisheries management might be achieved by establishing clearer shared views on how best to improve governance, develop high seas fisheries management, increase global monitoring, control and surveillance capacity and ensure stakeholder engagement in decision-making. Progress towards reform, in relation to subsidies and property rights, could aid rapid recovery and developing the case for private sector investment in fisheries recovery would also hasten the process.

The ISU invites reactions on the analysis, conclusions and proposals presented in this consultative report.
1 Introduction

The Prince’s Charities’ International Sustainability Unit (ISU) seeks to build consensus around solutions to some of the world’s key environmental challenges. The ISU hopes to use this document to invite input on the role it can play in supporting the transition to more sustainable and resilient fisheries.

1.1 About the ISU

HRH The Prince of Wales established the International Sustainability Unit (ISU) to facilitate consensus on how to resolve some of the key environmental challenges facing the world – these include food security, ecosystem resilience and the depletion of natural capital. The ISU works with governments, the private sector and non-governmental organisations, helping to strengthen partnerships between these sectors.

1.2 Marine Fisheries Programme

The ISU has consulted widely on the challenges faced by global fisheries and marine ecosystems and the solutions that are being proposed, in order to understand how fisheries could become more sustainable and resilient. As part of the consultation process, the ISU commissioned research by external consultants on the economics of ‘business as usual’ versus allowing fisheries to recover to the maximum sustainable yield. An economic model was developed and applied at a global level and to two specific fisheries. The model takes a holistic approach to fisheries, valuing some of the environmental externalities and social benefits in addition to the industry’s costs and revenues. The ISU also commissioned research to analyse 20 fisheries around the world that are transitioning to sustainability so as to understand the factors and tools that have made real change possible. This document incorporates some of the high level findings from these consultancy reports and the ISU’s research phase.

1.3 Purpose of this document

This is a Consultative Document, which presents the findings of the ISU’s research, whilst also drawing on the conclusions of other initiatives. This Consultative Document is not intended to be a public document. Instead, the ISU plans to distribute the document to experts, practitioners and policymakers for comment. The ISU hopes to use this document to validate the findings and seek input on what sort of role it can most usefully play in supporting the transition to more sustainable and resilient fisheries. The ISU will then use this feedback to refine its ideas and to define the focus of its marine programme, with the goal of producing a final proposal later in 2011.

Using the results of analytical research commissioned by the ISU, this document aims to demonstrate that sustainably managed fisheries could realise the untapped billions presently lost, eliminate the need for subsidies, provide long-term employment in a profitable sector and help to secure high quality protein for an increasingly hungry world. Then, using the results of case study research commissioned by the ISU, the document presents evidence that the prize of sustainable fisheries management is not only enormous but also achievable.

This document recognises the importance of sustainable aquaculture production and the continued growth of this sector to help meet rising demand for seafood. Similarly, it recognises the crucial role played by inland fisheries in contributing to food security and livelihoods, especially in developing countries. However, the focus of the document is on wild marine fisheries.

1.4 Background

During recent years the world has begun to awaken to the environmental challenges emerging across the world’s seas and oceans. The scale of the challenge has confirmed that urgent action is warranted and that, “business as usual is no longer a viable option.” Particular concern has been expressed in relation to the sustainability of the world’s fisheries and their ability to continue thriving in areas where environmental degradation and climate change are starting to threaten the natural capital on which they depend, produce sufficient protein to feed an increasingly hungry world, sustain livelihoods and contribute to economic growth.

The total catch from wild marine fisheries reached a peak in 1996 with an estimated production of 86.3 million tonnes and since then has levelled out to an annual production of approximately 80 million tonnes. The latest FAO figures report that 32% of marine fisheries are overexploited, depleted or recovering from depletion, up from 25% in 2006. A further 53% of fisheries are being exploited at their maximum level but moving at an alarming rate to being

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1 Foresight, 2011
2 FAO, 2010 (a)
3 FAO, 2010 (a)
overexploited and depleted. A fishery that is being exploited at the maximum level is one that is operating at the Maximum Sustainable Yield (MSY). The number of underexploited or moderately exploited fisheries has declined from 40% in 1970 to only 15% today (see Figure 1).

There are stark regional differences in the level of exploitation. In the Mediterranean Sea, the European Environment Agency recently reported that 60% of fish stocks are overfished. In the UK it is estimated that trawlers now have to work 17 times harder to catch the same number of fish compared to 120 years ago. Some fisheries have already collapsed, for example the South American pilchard declined from 3.3 million tonnes in 1980 to almost 0 in 2008, and the North Atlantic capelin fishery declined from 2.6 million tonnes in 1980 to 300,000 tonnes in 2008.

The World Bank recently estimated in their Sunken Billions Report that the sustainable management of global fisheries would contribute an additional $50 billion per year to GDP on top of the $274 billion currently being generated. Both the World Bank’s report and the research commissioned by the ISU, use the MSY as the ‘target’ for sustainable fisheries management as this is the point at which economic, social and environmental benefits are maximised. The ISU recognises that the MSY may not be the preferred target for the management of all fisheries. For example, the Maximum Economic Yield (MEY) maximises the economic profitability of a fishery by reducing fishing effort even further than the MSY (see Figure 2). Although biologically, this is an even safer level of fishing than the MSY, the MEY does not maximise the food production and employment generation from fisheries. The key point to emphasise is that overexploited fisheries are operating beyond the MSY and furthermore, those operating at the point of MSY, without sustainable management are fast heading for depletion.

The collapse of a fish stock is to be avoided at all costs. It causes a source of food to be lost, a loss of jobs and the loss of the associated economic and social benefits. It also affects the ecosystem, dramatically changing relationships within the food web and disrupting the ecology of non-target species, be they commercially valuable or not. The following chapter outlines in more detail why fisheries are so important and the challenges that they are facing.

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4 EU, 2010
5 Thurstan et al, 2010
6 FAO, 2010 (b)
7 World Bank, 2009
2 Why sustainable fisheries and marine ecosystems matter

Fisheries provide a vital source of food and livelihoods for billions of people and contribute $274 billion per year to global GDP.

2.1 To sustain the long term productivity and resilience of marine ecosystems

Occupying some 70% of the surface of the planet, the oceans are home to a large proportion of the world’s biodiversity. The preservation of marine ecosystems is absolutely essential to ensure the continued productivity of fisheries since this is ultimately the natural resource base on which fisheries depend. Removing any one species can have ramifications for the whole ecosystem by disrupting ecological relationships between species. These are complex systems, the details of which humankind knows little. We do know, however, that unsustainable fishing practices and methods often contribute to the destruction or over simplification of the very ecosystems on which they depend.

One example of the value of marine ecosystems in relation to fisheries is that of coral reefs. Coral reefs are home to an estimated 1-3 million species, including more than a quarter of all marine fish species. Some 30 million people in coastal and island communities are reliant on coral reefs for food production, income and livelihood. Coral reefs also provide valuable ecosystem services such as coastline protection. Destructive fishing practices can destroy coral reefs, thereby destroying their values including the productivity of coastal fisheries. In Belize, an evaluation by WRI found that their coral reefs were worth between $395 to $559 million per year, or up to 40% of GDP. However, the coral reefs were becoming badly degraded due to the use of destructive fishing practices. Once the true economic value was made apparent to the Government of Belize, the adoption of less destructive fishing practices quickly occurred.

The removal of long-lived predatory fish from the oceans is leading to the over-simplification of marine ecosystems. Over-simplification of the ecosystem can be illustrated by disturbance to ecosystem relationships caused by the exploitation of animals near to the top of food chains. This can be measured in terms of trophic levels, that is, the number of steps a species is from the bottom of the food chain, with the first step being the algae which harness sunlight. Most of the fish that are caught for food are between trophic levels 3 and 4.5. However, there has been an observed per decade decline of 0.05 to 0.1 trophic levels in global fish landings. There are significant risks associated with ecological simplification and the loss of biodiversity because healthy ecosystems are needed to provide resilience to exogenous shocks and stresses.

Fishing, climate change and pollution have left an indelible mark on virtually all of the world’s oceans, according to a recent study that has mapped the total human impact on our oceans. Scientists found that almost no areas have been left pristine, and that more than 40% have been heavily affected. Figure 3 shows the global map of human impact on marine ecosystems.

In addition to fishing, which is the most widespread and damaging direct human activity, humans have caused numerous indirect impacts on the oceans. ‘Dead zones’, which are no longer able to support marine life, are being created by the run-off of agricultural pollutants from land. Rapid coastal development is projected to have impacts on 91% of all inhabited coasts by 2050 and cause up to 80% of marine pollution. The oceans are the final destination for a wide range of chemical pollutants, some of which are bio-accumulative, endocrine-disrupting or carcinogenic and have been found in fish destined for human consumption.

8 TEEB, 2010
9 Cooper et al, 2008
10 Pauly et al , 2009
11 Pauly et al, 2009
12 Halpern et al, 2008
13 UNEP, 2008
consumption. Finally, climate change is causing ocean acidification, which will have a profound impact on all marine organisms that build calcium carbonate shells and coral reefs. According to UNEP, increased CO2 assimilation in oceans will lead to dieback of up to 80% of the world’s coral reefs.

Healthy and diverse marine ecosystems are vital in order to ensure they are resilient to the current and future exogenous shocks and stresses that are inevitable over the next half-century. Without resilient marine ecosystems it will not be possible to maintain the productivity of fisheries or the numerous other essential services that the oceans provide.

2.2 To meet the food security needs of growing populations

With food security very much at the fore of international discussions today, the contribution of fish and fish products to global nutrition and food security is of paramount importance. In 2009, the UK Chief Scientist highlighted the ‘perfect storm’ of pressures that the world is likely to face by 2030: 50% more energy will be needed and 30% more fresh water to produce 50% more food. The contribution of fish and seafood is vital to the world’s food security, and will only increase given the challenges that lie ahead for terrestrial food production. It is consequently vital that rising demand, coupled with population growth, do not lead to the eradication of the very source of food it will rely on.

According to the most recent FAO figures, fish consumption has reached an average all-time high of 17kg per person. It supplies approximately 1 billion people with their main source of animal protein and over 3 billion people with at least 15% of their animal protein intake. In the developing world, on average fish accounts for 20% of protein consumption, compared to 8% in the developed world. In many countries this proportion is even higher: 50% in India, 59% in Japan and 67% in Indonesia. Some small island developing states depend almost exclusively on it.

Despite a stagnation in the wild fish catch, the total production of fish and fish products has continued to rise. This is due to the rapid expansion of the aquaculture industry

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14 Greenpeace China, 2010
15 UNEP, 2008
16 Guardian, 2009
17 FAO, 2011
18 MRAG, n.a.
19 FAO, 2010 (a)
from less than 1 million tonnes in the early 1950s to 59.4 million tonnes in 2004.\textsuperscript{20} With an average growth rate of 6.6% per year since the 1970s, aquaculture remains the fastest-growing food production activity in the world and now accounts for almost half of total food fish supply.\textsuperscript{21} It is not so simple, however, to see one system replacing another. Firstly, even if aquaculture can meet the growth in demand for seafood, it is very unlikely that it will be able to fill the gap left by declining wild fisheries as well. Secondly, wild fish will continue to be needed to supply fishmeal and fish oil for the production of aquaculture, pigs and poultry.

2.3 To contribute to the economy, employment and livelihoods

In addition to food security benefits, fisheries represent an important source of employment and contribution to GDP. As fisheries decline so these benefits can be jeopardised. At a global level, wild fisheries contribute approximately $274 billion (2007) to GDP. Upstream activities, such as boatbuilding, could contribute another $160 billion per year;\textsuperscript{22} Whilst at the global level this does not represent even 1% of GDP, in many countries fishing is much more important. For example, in the Seychelles, fisheries account for approximately 30% of GDP, 12% in Uganda and almost 10% in Ghana. Furthermore, it is estimated that 45% of fish are traded internationally, making fish products one of the most traded protein commodities.\textsuperscript{23} Total exports were worth $86 billion in 2006. This is much higher than other agricultural commodities such as coffee (∼9 billion), rubber (∼5 billion) or cocoa (∼4 billion).\textsuperscript{24} Even in countries where fisheries do not provide a significant contribution to GDP they can be vital to local economies. This is particularly true in rural and island communities like the Aleutian chain, the West Coast of Norway, Faroe, Shetland and Newfoundland.

Between 120–200 million people are directly and indirectly employed by the fishing industry and 97% of all those employed live in developing countries.\textsuperscript{25} Whilst the relationship between poverty and biodiversity is not always clear, it is true to say that in developing countries a disproportionate amount of people rely on natural capital for their income (e.g. fisheries, forests).\textsuperscript{26} Furthermore, these dependents are often less well equipped to cope with the losses of critical ecosystem services, so sustainable management is all the more important. In both developing and developed countries alike, fishing is a crucial economic sector that is a vital asset for development as well as being important for livelihoods, communities, heritage and the cultural identity of localities.

Fishing is an industry that has shown considerable growth in terms of employment, almost tripling in the past three decades. Growth has been strong in Africa, but strongest in Asia. It is important to note, however, that this massive growth in employment has not been matched by a proportionate increase in catch. Indeed, between 1970 and 2000 the average reported harvest per fisher decreased by 42% from 5 tonnes per year in 1970 to 3.1 tons in 2000.\textsuperscript{27} Figure 4 illustrates how the catch per vessel has declined since 1975 despite increasing fishing power.

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20 FAO, 2010
21 FAO, 2010
22 World Bank, 2010
23 FAO, 2011 (c)
24 FAO, 2010 (b)
25 World Bank, 2010
26 TEEB, 2010; UNEP, 2008
27 TEEB, 2010
This growth, both in terms of people employed and the capacity of vessels to catch fish, means that the transition to sustainable fisheries will necessarily require a reduction in capacity. The UN has warned that more than 20 million people will have to retrain over the next 40 years if a global collapse in fish stocks is to be avoided. However, the point to emphasise is that many more will face a loss of livelihood if no action is taken.

2.4 Sustainable fisheries – a shared global goal

This brief outline of the importance of marine fisheries highlights the urgent need to manage fisheries and marine ecosystems in a more sustainable manner. There are many definitions to describe the sustainable management of wild fisheries but most definitions combine five broad elements:

First, fisheries should contribute to providing protein of sufficient quality to satisfy the critical health and nutrient needs of a population of 9 billion by 2050. It is desirable that this contribution will equate to no more than the Maximum Sustainable Yield;

Secondly, fisheries should preserve rather than deplete the non-renewable natural resources that are essential to sustain fisheries and aquaculture production in the long-term;

Thirdly, fisheries should minimise their negative impacts on the marine ecosystems, which are essential to support human life and the continued productivity of fisheries;

Fourthly, fisheries should produce socio-economic outcomes that are conducive to happiness, dignity and development;

Finally, the fishing industry should develop greater resilience to future shocks such as climate change and pollution events.

Whilst there is a growing acceptance among governments, industry and civil society that urgent action is required, and whilst there has been laudable progress in different countries and regions, the world is still very far from achieving fisheries management that effectively integrates the goals of maximising food security, employment and profitability. To understand why this is, it is important to understand the underlying factors that are driving unsustainable fisheries. This is the subject of the next chapter.
3 Drivers of decline in fisheries and marine ecosystems

The decline of fisheries results from the failure to respect three fundamental principles: the need for an ecosystem-based approach, robust fisheries management and sound economics.

It has become evident during a wide-ranging consultative process that there is an emerging consensus that fisheries are in decline because three fundamental principles are still not reflected in how they are exploited. These principles relate to the need for:

1. An ecosystem-based approach
2. Robust fisheries management
3. Sound economics

The application of these principles would promote long-term sustainability and increase resilience. Each of these principles is explored in more detail below.

3.1 The absence of an ecosystem approach

The traditional approach to fisheries management tends to focus on single species stock assessments, which do not recognise the complex and dynamic nature of marine environments. Furthermore, these stock assessments are often based on incomplete or misleading data, leading to poorly informed decision-making. To halt the decline of fisheries and maintain stocks into the long term, many experts conclude that transitions toward ecosystem-based fisheries management are required, based on more comprehensive information. This expert view is now also reflected in political agreement on the future of fisheries. For example, 57 countries pledged their support for the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem which included an intention to incorporate ecosystems considerations into the management of fisheries.29

The ecosystem approach to fisheries management is a broad concept that builds on the historic responses to fisheries management challenges. The principle distinction between this approach and that which has largely gone before is the extent to which exploitation is pursued through the management of the entire ecosystem, as opposed to a particular fish stock in isolation. Recognising that an ecosystem is generally defined as ‘an ecological community together with its environment, considered as a unit’,30 this is a basic and very important conceptual difference.

The aim of this overarching ethos is to maintain ecosystem health, based on the unavoidable conclusion that this is what sustains the volume of fish biomass and thus the viability of stocks. Ecosystem-based management must thus acknowledge the inherent complexity and heterogeneity of interactions within marine environments and reflect that complexity in management choices. Three key areas that are currently preventing the application of the ecosystem approach are outlined below.

The absence of high quality and comprehensive scientific data

Failures and problems associated with bad management are often due to poorly defined objectives and decision making and made worse by a lack of data on which to base management decisions. This can lead to the inappropriate selection and application of management measures. The way information for management is generated and how responsibility for enforcement is shared can also lead to problems.

Whilst a lack of resources or effective processes for data collection is often an issue, there is also an inherent level of uncertainty within fisheries. Fish stocks are not only affected by commercial exploitation but also by other environmental factors which are often unknown or hard to measure or model. Information is therefore often inferred only from catch rates or research sampling. This problem is particularly widespread within much of the developing world. The lack of high quality and comprehensive scientific data is a fundamental driver of decline, for without this information even the most basic steps toward more sustainable fisheries are difficult or impossible to take.

The absence of Marine Protected Areas and Marine Spatial Planning

Two tools that can be used to good effect under the ecosystem approach are Marine Protected Areas (MPAs) and Marine Spatial Planning (MSP).

No area of the ocean is now unaffected by human impact,31 yet only 1.17% is under some kind of protection. On land the proportion is approximately 12%. An expansion in the
number and coverage of MPAs could help to achieve multiple objectives, including the conservation of biodiversity and the restoration of fish stocks. Many organisations have concluded that a major MPA programme would help improve the productivity and management of fisheries but due to a lack of political will, industry opposition, inadequate financial resources and uncommitted international institutions, the number and size of MPAs remain small in the context of the global challenge. Furthermore, although it is not possible to develop an exact picture, only a small portion of the current MPA coverage is fully protected or ‘no-take’ whilst a large proportion of MPAs are ineffective or only partially effective.32

In addition to protected areas, it is clear that considerable benefits can be derived from more integrated planning. MSP is a technique that can be used to resolve actual or potential conflict between different users of the marine space (aquaculture, shipping, offshore renewable energy, leisure and tourism, and fishing), and thereby achieve more sustainable outcomes.

It appears that the relatively weak current focus on protected areas and spatial planning is down to a lack of awareness of the need to maintain healthy marine ecosystems as an essential basis for productive fisheries. Filling this gap in understanding therefore emerges as a priority action in moving toward more sustainable management.

High levels of bycatch and discards

There are also significant questions about how the overcapacity of the global fishing fleet impacts on non-target species. Discards are fish that have been caught but cannot be landed because of quota and other management restrictions, and are cast back into the sea dead. Bycatch is the unintended catch of non-target species, which are taken in mixed fisheries. Under good fisheries management, discards are eliminated and bycatch is minimised.

Bycatch and discards are estimated to add a further 8% to global catch levels, although there are stark regional differences.33 For example, it is estimated that half the fish caught in the North Sea is discarded back into the sea dead. In some fisheries, in particular the tropical shrimp fisheries, this percentage is much higher. It is estimated that 27% of global bycatch occurs in tropical shrimp fisheries due to the very small mesh sized nets that are used to trawl, and 13% of this is discarded.34 The EU Fisheries Commissioner recently described discarding of fish as “unethical, a waste of natural resources and a waste of fishermen’s effort”.35

As well as being economically and socially wasteful, bycatch and discards can also affect the ecosystem on which the fishery is based, by removing species that are vital to its health. The bycatch of juveniles is particularly destructive as it takes the fish out of the breeding cycle, thus further restricting the ability of the stock to replenish. Furthermore, these figures are usually not taken into account when setting quotas, resulting in actual catch figures being much higher than scientific recommendations. Bycatch and discards remain an enormous problem in global fisheries and very few fisheries have managed to minimise the problem.

3.2 The absence of robust fisheries management

Sustainable fisheries require support from robust fisheries management structures and measures. These can only be effective if there is effective enforcement and full stakeholder engagement. These tools are often absent.

Ineffective enforcement

No fisheries management system can be effective unless it is properly enforced. Whilst enforcement has improved within the national jurisdictions of many nations, this is by no means universal.
Data on Illegal, Unreported and Unregulated (IUU) fishing are, by their nature, hard to come by, but it is estimated to account for approximately 25% of global catch.36 In most cases IUU fishing is unreported e.g. boats that fish more than their quota, but falsify their catch record. However, there is also a fair amount of illegal or unregistered catch. IUU fishing persists because of a combination of low fines, poor monitoring and enforcement and significant overcapacity.

The situation on the high seas is even worse. The high seas (or international waters) refer to all areas outside of national jurisdiction and cover approximately 60% of the planet’s surface.37 All fisheries management challenges are compounded on the high seas, where legislation is weak and the basis for international cooperation flimsy. All high seas fisheries should now be managed by a Regional Fisheries Management Organisation (RFMO) and, according to the FAO, they should work according to common standards agreed globally. Unfortunately, however, the quality of management by RFMOs remains highly variable.

Lack of stakeholder engagement

Poor and ineffective fisheries management is often associated with a system of top-down decision-making that does not effectively involve all stakeholders. There are a large number of stakeholders that all have a vested interest in good fisheries management becoming a reality. These range from processors to consumers and from policy-makers to retailers. No stakeholder, however, is more important than the fishing sector itself and the input of fishers should always be prioritised in the development of new management regimes.

The fishing sector has a vast body of knowledge, skills, data and ideas on how to manage fisheries. It also holds the practical experience that is so vital in crafting responses that will work in the real world. Fishers have a passion for their industry, and not only are they a source of wisdom and knowledge, but also more likely to be willing partners in implementing a new fisheries management regime that they have been involved in designing.

Subsidiarity is also important. Many fisheries are, by their nature, regionally and locally based. It therefore makes sense to manage fisheries at this level.

3.3 The absence of sound economics

It is essential that fisheries are managed according to a sound economic approach. Tools to achieve this include the establishment of property rights, the redirection or removal of the estimated $16 billion of perverse subsidies and fully utilising the increasing demand for sustainable seafood. At best, these tools are used only weakly in fisheries management situations.

Lack of property rights

Oceans have always been considered a ‘global commons’ and, as such, very few countries have imposed constraints on their use. This has resulted in the age-old problem of the ‘tragedy of the commons’ whereby anyone with access to a shared valuable resource has an interest in over-exploiting it, and it is in nobody’s interest alone to maintain it. In relation to fishing, this concept results in fleet overcapacity, short-termism and consequently a reduction in the length of fishing seasons (or overfishing and IUU fishing where inadequate controls exist).

Over the past hundred years or so fishers have gradually become better at catching fish as they have adopted technological innovations and advances. For a long time the development of new fish-catching technology was backed by wildly optimistic forecasts as to the capacity of the oceans to meet relentlessly rising demand. During the 1970s it was predicted that it would be possible to harvest 2 billion tonnes of fish per year from the oceans.38 The limit of the oceans to supply increasing quantities of fish was reached in the 1990s, however, at only a fraction of this level, and has stabilised at around 80 million tonnes. At the heart of global fisheries decline is the adoption of more powerful technology, which has enabled the exploitation of a finite supply of fish without the incentive of property rights to act as a guide to wise management.

In an attempt to address these problems, property rights have been introduced into some fisheries (such as the Alaskan halibut, Icelandic cod, New Zealand hoki, Pacific groundfish, Vietnamese clam and Chilean loco fisheries). In these fisheries, and in those others where property rights...
have been introduced, rights-based fisheries management systems have been very successful at solving the problems associated with the ‘tragedy of the commons’. With rights-based management, the right to fish (e.g. the quota or days at sea) can be traded and therefore fish have a value when alive (before they are caught). Without rights-based management fish only have a value when dead (when caught). Giving selected individuals, fishing communities or associations the privilege of long-term, secure rights to harvest a specific area or percentage of the fishery’s total quota whilst excluding others from the fishery, or limiting the amount of effort (days at sea) encourages those fishing to take a longer term interest in the future health and sustainability of their stock.

In those few cases where fisheries are now managed on the basis of property rights real progress has been made. In short, the introduction of property rights would create a huge value within many fisheries where none presently exists. Unfortunately only a very few fisheries are managed through the allocation of property rights and the tragedy of the commons thus persists.

Perverse economic incentives

Whilst the depletion of marine fisheries, and the associated marine ecosystems and biodiversity that sustains them is clearly irrational in the longer term, it is made logical in the short-term through perverse subsidies worth $16 billion per year; with fuel tax exemptions accounting for approximately $6.4 billion per year (see ‘bad’ and ‘ugly’ categories below). Developed countries are spending twice as much tax-payer money on global fishing subsidies that encourage overfishing than on protecting the ocean. Subsidies were initially introduced to help drive technological improvements after World War II, when fisheries were believed to be inexhaustible, and governments wanted to encourage investment in the sector to increase food security and provide jobs in struggling coastal regions. However, as early as the 1960s the Organisation for Economic Cooperation and Development (OECD) warned of the link between overfishing and subsidies. Since then there have been many calls for subsidies to be eliminated, redirected or reformed.

Many subsidies artificially reduce the input costs of fishing, thereby increasing profits for the industry and enabling fishing to continue beyond the point where it would otherwise become unprofitable. This leads to the overcapitalisation of fishing fleets and consequently to the overexploitation of the resource. The impact of these subsidies is so great that some organisations argue that eliminating or redirecting them is the single most important action that can be taken to move toward more sustainable fisheries.

It is clear that instead of propping up unprofitable elements of the fishing industry, it would be more economically, socially and environmentally rational to redirect these subsidies to promote more sustainable fishing.

Increasing demand for unsustainable seafood

Another driver in the decline of fisheries is rising demand for seafood, in part driven by population growth. Currently, Asia accounts for two-thirds of total consumption, with 33.6 million tonnes out of the total Asian share of 36.9 million tonnes being consumed by China, where per capita consumption is the highest in the world. Whilst consumption levels per capita are lowest in Africa, at 8.3 kg, it is still a very important source of protein. Furthermore, the population of Africa, now one billion, is estimated to double by 2050 and the Asian population is set to rise from 4.16 billion to 5.42 billion in the next forty years. The increase in population and consequent increase in demand will have a profound effect on global fisheries. This may be alleviated by encouraging diversification of the species we eat and increasing the amount of certified seafood in the market, although this is not happening quickly enough.

In summary, there are several drivers contributing to the decline of global fisheries but sustainable fisheries are achievable, if based on the three fundamental principles of the ecosystem approach, robust management and sound economics. The prize of well managed fisheries has the potential to provide such value that it must be treated as an urgent and shared global priority.

39 World Bank, 2009
40 Sumaila et al, 2008
41 Sumaila et al, 2010
42 Population Reference Bureau, 2011
4 The opportunity

At the global level, fisheries make an economic loss of $8 billion per year, when the environmental and social costs and benefits are included. The World Bank's estimate that fisheries are underperforming by $50 billion per year does not even account for the social and environmental benefits of sustainably managed fisheries, leaving the case for reform even more compelling.

4.1 Methodology

Sustainably managed fisheries could release billions of presently untapped economic value, eliminate the need for subsidies after a transition period, provide long term employment in a profitable sector and help secure high quality protein for an increasingly hungry world. The management of global fisheries should be reformed not only because of the severity of problems caused by the 'business as usual' approach, but because the long term benefits of sustainable management are enormous and achievable.

As mentioned in Chapter 2, the World Bank has calculated that fisheries could be worth a staggering $50 billion more per year if managed at the MSY.43 To build on this work the ISU commissioned research from external consultants. The purpose was threefold: to understand how the current situation in global fisheries differs from the World Bank's calculation of the opportunity cost; to understand the opportunity cost of transitioning from 'business as usual' to a sustainable state in two individual fisheries; and to develop a holistic methodology that takes into account not only the direct revenues and costs of fishing, but also the environmental and social costs and benefits that they provide. The latter approach is necessary in order to provide an estimate of the aggregate 'value to society' of particular fisheries.

Having developed a holistic methodology, the researchers applied this to two specific fisheries: The N.E. Atlantic Bluefin Tuna Fishery and the Senegalese Mixed Coastal Fishery. A brief summary of the global picture and the two case studies is provided in this chapter and a fuller summary of the work can be found in Annex A. It is important to note that the purpose of this commission was to give an indication of the scale of the opportunity. Fisheries are data poor, so the margins of error may be high. This report concludes that despite limitations in the methodology, this is an analytical process that could usefully be developed, refined and applied to other fisheries.

4.2 The global cost of 'business as usual'

Although many examples of profitable fisheries can be found, the global picture shows that most fisheries are underperforming assets. Figure 6 demonstrates that the global fishing industry revenue of $79 billion per year was reduced to an operating profit of $6 billion after fuel, labour and other production costs were accounted for. The inclusion of capital costs of $11 billion produced a net loss for the industry of $5 billion per year. This became a $26 billion loss after the removal of subsidies. The researchers then went on to include the environmental and social costs and benefits of the global fishing industry. Since the only environmental externality that could be quantified was the carbon dioxide emissions, the environmental impact was calculated to be a small negative ($-5 billion) whilst the social impact was a large benefit ($23 billion), based on the total wage bill. With these important factors included, they then calculated that the net cost to society of the present global fishing industry

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43 World Bank, 2009
is actually $8 billion per year. When it is considered that
the World Bank’s $50 billion per year opportunity cost of
sustainable fisheries management does not account for the
social and environmental benefits of sustainably managed
fisheries, the case for reform becomes even more compelling.

Whilst it is interesting to estimate the value to society of
fisheries at a global level, the methodology becomes more
practical when applied to individual fisheries. This is because
all fisheries are different in terms of their MSY, behaviour and
the suite of economic, environmental and social challenges
that they present. To capture some of these differences the
N.E. Atlantic Bluefin Tuna fishery (a high seas fishery where a
high value species has been fished to the brink of commercial
extinction by international fleets) and the Senegalese mixed
coastal fishery (a developing country fishery that is important
for local food security where a lack of governance has led
to overfishing) were chosen for deeper analysis.

4.3 Opportunity in the N.E. Atlantic
Bluefin Tuna fishery

Bluefin Tuna is caught in the N.E. Atlantic and Mediterranean
by purse seine, longline and baitboat fishing vessels. In
2009 the three largest fishing fleets were France, Spain and
Italy. Bluefin is either killed during capture or captured alive
and transferred to floating cages in Italy, Spain, Turkey and
Croatia for fattening over 6 - 12 months in a process known
as tuna farming. Around 80% of N.E. Atlantic Bluefin Tuna
is then sold to Japan.

Responsibility for the management of the N.E. Atlantic
Bluefin Tuna stock lies with the International Commission
for the Conservation of Atlantic Tunas (ICCAT), which
restricts fishing through a series of management measures,
the main one being an annual total allowable catch
(TAC) quota. Quotas have long been set higher than the
sustainable level. The TAC has recently been reduced to
12,000 metric tonnes, after many years of being set at
around 30,000. However, the scientific recommendation
is only 6,000 tonnes and the actual catch is probably
much higher than the quota due to significant IUU fishing,
estimated to make actual catch 50-100% higher than
the quota in 2007. These problems are exacerbated by
the practice of fishing tuna during the breeding season
in the spawning grounds of the Mediterranean. Figure 7
shows that high quotas, IUU fishing and fishing during the
spawning season have driven the N.E. Atlantic Bluefin Tuna
stock to below 35% of its MSY.

To estimate the value to society of the N.E. Atlantic Bluefin
Tuna fishery under a ‘business as usual’ scenario and an
alternative sustainable state, a number of assumptions were
made. Firstly, tuna farming and any other intermediate value-
adding activities were excluded from the analysis; secondly,
downstream activities were excluded, essentially valuing the
catch at the dock; thirdly, due to the lack of data surrounding
IUU fishing in this fishery, the associated catch was
excluded despite recognition that this would have impacts
on the estimate; fourthly, the price of Bluefin Tuna under
the alternative scenario is assumed to be the same as the
‘business as usual’ scenario because a sustainable volume
of fishing after recovery (~50,000 tonnes) would likely be
around the volume actually fished now when taking into
account IUU fishing; and finally, it was assumed that vessels
target Bluefin Tuna exclusively, which although unlikely, was
necessary due to a lack of appropriate data. For clarity, full
details of the methodology and contributory data that was
used to estimate the economic, environmental and social
benefits of the N.E. Atlantic Bluefin Tuna fishery can be
found in Annex A.
Due to the high price of Bluefin Tuna, which has an average monthly price of $30,000 on the Tokyo Wholesale Market, the N.E. Atlantic Bluefin Tuna fishery has an economic profit of approximately $70 million per year despite high fixed and variable costs. However, this fishery receives significant subsidies, estimated to be in the region of 17% of revenue or $120 million per year.45

The carbon dioxide emissions produced by this fishery are high because the tuna travels long distances and is becoming scarce, so vessels have to travel long distances to catch it. At 5.5 metric tonnes per tonne of landed catch, this fishery emits 3 times more carbon dioxide than average for a wild fishery. Applying an average social cost of carbon, this equates to a negative environmental externality for this fishery of approximately $5 million per year.

Aggregating the economic profit with the cost of subsidies and carbon dioxide emissions gives the fishery a total loss of $55 million per year. However, the total wage bill for the N.E. Atlantic Bluefin Tuna fishery is estimated to be in the region of $145 million per year. Whilst the number of jobs are not high compared to other fisheries, employees receive

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**Figure 7** – The annual reported catch and estimated stock spawning biomass of N.E. Atlantic Bluefin Tuna from 1974-2008

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**Figure 8** – The current and potential value to society of the N.E. Atlantic Bluefin Tuna fishery

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Source: ISU commissioned research
above the minimum wage and work in conditions that are generally safe and hygienic. Adding the wage bill to the loss of $55 million suggests that the total profit to society of the N.E. Atlantic Bluefin Tuna fishery is $90 million per year. However, whilst the social importance of the fishery might be seen to compensate for its negative impact on public finances, it is important to note that this social value will not be maintained in the long term if current fishing practices continue. It has been predicted that continuing to overfish at current levels will force stocks into a state of collapse within the next 12-15 years. \( ^{46} \) Figure 8 provides an illustration of the valuation described in this section versus the valuation of a sustainable N.E. Atlantic Bluefin Tuna fishery described in the next section.

The prize of a sustainable N.E. Atlantic Bluefin Tuna fishery

To estimate the ‘size of the prize’, the researchers applied the same methodology to a theoretical N.E. Atlantic Bluefin Tuna fishery that is managed in a sustainable manner at the MSY. In order to recover, the N.E. Atlantic Bluefin Tuna fishery would need to be managed in accordance with the 3 principles referred to in Chapter 3. In terms of specific tools, the most important reforms would likely include the elimination of IUU fishing; the removal of capacity-enhancing subsidies; a short-term reduction in fishing capacity; the effective implementation of gear restrictions, size and age limits and catch documentation; and the implementation of effective monitoring and enforcement. Defining a set of measures to achieve this transition is beyond the scope of this study and would fall under the mandate of ICCAT.

The researchers estimated that after recovery, assuming appropriate size and age restrictions to preserve the population structure, annual catch could be increased to approximately 50,000 tonnes per year. \( ^{47} \) Assuming the average price and total costs fall from 90% to 80% of revenue (see Appendix A for more detail), the industry profit could increase to around $310 million per year without the need for subsidies after the transition period.

Carbon dioxide emissions would double because the number of legal fish caught would double. Researchers therefore estimated the environmental externalities to be $10 million per year under the alternative scenario. In reality, CO₂ emissions would hardly change if IUU fishing is eliminated. The sustainable fishery would provide long-term employment and the researchers estimated that total employment could increase from 6,000 to 8,800 after recovery. Since the fishers are paid a share of revenues, average wages would increase from $24,000 to $34,000 per person and the total wage cost, or social benefit, of the fishery would therefore increase to $300 million per year. Based on this analysis, the researchers estimate that the total profit to society of the N.E. Atlantic Bluefin Tuna fishery under a sustainable state would be in the region of $600 million per year, markedly different from the ‘business as usual’ scenario of $90 million per year.

4.4 Opportunity in the Senegalese mixed coastal fishery

Senegal’s coastal fisheries provide considerable economic and social value for the country. Fishing supports around 45,000 fishers \( ^{48} \) with 140,000 further jobs in downstream industries. Fish provides a very important contribution to dietary protein in Senegal. The industry also provides 30% of Senegal’s total export revenue. Within the Senegalese fisheries there are two distinct fleets – the artisanal and industrial fleets and Figure 9 illustrates the main characteristics of each. Historically, the artisanal fishers have caught Sardinella within the coastal zone, and the industrial fleet has fished higher value species such as tuna, shrimp and hake for export. In theory, the industrial fleet can only fish beyond 6 miles off the coast, but enforcement is weak. There have been an increasing number of reports that small artisanal boats are going further out to sea, into the domain of the industrial fleet.

‘Business as usual’ in the Senegalese mixed coastal fishery

In 2005 the total catch in Senegal was approximately 480,000 tonnes, \( ^{49} \) of which 425,000 was caught by the artisanal fleet and 57,000 tonnes by the industrial fleet. \( ^{50} \) The total revenue of catch from the artisanal and industrial

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46 Mackenzie et al, 2009
47 ICCAT, 2010
48 FAO, 2008
49 2005 data was used in this analysis as it is the last year in which data on a relatively broad set of indicators was available
50 FAO, 2008
The prize of a sustainable Senegalese mixed coastal fishery

As with the N.E. Atlantic Bluefin Tuna case study, the researchers assumed for the alternative scenario that the Senegalese mixed coastal fishery is managed in a sustainable manner at the MSY. Given very limited data about current stock levels in this fishery it is difficult to predict how long it would take for stock levels to recover. However a number of assumptions were made by the researchers to allow them to estimate the alternative scenario. They assume that catch volumes are reduced by 25% to stop overfishing, catch reductions are accompanied by a 5% price increase because fishers can catch more valuable species and capacity-enhancing subsidies are removed.

The researchers estimated that after recovery, overall catch would remain lower than it is today at approximately 360,000 tonnes, down from 480,000 tonnes. Taking into account the price increase, this translates into an industry profit of around $10 million per year, without the need for subsidies after the transition period.

Carbon dioxide emissions would be proportional to the reduction in catch, giving a total environmental externality of $20 million per year. Employment in the fishery would fall to around 28,000 people in total. However, salaries would increase from $1,100 to $1,400, so the total wage bill would only decline to $40 million per year. It could be argued that unless the number of jobs is reduced, the level of overfishing makes the fishery vulnerable to complete collapse. Based on this analysis, the researchers estimated...
that the total contribution to society of the Senegalese mixed coastal fishery under a sustainable state would increase to approximately $30 million per year, markedly different from the ‘business as usual’ scenario of a loss of $49 million per year.

This chapter has shown that both at the global level and in individual fisheries, the potential prize of transitioning to the MSY is considerable. Transitioning to sustainable fisheries at a global level could yield as much as $50 billion per year in additional profits, plus social and environmental benefits. In the N.E. Atlantic Bluefin Tuna fishery, the transition might yield additional social value of approximately $510 million per year and in the Senegalese mixed coastal fishery, the transition could yield additional benefit to society of approximately $80 million per year.

To achieve sustainable fisheries and thereby capture this prize, significant reforms would be required in underperforming fisheries. The ecosystem approach, robust fisheries management and sound economic models would need to be implemented. Chapter 5 outlines some case studies of fisheries around the world that have begun the transition process and Chapter 6 suggests how it might be possible to finance the transition to sustainable fisheries.

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**Figure 10 – The current and potential value to society of the Senegalese coastal fishery**

<table>
<thead>
<tr>
<th>Fisheries valuation – current state (2008 data)</th>
<th>Fisheries valuation – sustainable state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry revenue</td>
<td>Industry revenue</td>
</tr>
<tr>
<td>Costs</td>
<td>Costs</td>
</tr>
<tr>
<td>Industry profit</td>
<td>Industry profit</td>
</tr>
<tr>
<td>Subsidies</td>
<td>Subsidies</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Environmental impact</td>
</tr>
<tr>
<td>Full economic value</td>
<td>Full economic value</td>
</tr>
<tr>
<td>Social value (employment)</td>
<td>Social value (employment)</td>
</tr>
<tr>
<td>Full economic and social value</td>
<td>Full economic and social value</td>
</tr>
</tbody>
</table>

All figures are in US$ million

![Diagram showing the current and potential value to society of the Senegalese coastal fishery](image-url)
5 How do we move from where we are now to a more sustainable system?

Many fisheries around the world have started to implement an ecosystem approach and robust management based on sound economics. Confidence that the transition is possible can be gained from studying the levers and tools that have been used to create change in the real world.

Chapter 3 explained how fisheries decline has been driven by practices that do not take sufficient account of 3 fundamental principles – the ecosystem approach, robust fisheries management and sound economics. Although the overall global picture of wild fisheries is one of decline, there are many examples of successful interventions around the world that have made rapid progress towards restoring the productivity of depleted stocks. This chapter summarises a report that the ISU commissioned from MRAG in 2010, which describes case studies of fisheries that have taken measures to apply the three principles and analyses the benefits of reform that have been realised in each fishery so far. Most of the case studies are from the MRAG report but some are taken from ISU analysis. The detailed case studies can be found in Annex B and the full report is available on request.

The MRAG report tried to isolate individual measures and tools, such as a bycatch reduction initiative in one fishery or the implementation of a rights-based system in another, and analyse the costs and benefits of these measures. To undertake the transition to sustainability, fisheries will usually implement a variety of measures to address the need for an ecosystem approach, robust management and sound economics. It is important to note that this makes it difficult to isolate the costs and benefits of specific interventions. Furthermore, no two fisheries are the same, underlining the need for a varied tool box that can be used as different situations dictate.

5.1 Implementing an ecosystem approach

Tools that can assist with the transition from a single species approach to an ecosystem approach to fisheries management include the collection of comprehensive information, marine spatial planning to enable the sustainable integration of fisheries goals with other demands on marine ecosystems, and measures to minimise the capture and wastage of non-target species.

Science and data

A lack of data can lead to the inappropriate selection and application of management measures. There is also an inherent level of uncertainty within fisheries because in addition to commercial exploitation, fish stocks are affected by environmental factors that are unknown or hard to measure. It is important to identify what data is needed and how it can be incorporated into decision-making. It is still possible to achieve sustainable fisheries management in the event of uncertainty or lack of data, but under these circumstances precautionary measures should be taken to compensate.

The precautionary approach and ecosystem approach have been adopted very effectively in the Antarctic by the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). In addition to the collection of considerable amounts of data, which was assisted by the introduction of mandatory on-board scientific observers, CCAMLR has created yield models for species that incorporate uncertainty. An example of this is the Krill Yield Model, which combines known data, such as krill biomass, with uncertain information, such as variability in krill recruitment rates, and defines a precautionary limit for annual quotas. In addition to uncertainty modelling, CCAMLR has set conservative quotas in areas where predators forage for prey and has introduced regulations for reducing bycatch. This approach has had environmental benefits for the Antarctic region, such as the reduction of bycatch to negligible levels, as well as considerable economic benefits. Although the observer programme costs in the region of $293 million per year, this programme has allowed the South Georgia toothfish fishery and one krill fishing company (Aker Biomarine) to achieve Marine Stewardship Council (MSC) certification.

The collection of data on species abundance and size in Fiji’s mixed fishery allowed management strategies to be developed and led to the establishment of a protected area network in 2005 which has 17 small closed areas and 3 district-wide no-take areas. The location and size of these ‘Tabu’ areas was defined by a mixture of local traditional knowledge and new surveys, but the research and assessment programme was essential to the instigation of the work. The cost of this intervention has been estimated at approximately $3 million over four years (2005-2009) but the benefits have been considerable. Community members have reported an increased number and size of fish and an increase in coral cover since the new management strategy was introduced. Scientific assessments support these observations.
A more detailed report of the CCAMLR and Fiji case studies, along with examples of the importance of data collection in Scotland and Senegal can be found in Annex B.

Marine spatial planning and marine protected areas

Marine spatial planning (MSP) is a practical way to create and establish a more rational use of marine space and the interactions between its users. Taking an ecosystem approach to fisheries in isolation will not be successful in areas where pollution and environmental degradation are being caused by other actors outside the fishing sector. Given that aquaculture and offshore energy are set to expand in the future, it is likely that the usefulness of MSP in transitioning to the ecosystem approach will continue to grow. Any MSP exercise must be a continuous, iterative and adaptive process involving all stakeholders.

One of the most successful examples of MSP is Australia's Great Barrier Reef Marine Park (GBRMP). The GBRMP stretches along 2,300 km of coastline and is bigger than the UK, Holland and Switzerland combined. It was established in 1975, spurred by concerns that the reef was becoming degraded due to oil exploration, limestone mining, pollution from the land and shipping, overfishing and tourism. A zoning scheme was developed, reflecting the diverse nature of the marine area. The Preservation Zone is the most restrictive, prohibiting all entry except for scientific research. The General Use Zone is the least restrictive, allowing the area to be used for all ‘reasonable uses’ with the notable exceptions of mining, oil drilling and spear fishing. The ecosystem is not static, however, and a lack of initial ecological knowledge has led to the zones being revised several times. Strict management of the zones and the presence of no-take areas have given the GBRMP the high level of protection it required.

The GBRMP now provides over AUS $5 billion per year to Australia's economy. This value accrues every year, underlining how a large-scale sustainable economic benefit can be derived from effective spatial planning. The financing of continued conservation, education and science in the region has been assisted by the introduction of an environmental charge that is paid by tourists.

A more detailed report of the GBRMP case study, along with examples of marine spatial planning in China and closed areas in Kiribati and Norway can be found in Appendix B.

Minimising bycatch and discards

Wasting approximately 8% of annual global catch (6.8 million tonnes) through bycatch and discards is not a good use of marine ecosystems. In one year, it was recorded that 250,000 turtles were caught in pelagic hook and line fisheries. Although it is very difficult to completely eliminate bycatch from fishing operations, adopting the ecosystem approach will require implementing measures to minimise this practice.

Many different tools are already in use to reduce this problem. Examples include the introduction of bycatch reduction devices (BRD) in many trawl fisheries to allow the escape of smaller species from nets, and the use of turtle excluder devices (TED) in areas where turtles are vulnerable. To reduce bird mortalities associated with hook and line fisheries, bird-scaring devices, weighted lines and setting fishing gear only at night can minimise bycatch. Reducing bycatch is not only environmentally beneficial to fisheries but it can also provide an economic benefit – by capturing less non-target species there is more time, and space onboard vessels, for target species. This economic incentive has resulted in innovation in many fisheries.

In the Northern Prawn Fishery (NPF) in Australia 516 species have been recorded as bycatch. However, due to commercial pressure from the industry the NPF became the world’s first tropical shrimp fishery to introduce a bycatch action plan. The combination of time needed to sort bycatch from target catch and high temperatures were leading to a decline in the quality and therefore price of prawns. This created an economic incentive for the industry to design a ‘seawater hopper’, which is simply a container of water that the catch is emptied into. Due to their natural behaviour prawns settle on the bottom whilst the bycatch remains swimming in the upper levels of the hopper. When prawns sink to the bottom of the hopper they travel onto a conveyor belt for sorting. The initial investment cost is AUS $1000 for a small hopper or AUS $100,000 for larger ones but, because the amount of damaged shrimp produce has reduced by 5-10% and processing time is 30-50% faster, the industry has recovered all of the costs.

There are numerous other examples of innovative approaches to bycatch reduction around the world. Many of these have been spurred by WWF’s Smartgear competition, which awards a prize every few years for the best new solution to bycatch. More detail about WWF’s Smartgear
competition, along with a case study on Norway's discard ban, can be found in Annex B.

5.2 Applying robust fisheries management

Fisheries governance is the sum of the legal, social, economic and political arrangements that are used to manage fisheries. Poor governance is characterised by a lack of transparency and accountability, lack of regulation, the absence of law enforcement, the existence of corruption and most importantly the lack of participation from stakeholders.

Improving enforcement

Having defined the management objectives and rules for a fishery according to the ecosystem approach, the management rules then need to be implemented and enforced with a system of monitoring, control and surveillance. Countries around the world are increasingly adopting the use of Vessel Monitoring Systems (VMS), to plot automatically the positions of fishing vessels using satellite technology. However it is still not mandatory for fishing vessels to have VMS. The role of a comprehensive scientific observer scheme to fulfil the dual goals of enforcement and scientific data collection cannot be overestimated. However, where the cost of comprehensive observer coverage is prohibitive, other schemes have been trialled. In Denmark for example, scientists have successfully trialled the use of CCTV cameras on board 7 vessels, which has resulted in a significant reduction in discarding. Other methods of enforcement that can be used include marine patrols (as in the case of Norway) and aerial surveillance.

Namibia has a particularly good monitoring, control and surveillance system. After independence the Namibian government regained control over its Exclusive Economic Zone and passed the Sea Fisheries Act in 1992. The government charges rent for access to the fishery and reinvests the revenue from rent and licences into monitoring, control and social programmes. 70 to 100% of vessels now have observer coverage and regular arrests, fines and vessel seizures are made if vessels are found to be fishing without a license. There are very few incidents of IUU fishing as a result. The benefits of this monitoring system can now be seen ecologically. The hake TAC grew from 60,000 tonnes to 195,000 tonnes between 1990 and 2002 and the contribution of the fishing industry to Namibia's economy grew from $98 million to $372 million per year over the same period.

Stakeholder engagement

The failure of centralised management systems has increased the interest in decentralised, participatory decision-making or co-management systems. Participation by those who are to be regulated is essential for ensuring compliance. Examples of case studies where these inclusive forms of governance have been applied successfully include South Africa's Hake fishery and Mozambique's mixed fishery.

In South Africa, a structure for joint decision-making between industry, government, independent scientists and environmental organisations was established in the 1980s. This structure, known as ‘decision rules’ has been extremely effective, partly due to a few unique individuals that perform fisheries modelling to inform the negotiations, and partly due to the availability of abundant fishery data since the 1960s. All stakeholders have agreed to a 5-year management plan as well as a set of rules which are automatically implemented if the data shows declining stock levels. In preparation for the new management plan, all the decision makers meet to see models of their fish stocks that are based on new data. The stakeholders are given a few options for setting the TAC that will all lead to a sustainable fish stock over time and they jointly decide where to set the TAC. More detail about the South African case study and a case study of co-management in Mozambique can be found in Annex B.

5.3 Creating a sound economic approach

Sustainable fisheries management will only be achieved through rewarding positive rather than negative behaviour. Many of the current fisheries management policies indirectly reward negative behaviour. There are, however, numerous examples of measures being taken to correct the flawed economics of unsustainable fisheries. A few of these are outlined here and in Chapter 5. Full case studies can be found in Annex B.

Property rights

Due to the combined effects of insufficient regulations to constrain fishing, poor control of IUU fishing, technology development and the effect of subsidies, it is now estimated that the global fishing fleet is 2.5 times larger than can be sustainably supported by the oceans. Overcapacity also provides an incentive to fish over the quota, high grade and discard, thus further exacerbating the decline of fish stocks. Establishing property rights can reduce capacity, thereby removing negative economic incentives. Rights can be given in the form of a share of the total allowable catch (quota) or a share of the total allowable effort (days at sea). There are many different types of rights-based management systems including, but not limited to, catch shares, individual transferable quotas (ITQ), individual vessel quotas (IVQ) and territorial user rights (TURF). The best type of system will depend on local circumstances.

Both the Alaskan Halibut fishery and Icelandic cod fishery have introduced ITQ systems. Licenses became private property so quota holders were able to sell their licenses and exit the fisheries. With the reduction in capacity, the fishers that remained had more quota and therefore higher profits,
the fishing seasons increased in length and this led to higher quality products and greater availability of fresh fish. In Alaska, the higher quality halibut, combined with the fishery receiving MSC certification in 2006, led to an increase in the fisheries total revenue from $50 million in 1992 to $150-200 million in 2003 and $245 million in 2008. More information about these case studies, the US Pacific groundfish fishery and two examples of successful TURF fisheries in Vietnam and Chile can be found in Annex B.

Removing perverse incentives

Although public subsidies of approximately $16 billion per year are spent to increase fishing capacity and thereby drive the decline of fisheries, many countries are reluctant to redirect these funds due to fears about rising poverty and diminished food security. This analysis concludes that the opposite is likely to be the outcome, however. A focus on short-term job protection will undermining livelihoods and food security in the longer-term. The transition to sustainable fisheries requires the redirection or removal of capacity-enhancing subsidies, even though this will require adjustments in the short-term.

In Norway and New Zealand, capacity-enhancing subsidies have successfully been removed. Norway reduced subsidies to its fisheries by 85 percent between 1981 and 1994 (from $150 million to $30 million). Compensation in the form of alternative employment opportunities allowed the sector to downsize without significant negative impacts on local livelihoods. The sector is profitable without subsidies and fish stocks have shown signs of recovery. A more detailed summary of the Norwegian experience can be found in Annex B, along with the New Zealand case study.

Increasing demand for sustainable seafood

The use of supply chains to create positive economic incentives in fisheries is discussed in Chapter 6. A few case studies of measures to increase demand for sustainable seafood were covered in the MRAG report. These case studies included the International Seafood Sustainability Foundation (ISSF), which has successfully encouraged tuna processors and traders to sign up to a resolution that requires them not to purchase tuna from any vessel that does not have a Unique Vessel Identifier (UVI). This industry intervention makes it much more difficult for IUU vessels to sell tuna. As well as a more detailed explanation of the ISSF scheme, Annex B contains numerous examples of fisheries that have been positively incentivised to reform by applying for fishery certification.

This chapter has shown that there are numerous examples of successful interventions that have significantly improved the economic, social and ecological state of fisheries. However, most of the interventions documented in these case studies have been costly to implement. Chapter 6 suggests a few sources of finance that, if scaled, could help bridge the transition to sustainable fisheries.
6 How can we finance the transition?

Finance for the transition period is required. Potential sources of finance include the redirection of perverse subsidies, private sector investment, not-for-profit initiatives and the creation of more positive market incentives.

Although many stakeholders are confident that transitioning to sustainable fisheries management will generate greater profits, the transition process itself will require both finance and technical assistance. Fishers and businesses in the seafood supply chains often operate with low margins and without the cash or collateral needed to obtain the equity to fund major change. This is at least partly because $16 billion per year are being channelled into increasing fishing capacity rather than assisting the transition to sustainability.

Joint ventures between the public and private sector have successfully achieved sustainability goals on land and there is no reason why, under the right conditions, similar models could not be used to help finance the transition to sustainability in the marine environment. The best mechanisms to incentivise the transition to sustainable fisheries will be specific to the individual situation, but this chapter outlines a selection of public, private and market approaches that could be utilised individually or collectively.

Most of the examples outlined in Chapter 5 demonstrate that transitioning to sustainable fisheries can yield future profits. It is therefore possible to make a compelling case for private investment in the recovery of marine ecosystems, which have a similar potential cash flow profile to other business turnaround or recovery investments.

Four principle sources of transition finance have been identified:

- Redirecting capacity-enhancing subsidies
- Private sector investment
- Not-for-profit initiatives
- Positive incentives through the supply chain

6.1 Redirection, reduction and removal of subsidies

In Chapter 3 it was highlighted that global subsidies to fisheries are in the order of $27 billion per year, of which about $16 billion are used to finance capacity-enhancing fishing activities, rendering them unsustainable. As previously mentioned, by reducing the input costs of fishing, these subsidies artificially increase industry profits and thereby enable fishing to continue beyond the point at which it would otherwise become unprofitable. In addition to these ‘capacity-enhancing’ subsidies, it is estimated that approximately $3 billion per year is spent on fisher assistance, rural fishing community development and vessel buyback schemes.

These types of subsidies can be helpful if employed in the context of the transition to sustainable management.

Subsidies that have positive benefits do exist, beyond short term, artificial, economic support. However, the total amount of these, approximately $8 billion per year, is only about 20% of all subsidies. These typically go towards research and development, conservation and investment in fisheries management.

The redirection of $16 billion per year of public subsidies towards financing the transition to sustainable fisheries would be an enormous help. Chapter 5 and Appendix B provide evidence from Norway and New Zealand that the complete removal of subsidies is achievable. However, redirecting rather than removing public subsidies in the short term and ring-fencing this purely to finance the creation of sustainable and profitable fisheries would be more beneficial, and more acceptable to the fishing industry, than the immediate removal of this funding source.

6.2 Private sector investment

Sustainably managed fisheries are inherently profitable, generating long-term income streams that will attract private capital. The presence of opportunities to invest in sustainable fishing businesses would facilitate the development of a range of financial instruments, which might include bonds, trust funds, futures markets and loan facilities, to ensure the optimum operation of the industry.

Some examples of private sector initiatives that are already underway are outlined below:

Banking on Cod

WWF has developed a conceptual model to capitalise on the recovery of fisheries, called Banking on Cod. As yet the finance community has not investigated the opportunity in order to fully profile the risks, rewards and enabling framework that such an investment might need in order to make it a realistic fundraising structure. However, the Banking on Cod idea works on the principle that future benefits can be expected from sustainable fisheries in the form of more productive stocks, increased catches and higher value products. The underlying proposal is that investors buy the rights to a portion of the future income stream derived from fisheries that are currently

54 Sumaila & Pauly, 2010
underperforming or depleted. The money raised would be invested in implementing a sustainability plan prepared by the fishers. The plan would include measures to recover fish stocks to the MSY, and thus generate higher annual profits.

To achieve a sustainable yield in underperforming and depleted fisheries, fishing effort would need to be reduced, at least in the short term to allow recovery. As well as implementing the sustainability plan, a portion of the money raised would need to be used to support fishers in bridging the financially difficult transition period.

The California Fisheries Fund

The California Fisheries Fund is a revolving loan fund, designed to improve the performance of ailing state fisheries. It was developed in 2007 by Environmental Defense Fund, ShoreBank Enterprise Cascadia, a community development bank and the Sustainable Fisheries Group, an alliance of leading marine scientists, economists and ocean advocates. The California Fisheries Fund received an initial $2 million grant from the California Coastal Conservancy, a state agency that uses entrepreneurial techniques to purchase, protect, restore, and enhance coastal resources. Following their lead, the Gordon and Betty Moore Foundation and other private foundations then quickly invested a further $3 million. The Fund lends to fishers, fishing businesses, ports and communities to help them achieve environmental conservation and thereby improve the profitability of the industry and stability of port communities. It has invested in many Californian fisheries projects including a catch share programme for the trawling sector of west coast groundfish.

Verde Ventures

Verde Ventures has a similar structure to the California Fisheries Fund. They offer debt and equity loans of $30,000-500,000 to small and medium sized businesses seeking to improve the long-term sustainability of their fisheries.

6.3 Not-for-profit initiatives for the conservation of ecosystem services

There are a few examples of initiatives that use innovative financial mechanisms that, whilst not directly focusing on the transition to sustainable fisheries, are indirectly contributing to the pathway to recovery.

The Great Barrier Reef Foundation

The Great Barrier Reef Foundation (GBRF) aims to raise and provide funding to support research that contributes to the environmental protection, enhancement, preservation and conservation of coral reefs. The Foundation is developing an innovative finance mechanism for the research in the form of a bond, which, subject to Government approval, has the potential to deliver a highly replicable funding solution for coral reef research and protection as well as a range of environmental and social issues globally. In 2009, Oxford Economics produced a landmark report that assigned a multi-billion dollar economic value to Australia’s Great Barrier Reef. Researchers also conducted a survey of people’s ‘willingness to pay’ to preserve the reef, alongside industry profits generated by reef tourism and commercial fishing. GBRF has been working with Goldman Sachs Australia and KPMG to make the case for using the public’s ‘willingness to pay’ to conserve the reef as the revenue stream to repay the bond.

The Phoenix Island Protected Area

In 2008, the Pacific island nation of Kiribati more than doubled the size of its Phoenix Island Protected Area (PIPA) and, in so doing, made it the largest protected area in the Pacific Ocean. Kiribati has chosen to restrict commercial fishing so the country is foregoing revenues that it would have accrued from foreign fishing fleets through the sale of tuna licenses. An endowment fund is being created to cover the management costs of the PIPA and pay the government compensation for the opportunity costs of not issuing fishing licenses.

Conservation International has secured an initial commitment of $2.5 million to the endowment, from its Global Conservation Fund, and a range of other private, bilateral and multilateral donors are interested in supporting the project. The endowment fund will be administered by the PIPA Conservation Trust, which will enter into 5-year recurring conservation contracts with the Kiribati Government. The contract will define the management obligations, and the Kiribati Government will receive annual payments from the endowment fund in return for satisfactory management performance.

6.4 Using the supply chain to create positive incentives

Certification

Meaningful certifiable standards provide an important basis for market transformation. By acting as a benchmark or template for fisheries management, certification improves the business case for transitioning to sustainable management by ensuring that demand for sustainable products can be reliably met. By the end of 2010, 187 fisheries around the world were either certified or under assessment by the MSC. These fisheries land over 7 million tonnes of seafood annually – 12 percent of the global wild catch for human consumption. Whilst this is very positive, certification can be expensive and the entry point high, thus certification alone will not be able to solve all fisheries sustainability issues.

Partnerships and awareness raising

Commitments by purveyors of seafood products to support or partner with fisheries can finance the transition to sustainable management.

As aquaculture expands, the role of buyers in driving sustainable supply chains will become increasingly important,
not only for fish intended directly for human consumption, but also for fishmeal. In this respect markets beyond seafood, such as the fish oil, pharmaceutical or pet food markets, will need to be engaged. Some examples of initiatives aimed at the fisheries sector are outlined briefly below:

**Sustainable Fisheries Partnership**

The Sustainable Fisheries Partnership is one of the not-for-profit organisations that provides strategic and technical guidance to suppliers and producers, and builds partnerships to improve policies, marine conservation measures and fishing and fish-farming practices. The partnership operates on the basis that if buyers and suppliers help to improve the sustainability of their supply they are not only making that supply more secure but also contributing to their own sustainability targets. Examples of projects within specific fisheries are Baltic cod in the European Union and hake in Argentina. These kinds of engagement can also help fisheries obtain MSC certification without having to finance the transition themselves.55

**FishWise**

FishWise works with seafood businesses to design sustainability programmes that reflect their needs through market based tools. Businesses are able to improve their sustainability by using the tools that FishWise can provide, which are based on the best available scientific research. By looking at both the producer and consumer side, businesses can understand the pressure exerted up and down the supply chain and are thus able to make more sustainable seafood choices. Consumer confidence, customer loyalty and seafood sales have improved by as much as 10%.56

**The Marine Conservation Society**

The MCS also aims to equip retailers, restaurants, governments and consumers with the knowledge required to make the most sustainable seafood purchasing choices. For example, they produce an online guide (Fishonline) for fish that should be avoided and those that are better choices. The MCS also works with stakeholders to establish sustainable seafood buying policies.

**Fish2Fork**

This initiative concentrates on raising consumer awareness in the restaurant business in the UK, and it is now extending to France and Spain. It reviews restaurants exclusively on the basis of the sustainability of their fish. Fish2Fork publishes guides to the best and worst species to eat or serve in restaurants.57

**Good Catch**

The Good Catch initiative supports the food service sector to make the best purchasing decisions and to understand the value that can be created from taking those choices. It provides workshops, online and hard copy tools, field trips and bespoke services, to ensure this part of the industry is equipped to drive change.

In summary, the awareness and pressure that is created within the seafood market to perform to higher levels of sustainability has effects throughout the seafood supply chain. Some can have more direct effects on the fisheries themselves, such as pressing for certification, whilst others have more indirect effects, such as changing consumer patterns and behaviours.

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55 Sustainable fisheries partnership, 2010
56 Fishwise, 2011
57 Fish2fork, n.a
The analysis presented in this report, derived from the work of leading experts, concludes that effective steps could be taken toward sustainable marine fisheries that would achieve outcomes which are economically and socially attractive, as well as environmentally rational. The forward challenge is to involve the full range of interests and stakeholders in building a consensus on the means to most effectively realise these positive solutions.

This analysis concludes that the solutions might best be pursued on two fronts: furthering consensus around the 3 principles and how to achieve these in practice; and progressing the debate on how to finance the transition period from ‘business as usual’ to sustainable fisheries.

7.1 Principles

It would be useful to develop further consensus on the transition to sustainable and resilient fisheries by applying three overriding principles: the ecosystem approach; robust fisheries management and sound economics.

Ecosystem management

There is as yet little consensus on how best to implement an ecosystem approach to fisheries management. At present, the approach is sometimes misconstrued, poorly implemented or avoided due to concerns over the time and data required to arrive at properly informed solutions. The development of simple implementation guidelines, based on field experience, or an effort to prioritise the main components of the ecosystem approach, might be beneficial. Reaching a consensus on how national and regional data collection efforts could be increased might also help to progress the implementation of this approach.

Robust fisheries management

Reaching agreement on how best to deliver change at the level of individual fisheries is often a complex process.

In this case too it is evident that progress can be made, for example to establish clearer shared views on how to improve governance, develop high seas fisheries management, increase global monitoring, control and surveillance capacity and ensure stakeholder engagement in decision-making.

The case studies outlined in this report, plus numerous other examples of progress around the world, provide a sense of the opportunities that could be seized. However, it is evident that further work is needed to understand how examples of good practice can be taken to scale.

Sound economics

The economics of many fishing practices are illogical and should change. The material outlined in this report demonstrates the scale of additional profits and social value that could be attained if the economics of fisheries are adjusted. However, a number of questions remain, particularly in relation to changing perverse subsidies and how to implement rights-based fisheries management.

7.2 Transition finance

The short-term costs of transitioning fisheries from ‘business as usual’ to sustainable management could be met through the development of new financial instruments. Innovative public-private partnerships might make it possible to harness and coordinate some of the existing fisheries finance, such as perverse subsidies, foundation finance and positive market demand, with new sources. Working to deepen and expand the understanding of current and potential finance flows could assist the move towards implementation.

The ISU offers this report to selected experts from all the stakeholder groups operating in fisheries as work-in-progress. Stakeholders are invited to provide feedback on its contents and to express views on how the ISU might best contribute in efforts to move toward more sustainable fisheries. The ISU intends to incorporate stakeholder views in a final report, to be published later in 2011.
Annexes

ANNEX A
Extra material for Chapter Four – The opportunity

ANNEX B
Extra material for Chapter Five – Moving to a more sustainable system
This annex aims to give fuller details on the full economic, environmental and social evaluation of two case study fisheries:

**Case Study 1: The N.E East Atlantic bluefin tuna fishery** – a subsidised fishery facing commercial extinction vs the opportunity to have a $600 million a year benefit to society.

**Case Study 2: The Senegalese coastal fishery** – a $50 million loss could become a $30 million benefit to society.

### A.1 Limitations of the research

The ISU recognises the limitations of this research. The results are only as good as the data that could be found within existing scientific or economic literature. In all cases local data was sought for case studies but, where such data did not exist, proxies and extrapolations were used to derive estimates – there may be considerable error in these estimates.

The approach was purposefully narrow and did not include downstream activities such as trading, processing, distribution and retailing. The case studies focused on activity within individual countries or fisheries and did not attempt to estimate the implications for trade or other decisions made in other parts of the world. The analysis was primarily static, rather than dynamic, and did not attempt to model the transition itself. It is recognised that all of these factors would need to be part of a comprehensive food systems analysis.

### A.2 Summary of the methodology

A complete understanding of the economics of fisheries must take into account not only the direct revenues and costs of the fishing industry, but also the broader environmental and social costs and benefits that the industry provides. This is necessary in order to provide an estimate of the aggregate ‘value to society’ that fisheries provide. To this end, where possible, monetised values were sought. However, it is fully appreciated that where it is not possible to put a dollar value on a cost or benefit, this should not mean that the aspect should be disregarded. Therefore, in these circumstances, the other non-monetised aspects are mentioned.

The methodology as a framework for analysis is illustrated below using global figures and then the methodology is applied to each case study to arrive at a total economic, environmental and social value for each.

#### Economic value

This is the total profit (or loss) from global fisheries, as measured by total revenues minus total costs. Total subsidies are subtracted from this, as they represent an additional cost to society of the fishing industry.

The FAO’s estimate of the value of annual global catch in 2004 was around $79 billion. According to the World Bank, the operating costs, including fuel costs, labour costs and other operating costs, totalled around $73 billion, with the total capital costs of the industry estimated at $11 billion. This implies that the industry as a whole made a loss of $5 billion. At the same time the fishing industry also benefits from significant government subsidies. Accurately measuring the amount of global subsidies is difficult, but estimates indicate that the total amount of subsidies given to the fishing industry is around $27 billion.58 These need to be subtracted from the economic profit. Fuel subsidies make up about $6.4 billion of total subsidies to the fishing industry. Fuel subsidies are typically provided by government through a reimbursement directly to the fishing companies,59 and so the cost of the subsidy is already accounted for in the cost structure of the fishing fleet. The cost of fuel subsidies is therefore not added back together with other subsidies. Taking into account all other subsidies except fuel subsidies, if the total value of subsidies is taken into account, the full economic value of the fishing sector is equal to a cost or loss of $26 billion.

#### Value of environmental externalities

Global fisheries have a number of environmental consequences. These represent a cost to society, which is generally not accounted for by the industry’s direct revenues and costs. Many of them are also very difficult to assign a monetary value to. This valuation of externalities at the global level is therefore limited to the cost of carbon dioxide emissions from global fisheries, although it is evident that there are other externalities that would represent a negative cost even if they cannot be quantified. Other

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58 Sumaila et al, 2006
59 Sumaila, 2010
major externalities are: destruction of coral reefs; unwanted bycatch and discards; and destruction of benthic habitats. Particularly destructive practices are discussed in relation to the individual case studies.

Total CO₂ emissions globally are around 132 million tonnes. The cost of carbon has a wide range of estimates across the literature. After considered analysis this methodology uses a social cost of carbon of $29 based on Tol, 2009, but recognises the high margins of error and differences of opinion inherent in this analysis. Alternative assumptions for the social cost of carbon that were considered and rejected include the Stern Review cost of $86, Tol’s median cost estimate of $8 per tonne of CO₂e, the McKinsey marginal abatement cost estimate of about €50 (about $70), the related marginal abatement cost for agriculture and forestry estimated at €30, and the market price of carbon, currently €15/t CO₂e in the EU. Using the chosen value of $29, total carbon emissions from global fisheries have a social cost of $5 billion. To account for this, the cost of $5 billion is added to the full economic cost of fisheries of $26 billion, to get a total cost of $31 billion.

Social value
Fishing carries with it important social benefits. In particular, they are a significant source of employment, often in areas where there are few other jobs available. In the analysis above, wages are only accounted for as a cost, although they clearly have an important societal value. The value of wages is therefore added back in to get a sense of what the real ‘value to society’ might look like.

Total employment generated by fisheries is around 120 million jobs. In many cases, this is likely to be an important reason why governments persist in supporting unprofitable and environmentally destructive fishing practices.

To take into account the value of this employment created, the total labour cost has been added back in (i.e., the sum of all salaries paid by the industry). This serves as an estimate of the annual value of the labour created by the industry. This approach is in line with what has been proposed for the UNEP Green Economy initiative. There are also other social benefits from fishing, including the preservation of traditional ways of life and social payoffs from employment beyond the wages paid. At the same time, there are some negative aspects of employment in the fishing industry, including use of child labour, forced labour and generally poor working conditions. These are acknowledged but are not able to be quantified.

If the benefit of employment (the labour cost), estimated to be $23 billion, is added to the total economic value of fisheries, including economic externalities, the loss of $31 billion, the overall estimate of the total value to society of fisheries is a cost of $8 billion dollars a year.

A.3 CASE STUDY: The N.E Atlantic Bluefin Tuna fishery

A.3.1 ‘Business as usual’ in the N.E Atlantic Bluefin Tuna fishery

Assumptions
In order to estimate the current total social economic value of the N.E Atlantic Bluefin Tuna fishery a number of assumptions were made: firstly, tuna farming and any other intermediate value-adding activities were excluded from the analysis; secondly, downstream activities were excluded, essentially valuing the catch at the dock; thirdly, due to the lack of data surrounding IUU fishing in this fishery, the associated catch has been excluded despite recognition that this will likely have impacts on the estimate; and finally, that vessels target bluefin tuna exclusively, which although unlikely, was due to a lack of appropriate data.

Economic value
Total reported catch was around 24,000 tonnes in 2008 and a price of $30,000 per metric tonne ($30 per kilo) was assumed based on the 2005-2009 average monthly price of frozen bluefin tuna at the Tokyo Central Wholesale Market. This price and volume data values the industry at around $715 million in revenue.

In terms of industry costs, given the lack of aggregate data and wide variation in vessel cost structures, costs were estimated from FAO survey data. Net profit margins for the vessels detailed were around 10% of revenue. The cost structure is composed of labour costs, variable operating costs, and fixed costs. Fishers are typically paid on a crew share system – with labour costs of about 20% of revenue, corresponding to an annual salary of around $24,000 per fisher. Other operating costs include fuel and bait and are estimated at 35% of revenue. Current fixed costs, including gear, maintenance, capital and interest payments, are estimated at 35% of 2008 revenue. Consequently, in total, costs were estimated at $145 million for labour, $250 million for variable and $250 million for fixed. This gives the industry profit of $70 million.

The industry also receives significant subsidies, which are evaluated as a cost to society. It is generally not possible to observe fisheries subsidies directly and this would be particularly difficult for a multi-national fishery. However, extrapolating from Munro & Sumaila’s methodology for calculating national subsidies and adjusting for bluefin catch by country suggests subsidies amount to 17% of revenue (compared to a global average of 19%), totalling around $120 million annually. These are mostly through capacity support and fuel subsidies, although a breakdown between the different kinds of subsidies is not available for the bluefin boats specifically. So, the total economic cost to society is $70 million dollars minus subsidies of $120 million dollars giving a total loss to society of $50 million dollars.

60 Tyedmeyers et al, 2005
61 Munro & Sumaila, 2002
A.3.2 A more sustainable scenario for the N.E Atlantic Bluefin Tuna fishery

Whilst estimates of future stock trajectory are highly contested, continuing to overfish at current levels will likely force stocks into a state of collapse within the next 12-15 years at the latest.64

Assumptions
In order to illustrate the ‘size of the prize’, which could result from sustainable management of the fishery, what the bluefin tuna fishery may look like in an alternative, sustainable state has been modelled (see Figure 8, Chapter 4). This alternative state assumes a number of changes to the fishery; namely, that IUU fishing is completely eliminated; stocks are allowed to recover to the level which will allow fishing at the long-term maximum sustainable yield; subsidies are discontinued (but redirected for the transition period to support capacity reduction); fleet capacity is reduced in the short term; gear restrictions, size and age limits, and catch documentation are implemented effectively.

Economic value
These assumptions would mean that after stock recovery and assuming appropriate size and age restrictions to preserve population structure, annual catch could be increased to about 50,000 metric tonnes per year.65 Assuming that the average price of $30,000 per metric tonne stays the same and increasing volumes to 50,000 tonnes would give total revenue of $1.5 billion for the fishery. In the sustainable state, it was assumed that labour and variable costs would remain at the same percentage but that fixed costs would need to be scaled up to the number of vessels required to catch 50,000 tonnes of bluefin. In the sustainable state, total costs fell from around 90% to around 80% of revenue and industry profit increased to around $310 million vs $70 million today.

In a sustainable state, there would be no direct subsidies to the fishery, although during the transition period subsidies would be required, in particular to retire existing vessels and reduce capacity in the short term.

Valuing environmental externalities
Assuming that CO2 emissions would remain constant per tonne of fish caught, a total of 275,000 tonnes of CO2 would be emitted, with a total environmental cost of $10 million. Through potential gear restrictions, bycatch could also be reduced, for example through the use of malleable hook designs tested in US waters for longline vessels. If this were the case it is likely that bycatch would decline. Given that the average tuna bycatch is 20%, substantially lower than the bluefin fishery, a decline even to the global average would be extremely beneficial.
In total, therefore, the industry in this more sustainable scenario has a positive economic value to society of around $300 million ($310 million profit less environmental costs of $10 million). This is a significantly improved outcome to the BAU scenario.

Social value
The fishery in the long term would also employ more people, seeing an increase in total employment from about 6,000 people to around 8,800, if it is assumed that vessel capacity and employment per vessel remains at current levels. As fishermen are paid as a share of revenues, average wages would increase from around $24,000 to around $34,000 per person. Total estimated wage costs are $300 million, up from $145 million today. Add this benefit to the economic value of $300 million and the total value to society of this fishery in its sustainable state would be $600 million. This is a dramatic improvement on the current value to society of $90 million, which is likely to decline over time as stocks deplete under a BAU scenario.

A.4  CASE STUDY: The Senegalese coastal fishery

A.4.1  ‘Business as usual’ in the Senegalese coastal fishery

Assumptions
In order to simplify the economic analysis due to a lack of robust data a number of assumptions have been made. First, it is assumed that the fishery has two clearly defined sectors – artisanal and industrial – with no overlap between them. Second, although the fishery contains over 100 different species of fish, a single fish stock was assumed. Third, downstream processing industries were excluded, in effect valuing the industry ‘at the wholesale dock’. Fourth, despite IUU fishing catch estimated to be around 8% of total catch, a lack of robust data has meant exclusion of this from the analysis.

Economic value
In 2005 the total catch in Senegal was approximately 480,000 tonnes, of which 425,000 was caught by the artisanal fleet and 57,000 tonnes for the industrial. The total value of this catch was estimated at $77 million and $82 million respectively. This gives an estimate for price per tonne of $182 and $1435. Total industry revenue, at the wholesale dock, is therefore $159 million.

There is a lack of systematic cost data for Senegal and as a result the analysis of cost structure is based on FAO survey data in 2003. Based on the multipurpose canoe (pirogue) for the artisanal fishery, the cost structure of the artisanal fleet is as follows: operating costs at 27.5% revenue, labour costs at 49.3% of revenue, and fixed costs at 13.8% revenue i.e. a profit margin of around 10%. Using data from a Senegalese deep water trawler as a proxy for the industrial fleet the cost structure is: operating costs at 79.9% of revenue, labour costs at 15.4% of revenue and fixed costs at 21% of revenue. This would indicate that the industrial fleet is loss-making with total costs of ~116% of revenue. The fishery involves ~12,500 artisanal vessels with an implied annual fixed cost of around $850 per vessel, and ~2,500 industrial vessels with an implied annual fixed cost of around $110,000 per vessel. In total, taking into account revenues of ~$160 million and total costs of ~$165 million, these calculations thus suggest that the industry is losing $5 million a year before subsidies.

Senegal provides significant subsidies to its fisheries, primarily through tax breaks on vessel upgrades, and export subsidies. The total aggregate subsidy estimate from Munro & Sumaila is around $70 million annually. This figure is used for this analysis, although other sources, such as the Sea Around Us Project, estimate total subsidies to be lower at around $50 million annually.

Valuing environmental externalities
To calculate the global cost to society of the impact of greenhouse gas emissions linked to the fishery the average global figure for CO2 emissions of 1.7 tonnes of CO2 per tonne of catch was used. This gives a total of around 818,000 metric tonnes of CO2. Valued at a social cost of carbon of $29 per tonne of CO2, this creates a negative global externality valued at around $24 million. Therefore, by taking subsidies and environmental externalities of $70 million and $24 million into account, and combining them with the industry loss of $5 million, the industry is costing society $99 million a year before consideration of its social value.

Bycatch in Senegalese fisheries is estimated at around 50%. Although this is not quantified it is clear that this is a high percentage of catch.

Social value
The fishery in Senegal is an important source of income in a country that has very few jobs outside of the agriculture sector. The fishery employs ~42,000 artisanal fishermen. Working conditions are thought to be poor generally with child labour making up 15–30% of vessel crews and conditions described as described as ‘difficult and precarious’. On the other hand, it is an important source of employment corresponding to around 1% of total employment. Perhaps more significantly, fish represents a very important part of the diet in Senegal. 61% of the catch is consumed domestically and it represents 49% of animal protein consumption.
In quantifiable terms, the cost structure described above indicates an implied salary of around $900 per year. The industrial fleet employs around 2,500 people, with an implied salary of around $5,000 per year. This adds up to a total wage bill of about $50 million, which, whilst significant, remains less than the total level of subsidies. Add this benefit of $50 million to the economic and environmental loss of $99 million and the total cost to society of the fishery is $49 million.

A.4.2 A more sustainable scenario for the Senegalese coastal fishery

In order for the Senegalese coastal fishery to transition to a sustainable state, fishing effort needs to be reduced. Given the limited amount of information on stock levels, it is, however, difficult to say exactly how much catch volumes need to be reduced, and how long it will take for stocks to recover to a sustainable level. This is further complicated by the significant impact of the Senegalese coastal upwelling on Sardinella catch volumes.

However, a number of assumptions have been made in order to see what a sustainable state might look like (see Figure 10, Chapter 4). First it is assumed that catch volumes decline by 25% and that there is a more sustainable mix of species to reduce overall overfishing. Second, that catch reductions are accompanied by 5% price uplift in the sustainable state, as fishers catch more valuable species (‘fishing up the value chain’). This is consistent with the global methodology used by the World Bank in ‘Sunken Billions’ regarding the price elasticity of biomass. Further, it is assumed that subsidies are completely eliminated once the sustainable state has been achieved and as a consequence the unprofitable sub-set of industrial vessels will exit the market, shifting the weighted average cost structure of the industry from loss-making to a 10% profit margin in line with the artisanal fleet’s current profit margin. At the same time the overall fleet is re-calibrated to a more efficient level, with small increases in catch per vessel. It is assumed that labour costs remain the same in percentage of the cost structure but decrease slightly in absolute terms as revenue falls.

Economic value

In this sustainable scenario, overall catch falls from ~480,000 metric tonnes to ~360,000 metric tonnes. At the same time, the assumption that a slight increase in price as stocks recover and fishers increase their catch of high-value species, means that revenues fall from ~$160 million to $125 million. Based on this, the average industry profit margin for vessels would increase from around -5% to ~10% as the unprofitable segment of industrial vessels are eliminated, shifting the fishery from loss-making to profitable. Private profits would be around $10 million.

As subsidies would be eliminated, there would be no additional cost to society from subsidies once the fishery has reached its sustainable state.

Valuing environmental externalities

Greenhouse gas emissions are assumed to be proportional to catch in this scenario, so with a reduction of 25% in catch, CO₂ emissions would see a similar reduction, to just over 600,000 metric tonnes. This represents a total externality cost of around $20 million, down from $24 million. Similarly, it is assumed that the boats that cause the most bycatch are the least efficient and therefore bycatch figures will also fall when the least efficient vessels are eliminated, from approximately 50% to below 40%.

The total economic value of the fishery would therefore still be negative ($10 million industry profit, less $20 million environmental costs), although now at around negative $10 million rather than negative $100 million as was previously the case.

Social value

At the same time, weighted average industry annual salary would increase from ~$1,100 to $1,400 as labour costs decline by less than the number of fishermen which falls from ~44,500 to ~27,000 across both sectors. This would mean that total wages in the industry would reach about $40 million. If this value is included in the total calculation, this gives a total value to society of $30 million, which is a major improvement from the BAU scenario. However, a decline in catch would mean a decline in available protein. Whilst it is assumed that the share of fish used for domestic consumption would remain equal, the share of protein consumption that comes from fish will decline in line with the volume of catch.

Sustainable management, therefore, has the potential to create around $80 million in annual economic and social value for the fishery. In this sustainable state, the fishery would be economically more productive, have reduced environmental externalities, and increased social value. By contrast, if left in its current structure there will be a decline in fish stocks, a consequent reduction in value to society and a steady erosion in employment from the fishery.
Chapter 5 outlined some of the ways in which better fisheries management based on the three principles of the ecosystems approach, robust fisheries management and sound economics have been implemented in fisheries around the world. This annex provides more detail about each of the case studies mentioned as well as supplementary case studies.

The case studies are mainly taken from a report commissioned by the ISU by MRAG Ltd and supplemented by research undertaken by the ISU. The full report, ‘Towards Sustainable Fisheries Management: International Examples of Innovation’ is available on request. Unless otherwise stated, data is taken from this report.

B.1 Implementing the ecosystems approach

Science and data

The Antarctic's Regional Fisheries Management Organisation

The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) came into force in 1982. The conservation area covers the closed ecosystem of the Southern Ocean which is bounded by the biological barrier of the Antarctic Convergence (where warmer water meets the Antarctic). It was developed mainly due to the overexploitation of the krill population, but its broader aim is to preserve the natural ecosystem and marine life. However, it does not exclude harvesting of fish for commercial purposes. For this reason the Ecosystem-based and Precautionary Management approach was adopted. In order to use this approach a large quantity of complex data was required and therefore data collection has been an important focus. However, CCAMLR did not want to revert to inaction when faced with either missing or nonexistent data. Hence, the ‘precautionary’ part of the approach was crucial in reducing the risk of unsustainable practices in the event of uncertainty. Certain innovations in yield modelling have been employed that encapsulate this approach. For example, the ‘Krill Yield Model’ combines known and certain data, such as krill biomass, with uncertain information, such as variability in krill recruitment rates. The model and the precautionary approach help to define a precautionary limit for annual yields. Other precautionary measures are also used such as setting stricter caps in areas where predators forage for prey and regulation for reducing bycatch. Another important part of the scheme was the introduction of mandatory on-board scientific observers.

However, data collection requires resources. For example, whilst the observer scheme is invaluable for problem identification as well as data collection, it is estimated to cost approximately $293 million in this case.

This approach has had two positive outcomes. Bycatch has been reduced to negligible levels and MSC certification has also been given to one of the toothfish fisheries whilst others are under assessment. This certification has considerably strengthened the fishery’s value chain.

Fiji’s mixed fishery

Whilst the Fijian government retains primary responsibility for licensing and enforcement, her coastal resources are largely governed by customary marine tenure and management under the control of the local communities. Pacific island communities have long practised traditional methods of preserving valuable natural marine resources in order to maintain food security. To this end management practices such as seasonal bans, temporary no-take areas (tabu) and prohibition on certain species have been employed. However, continuing pressures from external sources, such as logging, as well as internal sources, such as increased commercial vessels operating in the same areas, has necessitated the partnership of the local communities with NGOs. As a result scientific research programmes have been established that seek to complement existing local knowledge. Data has begun to be collected on species abundance and size as well as exercises in the mapping of fishing pressures. Surveys have highlighted linkages between terrestrial, marine and freshwater systems. Management strategies against clear objectives have been developed. As a result a protected area network was established in 2005 and has since expanded to 17 small, traditional closed areas and three large district-wide no-take fisheries areas. Location and size of tabu areas is defined by a mixture of the local traditional knowledge and information from the new surveys.

The costs of this sort of project vary greatly depending on the extent of technical investigation but are highly valuable. In this case they have been valued at approximately F$1300 a year to support. Benefits of this complementary system include social cohesion and a renewed awareness and respect for the communities and their traditional methods. Crucially, there has been a noticeable increase in fish abundance and size, as well as coral cover. This bolsters the community’s ability to exist on their natural resources and enhances their food security.

Senegal’s mixed fishery

Artisanal and industrial fishing in Senegalese waters represents a very important contribution to both food security
and the economy. Over the last few decades there has been a huge rise in artisanal fishing which, whilst foreign industrial fleets have decreased, has led to significant overcapacity. Catches per fisher have declined and have led to fishers having to fish harder and further away. Furthermore, it has encouraged fishers to use illegal fishing gear and fish illegally in foreign waters. The World Bank estimates that 30% of artisanal demersal fish catch is caught outside Senegalese waters, costing countries such as Guinea-Bissau, Guinea, Gambia and Mauritania approximately $100 million annually. One important driver of overcapacity is the migration of farmers to the coast in times of drought and hardship and as such coastal resources represent a vital safety net with low barriers of entry. The situation is exacerbated by lack of control and regulation especially in terms of licenses to fish or on gear restrictions.

Whilst there is a lack of state capability to enforce management measures, some local fishery management initiatives have emerged. One such example is Kayar Village, where local fishers have developed committees to regulate fishing and enforce fines for non-compliance. A lack of data on fish catches and illegal catches makes estimates difficult so these management systems rely on local knowledge and information to set catch limits and restrictions on certain species. These management measures, led by the local initiatives have led to price and income increases for fishers. Better facilities and marketing hubs have been developed and social cohesion in the village has improved. This initiative was supported by NGO funding but has come at little or no cost to the state. This is an example of local knowledge being harnessed to bridge data gaps in order to manage fisheries more sustainably.

Scotland’s cod fishery
Cod stocks and landings in the North Sea have declined over the last few decades. Landings have declined from an average of 250,000 tonnes in 1971 to 95,000 tonnes in 2000. Cod are caught within a mixed demersal fishery in Scottish waters. ICES estimates that cod catches are actually higher than reported due to vessels discarding cod when they are in excess of their quota or if they were targeting other species.

The allowable catch systems for cod that had been established to restrict catches were not succeeding in their aim of letting stocks recover. They were also socially and politically unpopular. The challenge remained one of reducing cod mortality rates within the mixed fishery whilst maximising the number of fishing days available to the fleet.

An innovative solution to this problem was proposed by the Scottish government, the industry and NGOs – the Conservation Credits Scheme. One particularly important feature of this was the use of temporary closures of areas where cod would aggregate. In order for this to work fishers had a vital role in providing data and information about catch rates. This data would trigger ‘Real Time Closures’ (RTC) of these areas when a certain catch rate was reported.

Environmental benefits are hard to quantify at this stage although ICES suggest that vessels have been compliant with the RTCs and that the cod stock has been gradually increasing to approximately 68,000 tonnes – almost at the estimated sustainable limit of 70,000 tonnes. Fishers were able to fish for the full year in 2009 although landings were still higher than regulation allowed at 91,000 tonnes.

Marine spatial planning and marine protected areas

Australia’s Great Barrier Reef Marine Park
According to UNESCO, Australia’s Great Barrier Reef Marine Park (GBRMP) is one of the best examples of marine spatial planning in the world. It stretches along 2,300 km of coastline and is bigger than the UK, Holland and Switzerland combined. It covers one of the richest and most diverse ecosystems in the world. The GBRMP was established in 1975 with the goal of providing long-term protection, sustainable use and understanding of the Great Barrier Reef. In the early seventies there was a perception that the reef was under assault from a variety of sources; namely – oil exploration, limestone mining, pollution from both land-based and shipping sources, over-fishing and tourism; and as a result the reef was degrading. Spatial planning was key to the establishment of the marine park. Zoning was established to achieve multiple objectives such as maintaining biological diversity and ecological systems as well as managing the impacts of tourism.

The zoning scheme reflects the diverse nature of the marine area. For example, the most restricted zone is the Preservation Zone, into which all entry is prohibited except for exceptional scientific research. The least restricted zone is the General Use Zone, in which all reasonable use of the area is allowed with the notable exceptions of mining, oil drilling and spear fishing. Other zones fall between these two extremes and buffer zones are set up around the most protected areas in order to enhance the likelihood of their continued protection. The zoning scheme has also been complemented by management plans of specific localised areas. The MSP is a multiple-use, integrated plan which is reinforced with the provision of permits for the specific activities that are allowed to take place within each zone.

Recognition that the ecosystem is not static has led to plan revision over the decades. For example, initially only 3% of the area was designated as ‘no-take’ areas but after a re-zoning process about a third of the area was designated. The iterative process has been particularly relevant in the GBRMP as it had very little precedent to build on as well as little initial ecological knowledge. Success has meant that 28 coastal areas initially excluded from the marine park have now been included. One particularly relevant innovation established here is an environmental charge paid by tourists that contributes to the continued conservation, education
and research of the area to the order of approximately $7 million.\textsuperscript{75}

The outcome is that the Marine Park generates over $5 billion annually to Australia’s economy, mainly through tourism and fishing, and a plethora of jobs and livelihoods are now being supported; approximately 90,000 from tourism alone. Most importantly this is an operating model that will continue to deliver these benefits for decades to come as a result of the sustainable management of this important natural resource.

\textbf{China’s national marine functional zoning scheme}

The Law on Management of Sea Use, which was proposed in 1997 and officially adopted in 2002 is a good example of a centralised, national spatial planning exercise. The law was promulgated by the Chinese government partly in response to the rapid and economically advantageous development of the Chinese marine industry and partly in response to the call of the World Summit on Sustainable Development.\textsuperscript{76} Before the law was passed the development of the marine industry was characterised by the ‘three nos’: ‘no order’, ‘no control’ and ‘no fee’. Consequently, the resource base was exploited, and the environmental quality of marine areas significantly reduced. In order to combat these issues the law is comprised of three principles:\textsuperscript{77}

- \textit{Right to the sea-use authorisation system:} rights to the use of the sea to be applied for and granted
- \textit{Marine functional zoning system: }division in to functional usage zones according to ecological functions and priority usage
- \textit{User-fee system: }users must pay a fee in order to use the sea to carry out productive activities

The law was established on a ‘two-level management system’, which means that all applications are assessed at the provincial and national government level. It is also emphasised that all rules and regulations as well as management must operate upon the principle of ‘development in protection and protection in development’ for a rational and sustainable use of the sea.\textsuperscript{78}

Although the long term benefits are hard to assess at this relatively early stage in the execution of the zoning scheme and management system, improvements have been noted such as the containment of illegal occupation of coastal areas and the restoration of order in sea use in coastal cities. Since implementation 40,000 certificates have been issued, 1.1m ha covered and 3.5 bn Yuan collected in user fees (approx 500m USD).\textsuperscript{79} It also goes some way to showing how a legal system based on property rights can be established at a national level, thus addressing the common resources problem. However, there are still issues apparent such as the unevenness in the pace of development in some provinces which has meant that some resources are still over-exploited whilst others are under-exploited. Most importantly, the rapidity of development and population growth within the country means that pressure will continue to be exerted on marine ecosystems and coastal areas despite the zoning and management schemes.

\textbf{Minimising bycatch and discards}

\textbf{Australia’s Northern Prawn Fishery}

The Northern Prawn Fishery (NPF) in Australia is typical in many ways of a tropical shrimp fishery, particularly in its high bycatch and discard rates: 516 different species have been recorded as bycatch, including six species of turtle. When bycatch began to be washed up on tourist beaches, it led to strong pressure from the public to do something. As a result the NPF became one of the world’s first tropical shrimp fisheries to introduce a bycatch action plan. However, commercial interest in even further reductions of bycatch led to the design and investment in the creation of the seawater hopper. The combination of time needed for sorting bycatch from catch and high temperatures were leading to a decline in the quality of the shrimp and therefore on the prices fetched at market. An economic incentive was therefore created which would also result in environmental benefits. The seawater hopper was designed to use the shrimp’s natural behaviour to separate them from unwanted bycatch; whilst the shrimp would fall to the bottom and onto the conveyor belt, the bycatch species would remain in the water in the hopper. Once the shrimp had been sorted the hopper would be drained and bycatch returned to the sea.

Both larger and smaller scale hoppers became available and investment costs ranged from around AUS $80,000 to AUS $120,000 for installation of the larger ones. Crucially, the investment in this technology by vessel owners was a decision based on sound economics and no subsidisation was required. By contrast, in an adjacent fishery where the economic incentive was not as strong, subsidies up to AUS $30,000 were offered. As yet uptake has not been strong. In the NPF the hopper successfully helped fishers to improve the quality of the shrimp and reduce sorting time, thereby leading to higher income and a better reputation both nationally and internationally. As the catch has time to recuperate whilst in the hopper, damaged shrimp produce has been reduced by 5-10% and processing and packing time is 30-50% faster. In terms of the survival rates of discarded bycatch, anecdotal evidence suggests that they are up by 30-95% depending on length and depth of the trawl. Other research has found that they have doubled from 8-16% for vessels with hoppers. Due to their success Australian manufacturers have had requests from vessel owners in Mozambique, Spain and French Guyana.

\begin{itemize}
\item \textsuperscript{75} Scottish Natural Heritage, 2006
\item \textsuperscript{76} UNESCO, 2010
\item \textsuperscript{77} Li, 2006
\item \textsuperscript{78} UNESCO, 2010
\item \textsuperscript{79} Endo, 2008
\end{itemize}
WWFs Smartgear Competition

Smartgear is an international competition that specifically aims to solve issues of bycatch through technical solutions. WWF realised that whilst positive developments aimed at solving bycatch issues were taking place around the world, not enough was being done to draw these innovations into the global arena. In 2005 the first Smartgear competition was launched. It encourages innovation and collaboration between stakeholders to provide solutions to bycatch problems and receives between 70 and 90 entrants from around 30 countries. A first prize of $30,000 is given as well as two runner up prizes of $5,000 each. The first prize winner is obliged to invest at least $10,000 of their winnings into the further development of their idea. The judges and organisers also give specific feedback to non-winning entrants in how to improve their ideas. In some cases this has led to their re-entry in subsequent years. WWF then use their international network to promote implementation of the winning designs. In 2011, a category for reducing bycatch within global tuna fisheries will be introduced.

Since its inception the competition has identified four winning designs, eight runner up designs and two regional-specific winners. As an example, the winning design in 2009 was a highly engineered but practicable Underwater Baited Hook which succeeds in keeping scavenging birds away from the lines. This device has undergone a successful trial and proof of concept period, demonstrating that it is viable in commercial fisheries. Winners have often been able to turn their designs into businesses. One of the other big advantages of this competition is that it provides strong incentives for non-governmental development of environmentally smart fishing methods, thereby harnessing the knowledge of the fishermen themselves. This means that solutions are more likely to be mutually beneficial and therefore have better uptake potential.

Norway’s cod fishery

In the Barents Sea cod fishery, vessel owners do not have the right to sell a species unless they hold a licence and sufficient quota to do so. This meant that significant amounts of bycatch, of either undersize cod or non-target species, were being discarded at sea. Minimum size limits for landed cod and practices of ‘high-grading’ were also leading to undersize fish being discarded. Discarding was an issue that was receiving attention not just within the industry but also from the media, particularly given that stocks were rapidly declining. However, it was specifically the media attention given to the fact that a strong year class in 1986 was not given the opportunity to boost cod stocks as it should have done, due to high levels of discarding and high-grading, that finally triggered the change. It was clear that the potential benefit of a strong year class was being lost. In order to avoid repetition of this failure, the Ministry of Fisheries decided to make discarding illegal and a discard ban was eventually put in place on cod and haddock in 1987. The ban included measures to compensate fishers for the fishing effort spent on undersize or over-quota fish that were landed, thereby decreasing incentives for discarding. It was complemented by fishing area closures and fishing gear restrictions. Catch at sea and at port is monitored and inspectors are now able to board vessels to make sure discarding does not take place. They are also able to respond to low catch levels by the temporary closure of the associated fishing areas.

The monitoring of the discard ban, which is pivotal to its success, comes at a cost of approximately £60 million to the Norwegian government. However, the measures have been effective at discouraging bycatch altogether whilst simultaneously encouraging its retention and landing. Another benefit of all bycatch being landed rather than discarded is the ability to include it in stock estimates thereby ensuring that more informed decisions regarding quotas are able to be made. It is estimated that due to the discard ban, strong recruitment and the eventual elimination of unreported catch have resulted in stock levels increasing from 121,243t in 1987 to 1,145,460t in 2010; an 844% increase. This stock increase creates a more stable economic outlook for the fishery. The value of total catch increased by 57% from 1989 to 2009 when it was valued at £352 million. Furthermore, the fishery has now achieved MSC certification and so fishers can now receive premium prices for their catch.

B.2 Applying robust fisheries management

Enforcement

Namibia’s fisheries

Namibia has the largest fishery in the southern Africa region. This is for two reasons: firstly, much of the coastal region falls within the Benguela deep sea current, a high yielding geographical area; secondly, much of the coastline is desert and therefore undeveloped, thereby minimising the impact of human settlement on the coastal waters. However, prior to its independence from South Africa in 1990, the Namibian fish stocks were subject to overfishing due to foreign distant water fleets, predominantly from Spain and the Soviet Union, fishing in Namibian waters. As a result, whilst the fishing sector appeared successful during this time economically, ecologically, it was devastating the fish stocks. After independence the Namibian government regained exclusive control over its EEZ and passed the Sea Fisheries Act in 1992. This had two guiding principles: firstly, to sustainably manage the growth and harvest of the marine resources and secondly, to maximise the economic and social benefits of the fishing sector to Namibians.

There are several innovative features of the management system in place in Namibian fisheries. They have adopted...

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80 High grading is the practice of discarding fish that are of lowest economic value when a vessel quota has been reached in order to land the most economically valuable catch.
81 Food and Water Watch, 2009
82 Nichols, 2004
a resource rental approach whereby the government rents out the access to fish for sustainable catching by commercial fishers. All vessels are required to hold fishing rights for four to twenty years (as of 1994) and a total annual catch (TAC) limit is established based on scientific data. The vessels then rent quotas of the TAC from the government. This is done for the 7 species that make up 90% of landings. The cap on the quota enables the sustainable management of the fishery. There is no government subsidisation of the Namibian fishing fleet. Instead the revenue that the rent and licences bring in is re-invested into monitoring and enforcement and social programmes. Further management processes such as catch reductions, seasonal closures, area restrictions and biological research are also implemented. Monitoring and enforcement is a crucial aspect to this management system. 70 to 100% of vessels have observer coverage and arrests, fines and vessel seizures are made if vessels are found to be fishing without a license. The Monitoring, Control and Surveillance system is widely regarded as a very effective system.83 There are very few incidents of IUU fishing as a result.

The benefits of the new system can be seen ecologically as well as socio-economically. The hake TAC grew from 60,000 tonnes to 195,000 tonnes between 1990 and 2002. The horse mackerel stock also continues to recover. Similarly, the contribution to the economy of the fisheries sector increased from $98 million to $372 in a decade. From a social perspective, incentives for Namibians to gain employment within the fishing industry, both up and downstream, have resulted in nearly 14,000 Namibians working in the fisheries sector and 162 out of 163 of the rights to access are held by Namibian vessels.84

**Stakeholder engagement**

**South Africa’s hake fishery**

The South African hake fishery is worth approximately $600 million representing about half of the value of all fisheries in South Africa and employing around 7000 people in total. The fishery began being exploited in about 1910 with intensive operations beginning in the 1960s with an influx of foreign vessels. By 1972 ‘peak’ catch had been achieved and the first stock collapse was experienced in 1976. Changing political scenarios and management bodies since the introduction of the EEZ in 1977 gave rise to an increasing allocation of fishing rights, away from the few historically established, vertically integrated companies that dominated the fishery. This worried the industry as it had been relatively successful at sustainably managing the fishery historically. This was because of three main things: a cohesive industry body that comprised almost all of the main rights holders; a history of good data collection; and the existence of a ‘rules-based approach’ to the allocation of TAC using trusted science. This makes it hard for industry or government to intervene.

However, the industry was concerned that further plans for rights re-allocations and increases might undermine the sustainability of the resource and so MSC certification was sought in order to stabilise the fishery, as well as to externally publicise the good management procedures already in place and to act as a supporting argument against plans to further expand fishing capacity. As such, the acquisition of MSC certification, awarded in 2004, is used as a tool for sustainable governance by all stakeholders. The requirements are used by government to improve bycatch rates and increase observer coverage, the industry sees it as added value to the fishery and environmentalists use it to push for better standards. Several sustainability gains have consequently been made: access to new markets has improved economic performance; the biomass of one of the hake species (paradoxus) has improved; and reductions have been seen in bycatch of birds and non-target species. This has been done without the need for subsidies as levies on the industry have covered certification and associated management costs.

**Mozambique’s mixed fishery**

As in many developing countries, the coastal waters of Mozambique are crucial for local employment and food security. However, as the majority of inland Mozambique was devastated by civil war from 1975–1992, the coastal regions became ever more important as a haven for conflict refugees. This led to increasing pressure on the marine resources, particularly as the local fishing gear, the beach seine – a 500m long net deployed off the back of a small boat – did not provide much of an entry barrier to fishery exploitation. Some enterprising individuals even used mosquito nets as fishing gear. This led to over capacity and over exploitation of the resource, particularly as fine meshed nets were catching juveniles as a matter of course. Added to this already pressured situation was the presence of large shrimp trawlers that caught fish as bycatch. Conflict began to break out and by 1994 it had escalated to the point of government intervention. The Institute for the Development of Small-Scale Fisheries (IDPPE) was created and in turn local co-management structures were put in place (Comité de Co-gestao de Pesca, CCP). These became the legal voice of the fishing communities. Local people were given an opportunity to discuss local problems with government representatives and ultimately CCPs were given the responsibility of issuing licences to fishers within their delimited area of influence.

Challenges still remain in that fishers still use illegal nets and enforcement is half-hearted given the importance of the fisheries as a food source to so many. This means that improvements in stock levels have been hard to observe. Concerns have also been expressed that the CCPs are effectively being used by the government to do their own job and not seeing any return for it. However, this co-management governance approach has provided clear benefits: the reduction in conflict through licensing and IDPPE support; more coherent regulation of fisheries through the delimitation of fishing areas; the creation of a network of CCPs that are able to share knowledge.

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83 ibid
84 Food and Water Watch, 2009
and problem solving; representation of local fishers at government level through the Fisheries Advisory Committee; and the power to reject the encroachment of the industrial shrimp trawler fleet on local waters. With this structure in place it is hoped that more sustainable practices will follow suit.

B.3 Creating positive economic incentives

Property rights

Alaskan halibut fishery

Alaska’s Halibut fishery experienced a rapid expansion in capacity from the 1930s, which, by 1990 had resulted in the fishing season being reduced from 9 months to 2-3 days. Whilst total catches adhered to quotas set by the International Pacific Halibut Commission and the fishery was always considered to be managed sustainably from a biological perspective, the fleet was economically inefficient and the short intensive fishing season, with thousands of vessels fishing for a very short time, was dangerous for the crews. Consequently, a rights-based management system was introduced, based on individual fishing quotas (IFQ), which could be traded between fishers. In order to reduce social costs to the small-scale fishing sector, all vessels were categorised into size groups and quota trading was only permitted within these groups. Within 5 years of the IFQ system being introduced, the number of fishing licenses reduced by 40 percent from 4,830 to 2,855. This occurred because licenses became private property so quota holders were able to sell their licenses and exit the fishery. With the decrease in capacity, each fisherman remaining in the fishery had more quota and therefore higher profits. In addition to the capacity reduction, a change in the value chain of Halibut contributed to increased profits. When the fishing season was only 2-3 days long, only a small amount could be sold fresh and the surplus had to be frozen. The longer fishing season led to a higher quality product and a greater availability of fresh haddock which, in combination with reducing capacity and increasing profitability, the system has been very successful. The number of trawlers in the fishery reduced by 44% and there was a 66% reduction in the number of vessels overall. Net profits were made in only four years between 1969 and 1991 but since 1996 the fleet has been profitable every year. In Iceland, the implementation of ITO’s has had a very positive effect on the ecosystem. ICES, (International Council for the Exploration of the Sea) estimated the spawning stock biomass to be 160,711 tonnes in 1991 and 300,488 tonnes in 2010. However, increasing stock levels cannot be solely attributed to the capacity reduction because, in addition to the ITQ system the Fisheries Management Act of 1990 increased the Directorate of Fisheries enforcement budget by 464% (adjusted for inflation) from ISK 57 million ($315,600) in 1990 to ISK 322 (£1.8 million) in 2008.

US Pacific Groundfish Fishery

The US Pacific Groundfish Fishery is located on the West Coast in the Juan de Fuca strait where there are 60 different stocks of groundfish, including dogfish, halibut, lingcod, snapper and sablefish. From 1973, 2000 or so licenses were in use and the fishery was managed competitively with Total Allowable Catches only implemented on a few species. The fishery would open and close when the TAC was reached and consequently significant investment was made into capacity and fishing power in order to catch as much as possible before closure. TACs were constantly being exceeded. All stakeholders were soon experiencing problems such as inability to manage stock rates, overcapitalisation of fishing fleets, high costs, falling landed prices, fishing in bad weather and crews working too long and too hard in a restricted season. Consequently, in 2006, the management system was completely overhauled and a new, integrated management plan was put in place. Principles were established such as: all groundfish must be accounted for; groundfish will be managed on a stock specific basis; fishermen will be individually accountable for their catch. New monitoring standards (dockside and at-sea) were established and implemented to meet the above 3 objectives. One of the most important innovations that was established was an Individual Vessel Quota system (IVQ) where the quotas are allocated
to each vessel prior to the season, are transferable and able to be carried over (with some exceptions). The reporting of catch was also tightened up: 100% monitoring at sea through on board observers or cameras and strict designated landing sites were also established.

There have been significant improvements to all stakeholders through this new management system. The IVQ system has meant that fishers no longer ‘race’ to catch the most fish and are provided with an incentive to maximise the value of their share through quality and on-time delivery. The asset value is also maximised due to the improvement in the health of the resource as catches stay within the TAC. Vessels have more flexibility and are therefore able to plan and run their businesses more effectively. Reduced fishing effort has also led to fewer vessels fishing less ground and using improved selective fishing techniques. Cooperation between fishers has also greatly improved on issues such as avoiding bycatch, conservation measures and policy measures. The season length has increased by over 150 days and quota values have increased from 13.52 in 1991 to 72.65 in 2009. Monitoring and data recording requirements have led to investment in these areas and data collection has greatly improved. As all catch and mortality are accounted for, management is conducted on a stock specific basis. Inevitably, the reduction in fishing effort has led to overall fleet reduction which in turn means that crew employment numbers has decreased by approximately 50% in every fishery. However, the number of person years of employment has not much changed and reviews have shown that crew jobs are currently better paying, longer term and provide more stability. Additional employment has also been created through the at-sea and dockside monitoring programmes.

Chile's Loco fishery

The Chilean Loco is a valuable mollusc resembling an Abalone, which is harvested by diving. In 1976, Loco was introduced to the Japanese market and, as a result, catches increase to around 25,000 tonnes. Despite the introduction of laws restricting the minimum size of Loco that could be caught, and a fixed fishing season, the resource began to suffer from overcapacity. In an attempt to avoid collapse, the government closed the fishery for three and a half years in 1989. However, the moratorium fuelled social unrest, which culminated with the leader of the regional federation of artisanal fishers interrupting a political meeting to deliver a direct message to the Chilean President to reopen the fishery. The President was persuaded and instructed the fisheries authority to implement a new management regime consisting of individual non-transferable quotas. Unfortunately this system was poorly constructed and ineffectively enforced so the illegal trading of rights occurred and within 5 years the catch per unit effort had fallen to pre-moratorium levels. With assistance from academic institutions, local fishers started experimenting with self-imposed closed areas, which appeared to aid Loco recovery. Local experiences were used to develop a territorial user rights system, which only permitted fishing for Loco in ‘areas for the management and exploitation of benthic resources’ (AMERBs).

The implementation of AMERB sites had begun around 1997 and by 2000, Loco could only be legally harvested within AMERBs. Territorial user rights for these areas were granted to fishers’ organisations, which were given exclusive harvesting rights. The government also mandates a harvest control rule, which only permits fishers to harvest 15-25% of the total stock. To keep their rights, these organisations must conduct regular surveys of the Loco and pay the government an annual fee for the right to continue managing the fishing area. The fishers’ organisations have therefore established effective monitoring, control and surveillance systems, which have increased regulation whilst at the same time reducing government enforcement costs. AMERBs have increased the abundance of the stock and enabled a stable harvesting level of 2000-4000 tonnes since 1997.

Vietnam’s Ben Tre clam fishery

The Ben Tre clam fishery in Vietnam is primarily harvested by hand-gathering, which occurs during low tides between April and October. During the 1980s and 1990s the clam fishery was badly managed and suffered from a decline in catches, poor product quality and low prices. This led to the establishment of a cooperative in 1997, with all clam gatherers required to belong to a cooperative. However, the cooperative structure did not deter new participants from entering the fishery and by 2006, 13 cooperatives had been established and clam populations continued to decline. Although exact figures are unknown, the average catch per hectare decreased rapidly between 2003 and 2005. As in many cases of overcapacity, too many participants and a lack of management had led to the harvesting of seed and undersized clams. On top of this, since the market for Ben Tre clams was domestic and there was an oversupply of clams to the market, prices were low and in decline. Low catches, poor product quality and low prices led to the introduction of a series of management measures by Vietnam’s Department of Agriculture and Rural Development in 2006. Measures included the management of capacity through allocating area rights to cooperatives and a new requirement for cooperatives to report their landings. Improved management of the Ben Tre clam fishery attracted the attention of WWF who, in collaboration with the Sustainable Fisheries Fund, invested the $120,000 required for the Ben Tre clam fishery to enter MSC assessment and certification.

Before the fishery could be awarded MSC certification, several management measures had to be implemented. Ben Tre province had to ban the harvest of clams below a certain size; ban the use of tractors on sand flats to transport catch; allow only rakes and sieves to be used to harvest clams; introduce closed areas to allow stock recovery; restrict the access of harvesters from outside the province; and improve data collection and recording. Control on technological development in the fishery had to be halted because technological creep would have made it very difficult to ensure sustainable harvesting. Despite the costs associated with becoming MSC certified, the process has been worthwhile from both an ecological and economic standpoint. The reduction in catch per hectare eased in 2005 and since 2006 it has stabilised at 1.2-1.3 tonnes per hectare per
year. Cooperatives were able to help regulate the supply of clams to the market and this, combined with the increased willingness of retail markets in the EU to purchase an MSC certified product, has led to a dramatic increase in clam prices. In 2007 the fishery was worth VND 91 trillion (€27 billion), rising to VND 324 trillion (€10.3 billion) by 2010.

Removing perverse incentives

Norway’s fishery
Norway reduced subsidies to fisheries by 85 percent between 1981 and 1994 (from €150 million to €30 million). More effective management measures were adopted simultaneously and as a result the sector is now self-supporting and fish stocks have shown signs of recovery. Although the effect of subsidy removal is difficult to isolate from other factors such as the variability of stocks, changes in the management of quota, the introduction of a discard ban and the fact that Norway shares its stocks with its neighbours, the case shows that a gradual removal of subsidies combined with an improved management regime can promote successful reform. The reduction in subsidies occurred at a time when Norway was under financial pressure from falling oil prices and significant external political pressure associated with multilateral agreements, i.e., the 1990 European Economic Space (EES) agreement to reduce direct price support to fisheries. Compensation in the form of optional employment opportunities allowed the sector to downsize without significant negative impact on local livelihoods. The Norwegian fisheries sector gained from improved overall profitability, whilst the country as a whole gained from efficiency improvements and the better allocation of public finance and the marine environment benefited from a reduction in pressure on the fish stocks.

New Zealand’s fishery
Poor fisheries management and the presence of subsidies to promote fisheries expansion in New Zealand had led to a significant decline in inshore fish stocks by the early 1980s. To avoid a complete collapse of the fishery, the government and industry realised that fundamental reform, including the removal of open access and the removal of subsidies, was necessary.

The reform process took place over a period of several years and began with 21 inshore species and 8 deepwater species. It involved the allocation of individual transferable quotas (ITQ) to fishers without charge because it was felt that a quota ‘give-away’ was necessary to prevent a backlash from the industry. The government removed subsidies and used some of this to buy-back NZ $45 million ($30 million) of provisional catching rights to reduce the overall exploitation of the fishery. In addition to the removal of subsidies, the industry was asked to take responsibility for the costs of fisheries management services such as research and compliance. The cost to the industry is approximately NZ $35 million ($20 million) per year. However, the fishery has become more profitable since the introduction of ITQs and removal of subsidies, increasing in value from NZ $2.6 million in 1996 to NZ$ 4 million in 2009 ($1.7 million to $2.3 million), which has more than offset the research and compliance costs. To introduce the ITQ system, the New Zealand government initially had to buy back NZ $30 million of quota allocations. But, not only are fisheries now profitable without the need for subsidies but they are also environmentally sustainable.

Increasing the demand for sustainable seafood

International tuna fisheries
Illegal, unregulated and unreported fishing (IUU) contributes to overcapacity in many poorly managed fisheries and it is particularly prolific in high seas waters because outside the waters of Exclusive Economic Zones (EEZ) the only authority able to prosecute a vessel is its flag state. IUU fishing in international high seas tuna fisheries is particularly problematic. There are five Regional Fisheries Management Organizations (RFMOs) on the high seas that cover all tuna, tuna-like species and billfish fisheries. These RFMOs have started to develop databases that detail which vessels are authorized to fish in their waters and lists of IUU vessels that have been sighted. If implemented, the IUU lists could be used by states that are party to the RFMO to take actions such as refusing port access to these vessels. However, unfortunately, these lists are not global and do not even cover all of the tuna RFMOs so it is difficult to control IUU vessels that operate between different RFMOs. Furthermore, once identified as an IUU vessel, the owner often changes the vessels name and reflags it to a different state. Recognising that the lack of coordination is compromising the ability to prosecute IUU fishers, there is now widespread agreement on the need for a global registry of IUU vessels. Representatives from the five tuna RFMOs met in Japan in 2007 and agreed that unique vessel identifiers (UVIs) should be installed on all registered fishing vessels. This essentially assigns a permanent number to each vessel for identification purposes, which remains unchanged when the vessel changes flag. However, little progress had been made by the time of the second meeting in 2009 and this led to the establishment, in the same year, of an organisation called the International Seafood Sustainability Foundation (ISSF).

The ISSF is a global partnership of fisheries scientists, the tuna seafood industry and WWF. In 2009 the ISSF sought membership from tuna processing companies to develop standards to help overcome IUU tuna fishing. Uptake of membership has been so successful that 60% of global canned tuna sales now come from ISSF members. In May 2010, the ISSF implemented Resolution 10-01, which states that ISSF members should only purchase tuna from vessels that have a UVI.
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