OECD INSIGHTS

PATRICK LOVE

FISHERIES

While Stocks Last?

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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Foreword

Few industries have such a mixed image in the public mind as fishing. We admire the bravery and skill of boat crews battling the elements to catch fish that are seen as a healthy contribution to our diet. At the same time, we deplore overexploitation of stocks and the associated ecosystem damage.

The basic problem of too many boats chasing too few fish seems simple, but any lasting solution needs to take into account multiple, often contradictory, influences, spanning economic, social and environmental concerns.

For the industry itself, the goal is to make the business more efficient and profitable. This cannot be achieved if it destroys the very natural resources on which it depends, whether the stocks of commercially valuable fish or the complex natural environment that allows them to thrive. This also means halting illegal practices such as the pirate fishing that robs legitimate fishers of their livelihood and makes it harder to manage stocks sustainably.

It is obvious that fishers should adapt their catches to stocks, but it is difficult to convince them to respect restrictions for long, if there are many free riders and somebody else takes advantage of any improvement in stocks. And asking them to give up a profession that is also a way of life and the foundation of the community will seem particularly unfair if there are no alternative jobs available.

Those outside the profession, on the other hand, will argue that it is both unfair to the taxpayer and counterproductive to support

an industry if that industry has itself created the difficulties that are now threatening to engulf it.

Fishing, therefore, finds itself at the meeting point of two major challenges. First, how to manage a shared resource at local, national, regional and international levels. Second, how to make reform succeed in the face of conflicting interests.

This latest *Insights* book draws on the OECD's extensive expertise in fisheries issues, as well as on the Organisation's work in a number of other areas, from structural adjustment to the environment. It presents fisheries as a modern, globalised industry. It shows the background to many of the issues we have to deal with today, as well as the ways in which fishing responds to changes in the economy, technology and lifestyles.

I trust this book will show how fisheries can continue to play an important role in society for a long time to come if the right set of policies is put in place.

Angel Gurría
Secretary-General to the OECD

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OECD Insights is a series of primers commissioned by the OECD Public Affairs and Communications Directorate. They draw on the Organisation's research and expertise to introduce and explain some of today's most pressing social and economic issues to non-specialist readers.

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Currency Note

Currency references are in US dollars unless otherwise indicated.

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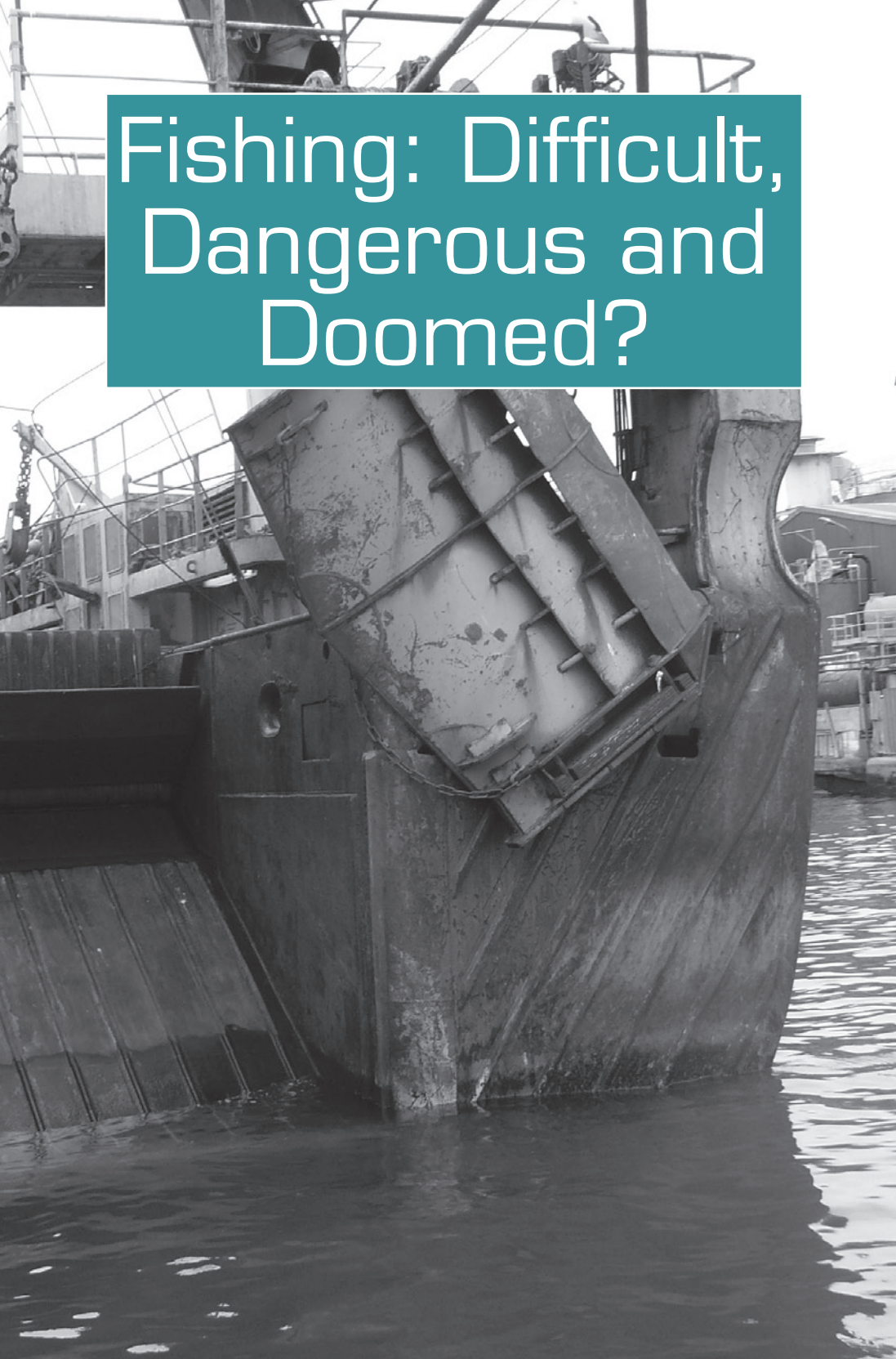
We eat more fish than ever, and the use of oils and other fish products is growing, yet the most commercially important stocks are being fished at or near their ecologically sustainable limits and there are fears that the industry may collapse in some regions. Addressing the problems means tackling a number of interlinked economic, social, environmental and legal issues, and will require a far higher degree of co-operation and agreement than has been the case so far.

Fishing: Difficult, Dangerous and Doomed?



By way of introduction…

What's bigger, faster and costlier than a sports car, and is edible too? Answer: a bluefin tuna. An adult measures 2 metres long for 250 kg, but can grow to over 4 metres and 650 kg. Bluefin usually swim at around 3 to 7 km/hour, but can suddenly accelerate to 70 to 100 km/hour when closing in on prey.

At the first auction of 2010 in Tokyo's Tsujiki market, a single bluefin tuna sold for 16.3 million yen ($177 777). The record is 20.2 million yen ($220 000) paid for another tuna in 2001, and at those prices you can easily understand why fishers want to catch as many as they can.

They may do so using "long lines" and also by "ranching". Long lines are rows of hooks over 80 km in length, while ranching consists of taking the fish alive and fattening them in pens. Capture techniques are so efficient, and stocks have been hit so hard in some fisheries, that there have been calls to put the species on the UN's Convention on International Trade in Endangered Species (CITES) list.

The bluefin is only one example of the fisheries industry making the news because of reports of fish stocks or species in danger of extinction, or because of actions by fishers to protest plans to restructure the industry. Fisheries are popular with other parts of the media, too. In the UK, the BBC attracted huge audiences with a documentary series on trawlers from Northeast Scotland, while in the US, Discovery Channel did the same with crab fishers in the Bering Sea.

Part of the attraction is the fascination of dangerous, difficult work in spectacular surroundings. There's also the feeling in more nostalgic presentations that fishing like this can't go on, and that it's a dying occupation. Yet by some measures, fishing is a thriving industry. Demand for fisheries products is growing, thanks in part to the general increase in demand for food products worldwide, and also because of the healthy image of fish and fish oils, rich in omega-3. At the same time, as the media reports show, crises are frequent, even chronic.

Practically everybody involved in fishing recognises the problems of too many boats chasing too few fish, but, quite understandably, few, if any, are prepared to sacrifice their own livelihood in the greater interest of all. The result is often "a race to fish", sometimes encouraged by government policies such as subsidies, or by lack of effective management of fisheries.

The key challenges concern how to manage the world's oceans and how to devise policies that are fair to all concerned. In other words, how to manage a common resource where each person's consumption reduces availability of the resource to others – the central theme in the work of Elinor Ostrom, who won the 2009 Nobel Prize for economics. Success in building a sector that is economically and environmentally sustainable hinges on a major shift in thinking on how to manage a shared, relatively unpredictable, resource.

There are a number of other challenges too. The technology used for fishing is becoming ever more sophisticated and ever more efficient. In other industries, this would be seen as entirely good news, allowing production to grow and reducing the costs and time needed to make things. In fishing though, technological progress can have negative effects, destroying the sector's resource base and obliging boats to stay at sea longer to maintain catches.

Technology can also replace people, and employment in the industry is affected by the need for fewer crew members on the boats and greater automation in fish processing factories.

What this book is about

Fishing provides vivid examples of many of the preoccupations of citizens and governments today. Biodiversity is perhaps the most obvious one – the threat to fish stocks is well documented.

But fishing also illustrates a number of other issues in a concrete way. At the time of writing this book, the crisis in financial markets and the recession it precipitated are worrying

people everywhere. Fishing has been affected too, both directly by the drop in scales of "luxury" products and indirectly.

Around 40 per cent of fish from capture fisheries and aquaculture are traded internationally and fisheries products are the single most traded food commodity in the world, ahead of tea, coffee, bananas or cocoa. Like other businesses, this relies on credit, but loans are becoming harder to obtain as banks tighten requirements particularly for high risk enterprises such as fishing. Moreover, the early victims of the financial crisis included big Icelandic banks that were important in financing the fishing industry.

Unlike previous crises such as sudden fuel price hikes, the credit crunch affects aquaculture too. Some species take a couple of years to grow to a marketable size. During this time, fish farmers may need loans to buy feed and keep the business going until the fish are harvested. Moreover, restaurants, a big part of the fish trade, are among the first sectors to be hit as consumers start cutting back on non-essential items.

Fishing also illustrates long-term social and economic trends. Take the issue of population ageing and its impact on the workforce. An OECD workshop on the social aspects of changes to the fishing industry was told about the implications of ageing for the Japanese industry. The statistics themselves are impressive enough. The percentage of male fishery workers over 60 years old went up from 14% in 1971 to 47% in 2004. In 2004, only 13% of them were aged between 25 and 39, and only 3% between 15 and 24 years old.

What does that actually mean on a fishing boat? Small coastal trawlers are operated by 2-3 man crews. They have to hoist the net completely on board to gather the catch and release the untargeted species (bycatch). However, as crews become older, their physical strength wanes and they are unable to pull the net up as frequently. As a result, the net may stay underwater for hours. The fish become compressed and their commercial value decreases. The survival rates of bycatch and that of undersized fish fall, because they're not released in time.

Change in the labour force is only one topic we'll be looking at in the following chapters. We'll start by describing the state of the various subsectors that make up the industry – industrial

fishing, artisanal fishing, subsistence fishing, recreational fishing and aquaculture.

As we said, biodiversity is a major concern, and we'll examine the physical environment in which fishing takes place, not just biodiversity, but climate change, pollution, urbanisation and other factors interacting with fishing.

Descriptions of Dutch fishers operating out of English ports or Basque fleets ranging up to Newfoundland hundreds of years ago remind us that fisheries have been globalised for centuries, even if not on the scale seen today. We'll look at how the different parts of the chain link together to produce, process and distribute the fish we eat and use for other purposes.

The historical outline focusses on European fishers and northern fisheries, since they created the modern industry. But it's not possible to understand fully what is happening today without looking at the role other countries are playing, and how they are transforming fishing production and markets.

The natural reaction to much of what is going on is to wonder why nobody is doing anything about it. In fact many people are trying to do something – the fishers themselves, the industry more generally, governments, NGOs, and shoppers who buy one kind of fish rather than another, or something else instead of fish. All these groups may agree on a few basic goals, but how to achieve them is another matter. We'll therefore look at the controversies and contradictions behind bland jargon such as "structural adjustment" or "policy coherence".

Finally, we'll try to bring all these strands together to summarise the challenges the industry is facing and examine the responses. The aim is not to present a consensus. This book will not achieve what years of discussion and dispute have failed to bring about. Our hope is that you the reader will come away with a better understanding of the issues, even if you don't agree with all our analyses.

Chapter 2 describes the history of fishing and what has and hasn't changed over the thousand centuries people have been catching fish.

Chapter 3 summarises the state of the industry today, looking at capture fisheries and aquaculture, as well as recreational fishing.

Chapter 4 examines the interactions between fishing and the environment, both how the environment influences fishing, and how fishing influences the environment.

Chapter 5 studies pirate fishing and why it is so hard to stop it.

Chapter 6 outlines the impacts of social and economic factors such as globalisation and lifestyles on catching, processing, selling and eating fish.

Chapter 7 weighs the evidence for and against subsidising fisheries and the economic and other reasons for reform.

Chapter 8 concerns change and adjustment in the fisheries industry and what it means for the men, women and communities most directly concerned.

Chapter 9 discusses the governance of global fisheries resources and analyses why change is so difficult.

Fisheries at the OECD

As renewable resources, fisheries pose significant economic and governance challenges for policy makers and the fishing industry. Fish stocks need to be managed in a sustainable and responsible way. While moving towards sustainable fisheries, social and economic adjustment costs should be addressed without detracting from long-term conservation objectives.

The main role of the OECD in fisheries is to help OECD member countries deal with the challenges that policy makers and the fishing industry face.

The Committee for Fisheries provides a unique forum for an open and frank discussion on economic and policy aspects of fisheries issues. Debate, discussion and work focuses on policy reforms and improvements needed to achieve responsible and sustainable fisheries.

The Council of the OECD created the Committee for Fisheries in September 1961. The OECD Council approved the revised mandate on 4 December 2008. It is due for renewal at end December 2013.

In its *Review of Fisheries*, the Committee surveys policy developments in the fisheries sector of member countries and works on four major areas as part of its 2009-2011 Programme of Work:

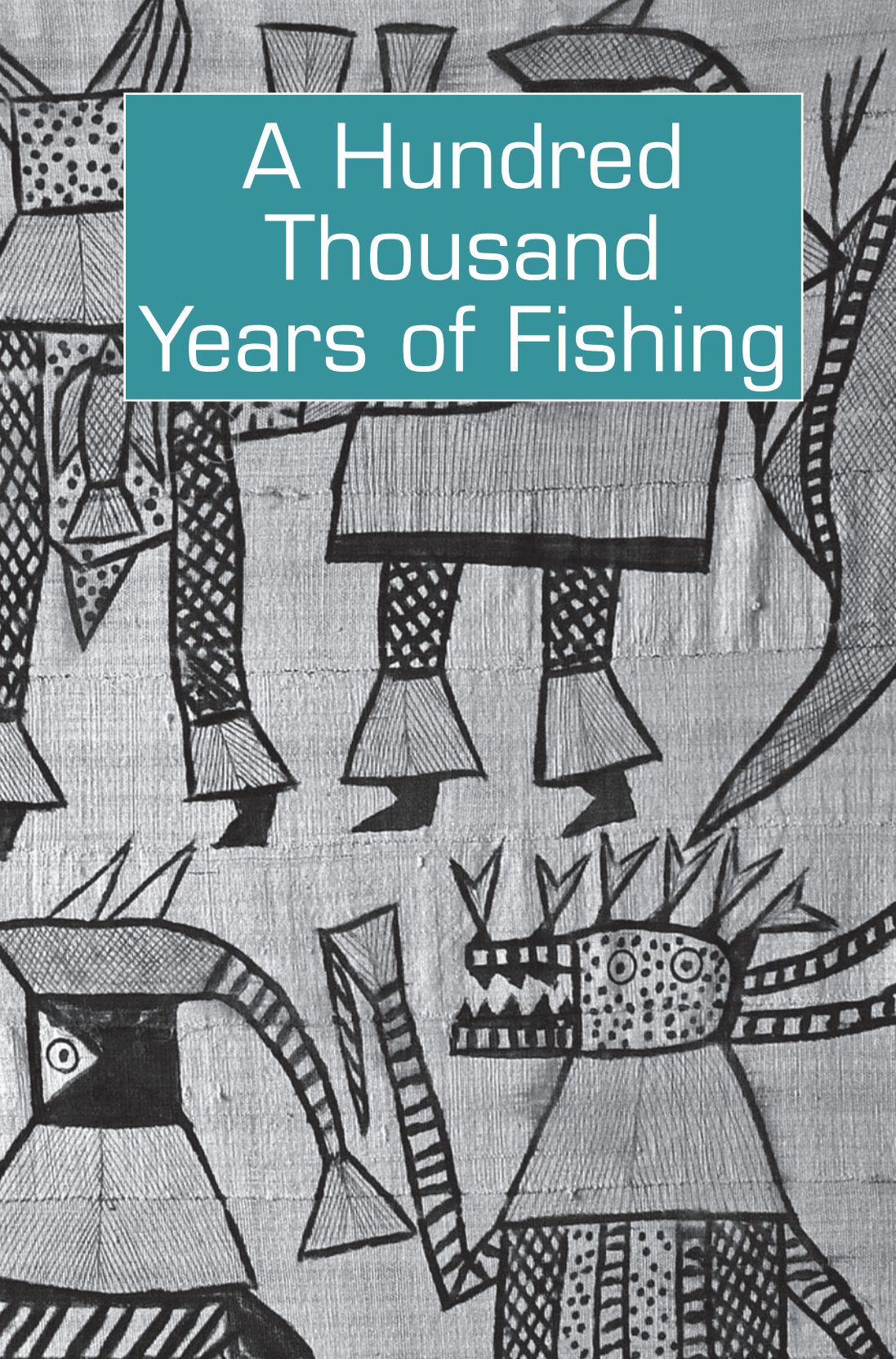
- Advancing the Aquaculture Agenda: Policies to Ensure a Sustainable Aquaculture Sector
- Project on Economic Aspects of Climate Change and Fisheries
- Fisheries and Aquaculture Certification
- The Economics of Rebuilding Fisheries

To find out more, visit the fisheries web site (*www.oecd.org/fisheries*).

2

The tasks and tools of fishing changed little for thousands of years – find fish and then trap them with a net, hook or spear. To begin with this was done inland or near the shore. Then, as the technology started to advance rapidly with the agricultural and industrial revolutions, fishing quickly transformed itself. Boats got bigger, travelled farther and became ever more sophisticated. Yet today's globalised industry still relies on the same resources and is still at the mercy of the same uncertainties as the earliest fishers.

A Hundred Thousand Years of Fishing



By way of introduction…

On July 1st 1956, Bernard Groisard started out on his first voyage as a cabin boy on the *Saint Nicaise*, a fishing boat from the Ile d'Yeu, an island off the Atlantic coast of France. When he got to the fishing ground, he saw a dozen Dundees, 50-60 ton sailboats used for tuna fishing. "I spent a while just looking at their sails, they were magnificent. I realised I was witnessing the end of an era and that these beautiful boats would soon be gone."

Bernard was right. Twenty years later, the last few steam ships disappeared too. He also saw new ways of fishing introduced, and new problems for an industry that had always had its lean times on Yeu, but never imagined that one day its very existence might be threatened. He was to work as a fisherman until 2006 and see as much change in the fishing industry in that time as had occurred during hundreds of years previously.

Technological progress is vital to ensure continued expansion in any sector of the economy. But fishing technology has become so efficient that it menaces the very resources on which the industry relies. At the same time, over the years, it's essentially the scale of the problems that has changed, not the problems themselves. A look at the history of fishing shows that many of the fundamental issues, and even techniques, have been around for hundreds if not thousands of years. Bernard Groisard would have found much that was familiar to him on practically any fishing boat at any time in previous centuries.

Fishing started around the same time as hunting using the same tools – nets and spears – although it's impossible to say if fishers adopted hunting weapons or if it happened the other way round. Whatever the sequence, around 100 000 years ago our ancestors were motivated by the need to have a more reliable food supply to supplement that available from simply gathering whatever could be found. Having more food meant that a given area could in theory support a bigger population. Hunting and fishing expanded the possibilities of finding food, but most of the diet still depended on gathering, so in fact population grew only slowly.

The first radical change came with the end of the Ice Age over 10 000 years ago. It's thought that climate change shifted the

distribution of plants and animals to such an extent that many previous sources of food were no longer available in sufficient quantities. One of the solutions was to use knowledge of natural resources to develop farming, in what archaeologists call the "Neolithic Revolution".

Fishing expanded at the same time, even though progress was less impressive than in agriculture. The end of the Ice Age saw the most important technological innovation since the spear and net – the fish hook. In fact, by around 5000 BC, as well as lines and hooks, most of the equipment still used in fisheries today had been invented, including systems of floaters and sinkers to manage nets. In some fisheries, hooks changed little from the Neolithic period until the Middle Ages.

Other modern techniques also have more primitive predecessors. Today remote sensing is done from satellites, but the Romans built high towers on the coast for exactly the same purpose – to detect shoals of fish and direct boats to the fishing grounds. The idea of legislation to control fishing isn't recent either. We'll come back to this point later, but Sumerian and Babylonian writings from 5000 BC include texts dealing with fishing rights.

One surprising characteristic is how similar some of the technologies were, wherever they were invented and developed. The knots used for the nets are practically identical in form and spacing in Europe, Africa, the Americas, Asia and Oceania for instance. Another similarity is that fishing was restricted to rivers, lakes, artificial ponds and the near shore. Different regions did of course develop different ways of doing things even if the basic techniques were the same, and some techniques were confined to a few regions, such as the use of cormorants to catch fish.

Leaving the shores

The next logical extension of fishing was to start hunting for fish farther out to sea. The Viking longship had proved its worth as a trading and fighting vessel, carrying merchants and raiders from Scandinavia as far as Russia to the east, Newfoundland to the west and Africa to the south around the end of the first millennium

of our era. As well as the swift, manoeuvrable longship, the Vikings also built "knars", shorter broader versions used for trade. The Viking ships were adapted to fishing on the high seas, and influenced the design of craft for the next thousand years.

The decline of the Viking Age coincided with the rise of feudalism in Europe. To begin with, any surplus produce was stored on the farm and the lord moved from site to site to consume it. As trade and storage technology developed, it became worthwhile to move the goods rather than the consumer, and market towns began to expand. An increasing share of the population was no longer producing its own food, and at the same time the population was growing, and with it demand for food. Fishing was still essentially a land-based occupation, and as for farming, much of it was done on common property – rivers and ponds that everybody could exploit. With the growth in demand from expanding urban populations, resources started to be overexploited.

Initially, there was little scope for expanding production. Aquaculture existed, especially carp in Cistercian monasteries, but it was fairly rudimentary, and to begin with fish of all ages were simply dumped in a pool with no intention of managing the life cycle. Later, this would be refined somewhat, but not to the extent of being able to cope with demand.

Moreover, the actual amount of land available for fishing was being reduced as agriculture developed, with drainage removing ponds and wetlands. The authorities responded using what the OECD would call "policy tools". Laws were passed restricting rights to common resources (the same was to happen in agriculture) and a system of permissions was introduced. Other measures imposed quotas on how much could be caught and traded, and on the type of fishing gear that was allowed, such as the size of nets.

These measures weren't enough to resolve the issue, and, to use modern jargon again, market-based solutions began to emerge where regulation had been inadequate. We mentioned above that hunting and fishing started around the same time, but of the two, only fishing was to become an industry. By domesticating plants and animals, farming did away with the need to go and hunt for them in the wild for most peoples.

Not so with fish. Resource and technical constraints and lack of knowledge limited what could be achieved by the inland and coastal fisheries of the Middle Ages. The expanded markets that came with population growth from the 11th and 12th centuries on made it worthwhile to exploit riskier resources on a larger scale.

Birth of an industry

Fishing as an industry was developed in the Hanseatic cities of Northern Europe to exploit Baltic herring in the late Middle Ages. In some ways the Baltic herring fishery was a precursor for much of the industry that would develop later under capitalism, and not just fisheries.

For a start, there was specialisation, with separate guilds for fishers and transporters. There was an international division of labour, with several nationalities doing the fishing and Dutch traders dominating marketing and distribution. There were technology leaders too. At its peak, Scania, at the tip of the Scandinavian peninsula, was the centre of an industry supplied by over 7 500 boats. One reason for Scania's success was naval architecture. The 20-25 ton Viking-type boats were replaced by Hansa vessels weighing up to 200 tons.

Hanseatic dominance began to decline in the 15th century and practically ceased in the 16th for a number of reasons, including high taxes on shipping and wars that saw the capture and destruction of fishing boats by the opposing factions. As well as that, the North Sea was emerging as a serious commercial rival. Resources were richer than in the Baltic, and the Dutch adapted their experience to the new conditions.

They also developed the theoretical arguments for treating the sea as a "commons", in a book that still influences fisheries policy today (and indeed any discussion on who "owns" marine resources). In 1609, Dutch philosopher Hugo Grotius – also known as Huig de Groot or Hugo de Groot – published *Mare Liberum*, translated into English as *The Free Sea* or *The Freedom*

of the Sea. Grotius argued that everyone should have free access to the sea, whether for sailing or fishing.

Fishing at this time was still essentially coastal, even if the fleets were going farther out to sea. Boats would leave their harbour, fish for a night then go back. This was to change due to two causes, one natural, one economic. Yarmouth in England, a major North Sea herring port, silted up. Around the same time, contrary to everything Grotius argued for, the English authorities imposed penalties on Dutch boats.

The Dutch response was to create the first real high seas fishing. They took advantage of their bigger boats to stay at sea, salting the catches on board. They also invented a system of transhipping – small tenders ferried the catch to the ports, leaving the mothership to continue fishing and processing.

The idea of processing the fish on board seems evident now, but in some fisheries similar innovations wouldn't be introduced for another few centuries. Bernard Groisard describes how tuna preservation evolved little. "To begin with, on the sailboats, the tuna were simply gutted and hung head down in an enclosure on the deck. You could preserve them for a week to ten days at most. The last of the sailboats had cold rooms you stocked with ice at the start of the voyage, but none of them had refrigerators."

Technological advances championed by the Dutch would go hand in hand with organisational innovations. They introduced the drift net – a long "wall" of netting made up of 40 or 50 smaller pieces. The Dutch also innovated in sales management, imposing regulations on the catch, processing and shipment to build a reputation for quality. The type of salt used to preserve the fish and the design and manufacture of barrels were strictly controlled, and each barrel was identified individually.

The Hanseatic trade was no match for these modern methods, and by the early 1600s the Dutch were exporting over 150 000 tons of herring. But as so often, imagination, invention and hard work proved helpless in the face of superior firepower. As the 17th century progressed, the Dutch fishing fleet increasingly became the target of the British and French navies, not to mention privateers and pirates. Over a hundred Dutch fishing boats were captured in one day in 1652 off the northeast coast of Scotland.

Over the following two hundred years, Britain came to dominate the herring industry, but the actual technology changed slowly. Innovations tended to be modifications of Dutch designs. The first significant change was the replacement of the Dutch "busses" by a faster, more seaworthy craft known as a lugger in the 19th century (although the Dutch were to modify it considerably after it arrived in Holland in 1865).

The 19th century also saw the start of mechanisation of the fleet, with the first steam drifter being built in Scotland in 1882. Within 25 years, the Scottish fleet would have almost a thousand of the new craft.

The period before the First World War marked the high point of the North Sea herring industry. Of course trade would have suffered because of the hostilities anyway, and the Russian market, a major outlet, disappeared forever after the 1917 Revolution. But other factors were at work too.

The North Atlantic

Demand for salted herring declined when the use of ice on board ships, coupled with more efficient rail networks linking ports to markets, encouraged consumer demand for fresh fish. Driftnet fishing itself presented a number of disadvantages. The large gear needed a large number of men and machines to work it. The fish could only be caught at night when they rose towards surface waters and the season only lasted for half the year, from May or June to December.

The solution was to equip the luggers with trawls as well as drift nets and to send them further north to catch fish earlier in the season. Pulling a trawl required a much more powerful vessel than drift netting, but it meant the boats could go farther and fish for longer.

The more northern fisheries were home to the other major species harvested by the fishing industry – the cod. English boats had been heading as far north as Iceland since the 15th century, and the Dutch joined them a hundred years later.

Eventually, the Atlantic fishing grounds would fall prey to wars and conflicts too (Britain and Iceland had a "cod war" as late as the 1970s), but the cod trade stretched to the very south of Europe. The Portuguese word for cod "bacalhao" is almost the same as the Old Dutch "bakeljauw", although we don't know which language borrowed it from the other.

The fisheries extended well beyond Iceland. The Vikings had gone as far as Newfoundland and the cod-rich waters off Canada may have been fished for centuries before records of Basque fisherman working the area in the 14th century appeared.

Secrecy has long been a feature of fishing – nobody wants to tell rivals where the best catches might be found. Even today, one of the difficulties in organising protection against pirates in some waters is that the captains don't want to travel in convoys under military escort in case other boats learn their secrets.

It was impossible to keep the secret forever though, and a flourishing fishing sector developed. The waters off the aptly-named Cape Cod became the centre of a three-way battle between rival colonial powers (Britain and France) and fishermen who had settled along the coast. Britain won, but many settlers went on to back the rebels in the American War of Independence.

New technologies

To begin with, cod fishers stood in a barrel on the side of the boat and fished using hand lines. At the end of the 18th century, these were replaced by long lines with multiple hooks.

Fifty years later, a highly productive, but highly dangerous innovation appeared, particularly in the Grand Banks cod fisheries off Canada: dories. These were small boats stacked on deck and lowered among the shoals with a crew of one or two who fished until the dory threatened to capsize under the load. Given the treacherous weather in this part of the Atlantic, where sudden storms and fog are common, it was not unusual for the dories to sink or get lost. On some campaigns a third of the crew might not come back.

The next big innovation was the arrival of steam trawlers in the 1920s. Nobody knows precisely when steam engines were first used aboard trawlers in any waters. Experiments were carried out at Arcachon in France in 1836, but no regular use was reported for another 40 years. We mentioned above that steamers started operating from Scottish ports in 1882, and a similar movement occurred in England around the same time. The technology was adopted quickly. In Grimsby, the biggest English fishing port, there were 623 sail-powered fishing boats in 1882 and 2 steamers. By 1909, there were only 29 sailing ships and 608 steamers.

ADAPTABLE BUT DANGEROUS

The Grand Banks cod fleets started using dories lowered from schooners in the 1830s. Since they were easy to build from readily available materials, they found many uses both on the high seas and near the coast in numerous fisheries, as this photo from the 1930s shows.

Source: Anders Beer Wilse/Norwegian Museum of Cultural History.

Steam trawlers resulted in a dramatic leap in productivity. They could fish at depths of 400m compared with 100m for sail, and could catch 6 to 8 times the amount of fish over a similar period of time. Efficiency was boosted by changes to the nets. The Granton trawl, named after the Scottish port where it was developed in 1892, attached boards (so-called "trawl doors") to the nets to open them, inspired by a salmon fishing technique. These trawls were a third more efficient than previous ones and easier to operate. In the 1920s, the French inventor Vigneron-Dahl added long cables to frighten the fish towards the net, increasing efficiency by almost a third again.

These technical improvements provoked a sequence of events that was to become familiar in fisheries. Initially, catches in the North Sea improved, but eventually started to decline and fishers turned to less valuable species such as plaice or haddock to make up for the more valuable sole, turbot and other flatfish. Stocks only recovered thanks to the closure of the fishing grounds during the First World War, but by the late 1920s, total yields of all species combined were in decline.

Steam trawling was slow to develop in more northerly waters, basically because the engines were not powerful enough to cope with the rougher conditions. This began to change in the 1930s and by the time the Second World War started, North Atlantic boats were much bigger than those fishing the North Sea.

Although some steam vessels were still around until the 1960s, oil-powered engines came to be the norm after the 1945. These had a number of advantages. Catches were 40% higher than for a steamer working under comparable conditions. Moreover, the engines were much smaller, freeing space on board for processing. Many fishing vessels had been equipped with boilers for extracting fish oil since the 1900s, but the new, smaller engines opened the way for today's factory trawlers. In the 1930s, French craft working off Newfoundland had deep freezes, cold stores and machinery for producing fish meal as well as the traditional oil boilers.

The next major innovation came in 1954 when the English trawler Fairtry was built with a ramp at the stern (similar to those used by whalers to haul the carcass aboard). This allowed a bigger trawl and meant that the sides of the boat didn't have to be

low to accommodate trawling gear. The possibility of having high sides enabled vessels to be much bigger than before. Around this time too, Japan and the USSR started to develop large fleets of factory trawlers, accompanied by factory ships and motherships that didn't do any fishing but provided the services needed to keep the fleet at sea. Other nations soon followed their lead.

These fleets, and even the individual boats that composed them, were costly to build and operate. They ushered in the modern age of fishing, where it is posssible to fish all the world's oceans, at every depth from the surface down to below 1 000 m and to hunt an ever-widening range of species, with consequences we'll describe elsewhere in this book. Bernard Groisard sees two ways his fishery could evolve. "We can either try to go for quality and get a higher price per fish, or aim at the mass market."

The agro-food industry

Before ending this brief overview of the history of fishing, it's worth mentioning a few other innovations that marked the development of the industry.

As we said before, many of the tools and techniques of fishing have been around for thousands of years. One of the most basic tools, the net, changed little throughout this time, until the industrial age. Then in 1820, the first hand-powered machine for knitting nets was invented, allowing nets to be made more quickly and with bigger sizes. In 1883 a mechanised version was developed. Knotless nets started to be used in Japan in 1922 and the cotton fibres that had replaced hemp gave way in turn to synthetics in the 1960s.

The 1820s also witnessed a major change in net design, with the invention in the US of the purse seine net that can be closed round the fish like a bag, trapping them more effectively than previous designs. The purse seine spread from America to Europe and then Japan. This type of net could be used efficiently for smaller fish than those that were commercially viable for human consumption, an important asset with the expansion of demand for fish oil and fishmeal.

Fish had long been used as a fertiliser by farmers, but in 1875, German scientists started experimenting with fishmeal as animal feed. Today, fish is important in many applications other than as food for humans. In 2007, FAO figures showed that over 110 million tons of fish were used for food, over 20 million tons for animal feed, and around 13 million tons for other uses.

Several times, we've described the impact of war on various fisheries. A final indirect impact had huge consequences for the fishing industry, indeed for the food industry as a whole. The wars that followed the 1789 French Revolution saw the French army fighting as far away as Russia. Hunger and scurvy were provoking more losses than the enemy, and as Napoleon is said to have remarked "an army marches on its stomach".

The government therefore launched a competition to find a way of preserving food for the soldiers. In 1809 Nicolas Appert came up with the winning entry – canning. The US had commercial canneries by 1818, Britain a few years later. Sardine canneries opened in France in 1825.

Canning enabled fisheries to expand into new markets, but the same was true of other products such as fruit and meat. One lesson to be drawn from this story is that fishing is part of a wider industry – what we now call the agro-food sector. As we saw with fishmeal, it contributes to the development of other parts of the agro-food industry, but it is also in competition with other foods for consumer budgets.

Another lesson is that fishing has to be understood in a context that is influenced by a complicated mix of technological progress, environmental limits, human factors and policy choices.

Find Out More

FROM OECD...

On the Internet
For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

...AND OTHER SOURCES

Fish and its place in culture, R. Kreuzer (1973):
People started fishing around 100 000 years ago and in this overview, Kreuzer describes how fish and fishing are linked to the development of civilisation. As in many other domains, the views people have about fish have changed more since the dawn of the industrial age than they did in the preceding millennia. The methods they use to catch and process fish have changed more too.

European Fisheries History: Pre-industrial Origins of Overfishing, Carolyn Scearce, Proquest Discovery Guides (2009):
Some scientists and historians have suggested that it is necessary to look back at least as far as the Middle Ages to better understand what unexploited aquatic resources may have looked like. This Discovery Guide examines what some historians, archaeologists, and ecologists have been able to uncover regarding the use of fishery resources by European populations in pre-industrial times, particularly in the Atlantic and Mediterranean regions.
www.csa.com/discoveryguides/fish/review.pdf

L'île d'Yeu, cinquante années de pêche au thon, Bernard Groisard, Editions Héron and Héron (2006):
Bernard Groisard confirms Kreuzer's analysis, based on his own experience as a fisherman. He describes the radical changes he saw in the industry from the day he started half a century ago when some French fishers still used sailboats, to today's high-tech fleets.

Global fisheries history network
The GFHN centres on the period from the 14th to the 21st centuries and covers economic, social and political aspects; environmental and biological aspects; technological aspects; and intellectual and ideological aspects. The goal is to provide a directory for the exchange of results and new ideas or keep up with research trends. The network publishes a quarterly newsletter containing information on conferences, new books and other relevant information on the history of the fisheries.
www.fimus.dk/GFhn/gfhn.htm

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Most of fish consumed in the world today isn't caught by fishers, but comes from fish farms. That doesn't mean that the fishing industry is disappearing. For a start, fish farms couldn't exist without the feed supplied by the world's fishing fleets, and for millions of people fish is a major source of protein. The amount of fish being caught is not declining either. Yet behind the global figures lies a complex set of trends. Catches are maintained by switching to new species as traditional ones become overfished. Modern boats need far fewer crew. And in many countries, sports fishing is more important economically than professional fishing.

Fisheries: Taking Stock

By way of introduction…

Dan Imbert is an angler, and his friends think he's crazy. "They're maybe right," laughs Dan. "You drive over a thousand miles to get to a river, then you get up in the middle of the night, you stand for hours in cold water under the rain, and half the time if you do catch something you throw it back in the water." Thanks to Dan and millions like him, recreational fishing is a thriving business, and is one of the most popular hobbies in many countries. But catching fish to earn a living – the fishing industry – is a sector in crisis.

The "fishing industry" is a useful term to describe fish as a product competing with many others in the agro-food business. But it's too vague if you want to understand the state of a sector with so many different participants. The sector includes sports fishers like Dan, freezer trawlers catching and processing a ton of fish an hour, small artisanal fishers working their local waters, subsistence fishers struggling to feed themselves and their families. The fishing industry is also sometimes taken to include aquaculture, which accounts for over a third of annual supplies.

Looking at the figures for the industry overall, it seems to be doing quite well. There is plenty of demand for fish from a growing world population and new markets are promising. Production of fish was almost 144 million tons in 2006, including 52 million tons from aquaculture. Of this, 110 million tons were for food (53% from capture fisheries, 43% from aquaculture).

Fishing supplies the equivalent of over 16 kilos of food for each person on Earth, and fish provide 2.6 billion people with 15% of their animal proteins.

Non-food uses such as making fish meal for animal feed are a big market too, requiring almost 34 million tons of raw fish a year.

Yet the one challenge all these different kinds of fishing face is sustainability. At its most basic level, this means simply making sure there will still be enough fish left to catch in the years to come. Overfishing in the capture sector and poor environmental performance in aquaculture could threaten the survival of many fisheries. Sustainability implies more than balancing supply

and demand with the environment however. It can be summed up as responsible management to ensure that supplies of fish continue to be reliable while at the same time enabling fisheries to contribute to the social and economic development of the communities who rely on them to make their living.

The scientific, social and political issues shaping the sustainability of fisheries are discussed elsewhere in the book. In this chapter, we'll present the data and trends underlying these questions – how much fish is caught or farmed, which countries are the biggest producers and consumers, what the fish is used for and how much all this is worth.

The fisheries workforce

In 2006, 43.5 million people were employed either part time or full time in fishing or aquaculture, most of them in small-scale or artisanal fishing. This was 3.2% of the 1.37 billion people working in agriculture worldwide. There are another 4 million occasional fishers and fish farmers, 2.5 million of them in India. In the last three decades, employment in the primary fisheries sector has grown faster than the world's population and employment in traditional agriculture.

Eighty-six per cent of the world's fishers and fish farmers are located in Asia, with China having the most (8.1 million fishers and 4.5 million fish farmers).

As well as fishers and fish farmers involved in direct primary production of fish, fishing creates numerous jobs in other ancillary activities, such as processing, net and gear making, ice production and supply, boat construction and maintenance, manufacturing of fish processing equipment, packaging, marketing and distribution. Others are involved in research, development and administration connected with the fishery sector.

No official data exist on the exact numbers of people involved in these other activities. Some estimates indicate that for each person employed in capture fisheries and aquaculture production, there are about four jobs produced in the secondary

activities, for a total of more than 170 million jobs in the whole fishery industry.

However, each jobholder on average provides for three dependants or family members. Thus, fishers, aquaculturists and those supplying services and goods to them assure the livelihoods of about 520 million people, 7.9% of the world population.

Counting fish

Knowing the size and distribution of fish stocks is vital for sustainable management of fisheries. But fish are not easily observed, the areas to be surveyed are vast, and personnel limited.

Ireland's Marine Institute describes how researchers try to overcome the practical constraints (*www.marine.ie*).

Two main sources of data are collected: fishery dependent and fishery independent data. Fishery dependent information involves collecting data on total catch and the amount of fishing effort needed to catch it (number of boats, days spent at sea).

This is known as catch per unit effort data (CPUE) and is usually derived from the logbooks of fishing vessels. Data on age and size of the fish are also collected. The underlying assumption is that changes in CPUE accurately reflect changes in the abundance of the fish stocks. Sampling throughout the year allows scientists to monitor differences in growth and age over the period.Size is calculated from the length of fish sampled in the ports and markets, or at sea on commercial vessels. Age is estimated using a small bone found in the head of fish called the otolith. Counting the rings on the otolith gives an estimate of the age of the fish (similar to the rings of a tree). The numbers of fish at different ages for various fishing gears, areas, quarters and nations are combined to produce annual catch numbers for a given age for each assessed stock.

One problem with sampling is that fishers discard some of the fish they catch, because of their size or age for instance. So although these fish are removed from the stocks, they never make it to port and don't show up in the statistics. Sampling of fishermen's catches at sea overcomes this to some extent, but requires placing a scientist on the boat to collect the sample, and experts are in short supply. In 2008 a report by the US Departments of Commerce and Education said the nation would need at least 340 scientists trained to do the research required to rebuild stocks and restore marine species – but US institutions will produce only 160.

Fishery independent data come from various kinds of survey. In "electrofishing" for instance, an electric shock is transmitted into the water to stun the fish so that they can be counted, measured and weighed. This is useful in relatively small, inland waters, but on the high seas, fisheries survey vessels use a combination of techniques including sonar and trawling. Again, resource constraints mean that the estimates are not as accurate as we would like, and the surveys are affected by a number of conditions, such as the weather, the type and condition of the gear used.

Catching fish

The figures for capture fisheries in any given year provide a useful snapshot of the state of the profession, but to make sense of what's happening, a longer time frame is needed. Of course this is the same for any industry, but few other sectors see such big changes in stocks from one year to the next as fishing.

The main species caught is anchoveta, an anchovy caught off Peru and Chile and used for fish meal. The catch in 2004 was 10.7 million tons, four times more than the next on the list, the Alaska Pollock. But this can swing wildly. In 1998, the catch plummeted to a record low of 1.7 million tons, only to rebound to a record high of 11.3 million tons in 2000. In 2006, the catch was 7 million tons, over twice that of Pollock (2.9 million tons).

In some cases, the stocks of a species may collapse to previous levels, but never recover, or recover only partially, as happened to the cod fisheries off Newfoundland in the 1990s.

Country rankings fluctuate too. Chile was the sixth biggest producer in 2002, dropped a place in 2003 and then rose to fourth place in 2004 because of fluctuations in anchoveta stocks, then dropped back to sixth again in 2006.

Cases like these underline the difficulty of making predictions about capture over short periods. Trends inferred from longer time series give a better idea of what is happening. World fisheries are divided up into broad geographical areas, nine in all for the Atlantic, Pacific and Indian Oceans, plus the Southern Ocean and the Mediterranean and Black Seas. Data for 25 years from 1970 show how total catches vary and how the mix of fish caught changes. The Northwest Atlantic and Northeast Pacific show an increasing trend since the start of the century following minimums in 1998 and 2000 respectively.

The Northwest Atlantic was the scene of what some called the "Dust Bowl of fishing". In the 1930s, decades of overexploitation of the prairies of North America, coupled with drought, brought an ecological disaster that destroyed farms and drove hundreds of thousands of Americans and Canadians from their homes. Half a century later, years of overfishing and the collapse of cod

stocks on the Grand Banks of Newfoundland led to the fishery closing and 40 000 people losing their jobs.

Experience from other areas shows that the impression of a fishery given by total catches can be misleading. The figures for the Mediterranean and Black Sea hardly changed over 1996-2006, but the type of fish making up the catch did. The most valuable species – tuna, sharks and demersal fishes (fish that feed on or near the sea bed such as cod, haddock or bass) – all declined. The difference was made up by small, less valuable pelagic fish (fish living in upper layers of the water such as mackerel, herring or sardines).

Not all fish is caught at sea. Inland fisheries are important in some areas too, with developing countries accounting for 95% of the world total. In Europe on the other hand, total inland catches decreased by 30% over 1990-2004 and then recovered slightly.

European totals are strongly affected by figures for the Russian Federation, accounting for 60% of regional inland production. Other influences could include competition from other sources such as fish farming and sometimes from recreational fishing. Changes in land use and other demands on water resources, tourism for example, can also affect inland fisheries, as can pollution.

Farming fish

One answer to a shortage of wild fish is to farm fish. Aquaculture has existed on a small scale for almost as long as fishing, and some Egyptian records suggest that there were attempts at more intensive production during the Middle Kingdom as far back as four thousand years ago. The Romans cultivated oysters using techniques similar to some in use today, and carp ponds were widespread in China according to manuscripts dating back to the 5th century BC.

But these practices were not really fish farming. Young fish were captured in the wild and transferred to ponds, and it was not until the 18th century that fish were grown in captivity from eggs. Even then, only freshwater fish were raised. Raising

DEVELOPMENT OF FISHERIES PRODUCTION AND EXPORTS

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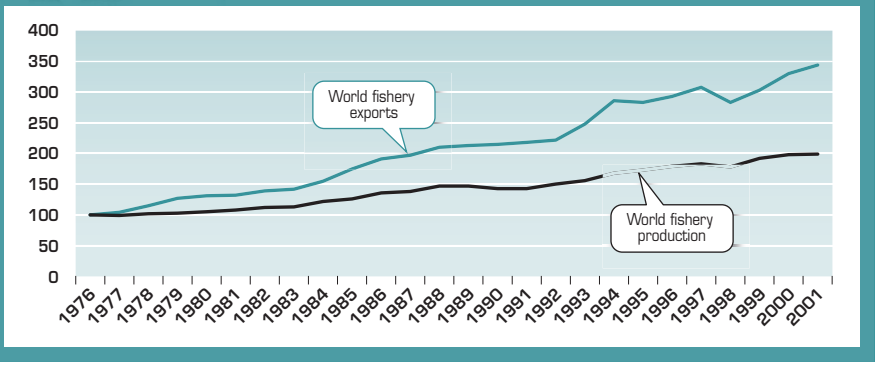


Source: Globalisation in Fisheries and Aquaculture: Opportunities and Challenges, based on FAO Fishery Statistics.
StatLink : *http://dx.doi.org/10.1787/888932295405*

saltwater species requires a high degree of knowledge of the biology of the fish, and despite steady progress over the preceding decades, the technical and scientific expertise that allowed fish farming to take off only became available in the 1970s.

Aquaculture accounted for less than 4% of total world production by weight of fish, shellfish and other aquatic animals in 1970. In 2006, it accounted for over a third (36%). It's now the fastest growing of the animal food-producing sectors, expanding at 8.7% globally since 1970, compared with 2.8% for farmed meat production and 1.2% for capture fisheries. Per capita fish supply from aquaculture was 0.7 kilos in 1970, but thanks to the expansion of recent years, it is now over ten times that.

Unlike capture fisheries, one country dominates the aquaculture industry: China produces two-thirds of the 60 million tons farmed annually and almost half of the $79 billion in terms of value. This helps to explain the overwhelming dominance of developing countries in aquaculture production – over 90% at present and production is growing at over 10% a year. And

there is room for further expansion. Despite some encouraging initiatives, Sub-Saharan Africa has not exploited its natural potential so far, even for tilapia, a native species that is now in the top ten species in terms of aquaculture production.

In 2006, more than half of global aquaculture production was freshwater finfish. Output was 28 million tons, worth $29.5 billion. Molluscs accounted for the second-largest share, 14 million tons (27% of total production), worth $11.9 billion.

Only 4.5 million tons of crustaceans were produced, but they were worth $17.95 billion.

New species such as Nile perch are becoming popular, but for some species that have shown spectacular growth in market share, the surge may simply be due to better data collection. The progression of sea urchins for instance is astonishing, from a mere 25 tons in 2002 to over 60 000 tons two years later. The most likely explanation in this case is that China, the main producer, started giving precise figures for species that had been lumped together under "unspecified".

Aquaculture also includes plants. This sector is worth only a tenth as much as other types of production ($7 billion a year) and is highly concentrated in Asia. China is again the biggest producer, at almost 11 million of the 15 million tons produced annually, with most of the rest produced by the Philippines, South Korea and Japan. Japanese seaweeds are the most popular plants. Seaweeds are used as a food or in food additives, but they have applications in many other sectors ranging from pharmaceuticals to cosmetics.

One of the most exciting possibilities for aquaculture is to produce feedstock for biofuel. Some micro algae contain an oil similar to vegetable oil, but which yields 40 times more energy than rapeseed and 100 times more than soya for an area of the same size. Unlike agricultural biofuel crops, algae do not compete with cropland and do not put pressure on food supply and prices. There are a number of other advantages too – algae contain no sulphur therefore do not emit sulphur dioxide. Moreover they consume CO_2 and can transform it into something useful.

Artisanal fishing

Several hundred million people worldwide are involved in fishing activities, but it's hard to know the exact figure because many of them do not show up in the statistics. Around 90% of the 40 million or so people actually recorded globally as fishers in 2006 are classified as artisanal or "small-scale", although the definition of small-scale can vary from one study to another. The technical means available to small-scale fishers in France for instance (such as boats with engines and sonar), bear no resemblance to those a fisher in the Philippines would have access to.

Over 100 million more are involved in the small-scale post-harvest sector and uncounted millions of other rural dwellers work part of the time in fishing activities, significant numbers of them women. Many of these people, especially in Asia and Africa, live in remote rural areas where there are few economic opportunities apart from fishing. In other areas, artisanal fishing can be the occupation of last resort when regular sources of income or food disappear.

> **"Small-scale fishermen provide half the world's fisheries production for direct consumption. Small fish are especially important for poor consumers, as they can be purchased in small quantities at low cost."**
>
> *Natural Resources and Pro-Poor Growth: The Economics and Politics*

Despite the lack of detailed data, studies of small-scale fishing communities show that although they may be poor and vulnerable, small-scale fisheries can generate significant profits, prove resilient to shocks and crises, and make meaningful contributions to poverty alleviation and food security.

Small-scale fisheries *can* overexploit stocks. Enterprises, whatever their size, are out to make as much profit as possible, and fish not caught by your boat will be caught by somebody else. And if there's nothing else to eat or trade, people take whatever is available.

Managing so many different fishers and types of fishing poses particular problems. Centrally imposed management and regulation would be costly and probably ineffective. The most

practical solution may be co-management by clearly identifiable members of the communities concerned, with clearly identified boundaries of the fishing grounds.

Small-scale fisheries can also show greater economic efficiency than industrial fisheries and have fewer negative impacts on the environment. They also tend to share economic and social benefits more widely, and contribute to cultural heritage. And as we'll see later in the chapter on globalisation, they also inspired at least one technique that transformed the world food industry.

Fishing for fun

There are probably even more sports or recreational fishers than in any of the previous categories, and it's a big business, thanks to people like Dan Imbert. "Every fisher I've ever known has a story about some kid who goes to the river with a stick and some string and catches a record trout." Dan is leafing through a fishing catalogue. "Of course, none of them has ever met the kid personally, but if you can't trust what a fisher tells you..."

Although like many sports fishers he likes to make his own flies, picking up odd bits of wool, thread or anything else he thinks might come in useful Dan is obviously not a stick and string man when it comes to gear. In common with a growing number of enthusiasts, he buys goods from specialists on the Internet as well as from traditional shops.

Japan is a leading supplier, and Dan is a fan. "They make some amazing stuff, their research is really first-class. I bought some Japanese lures over the Internet. They weren't cheap, but on the end of a line you'd swear it was a small fish the way it moves in the water." You can buy a fly fishing rod and reel for around $250, but better gear can cost over five times that, plus the cost of lines, hooks, nets and other material.

All this adds up. The real economic importance of recreational fishing is hard to estimate since many countries do not collect detailed information. Moreover, some of the money spent on fishing may not show up in the data, for instance money spent

on fuel to get to a fishing destination, or on a hotel on the way. National surveys that do exist show how popular recreational fishing is, and give some idea of its financial impact. Sports fishing is more important economically than commercial fishing in many countries.

One of the most detailed surveys is carried out by the US Fish and Wildlife Service. According to the 2004 survey, approximately 82 million marine recreational fishing trips were taken by 14 million anglers. These anglers spent over $16 billion, which in turn generated over $34 billion in total economic activity, supporting nearly 360 000 full- and part-time jobs, and billions in tax revenues and income (salaries, wages and business profits).

The report goes on to state that "...the total national economic impact from commercial finfish fisheries is 28.54% of the impact created by marine recreational fisheries". In other words, in terms of the economy, commercial fisheries are only around a quarter of the size of recreational fishing. Of course commercial fisheries are much more valuable in terms of the value of fish landed and consumed. They are also far more important as a source of food, particularly proteins, for the large part of the population that doesn't go fishing.

The Irish government estimates that overseas anglers alone spend 66 million euros in the country and that these tourists spend more per head than other tourists. In Norway the income per kilo of fish is ten times higher for tourism angling than for commercial fisheries.

Revenue from foreign tourists is important, but as the US figures suggest, the vast numbers of home fishers make sports fishing a major, if underappreciated, sector of the economy in many countries. The UK government calculated that an average coarse angler spends nearly £900 a year on fishing, and that the total value for all kinds of recreational fishing combined was £4 billion a year. (The term "coarse fishing" was invented by the gentry in 19th century Britain to describe what the lower classes got up to, as opposed to "game fishing" for salmon and trout by their betters.)

Even in countries with much smaller populations, the economic impact can be significant. A fifth of New Zealand's population goes marine fishing, contributing to a NZ$1 billion industry,

while in Australia, anglers spend around AU$700 million a year on fishing tackle alone.

The outlook is certainly brighter than for commercial capture fisheries. In many locations, rivers can be restocked with farmed fish, and as Dan pointed out at the beginning, anglers don't have to catch a lot of fish to be happy. That said, pollution of rivers and even near-coastal waters from urban centres and runoff of pesticides and fertilizer used in agriculture is a problem.

Another issue arises when sports and commercial fishers compete for the same species. In New Zealand for instance, recreational catches make up a large proportion of commercial species in some waters.

Finally, lifestyle changes are worrying fishing authorities in some places. In the US for instance, a number of states with traditions of fishing and hunting report a drop in applications for licenses, mainly because young people prefer other pastimes. This means there is less money to manage the resources, leaving wildlife managers with a dilemma: if they cannot obtain extra public funding, they will have to increase the price of permits, at the risk of discouraging some fishers from continuing and new ones from starting.

An industry in decline?

Fishers are highly adaptable in pursuing their trade. When your livelihood depends on so many unpredictable factors, you have to be. Take two examples from radically different types of fishing.

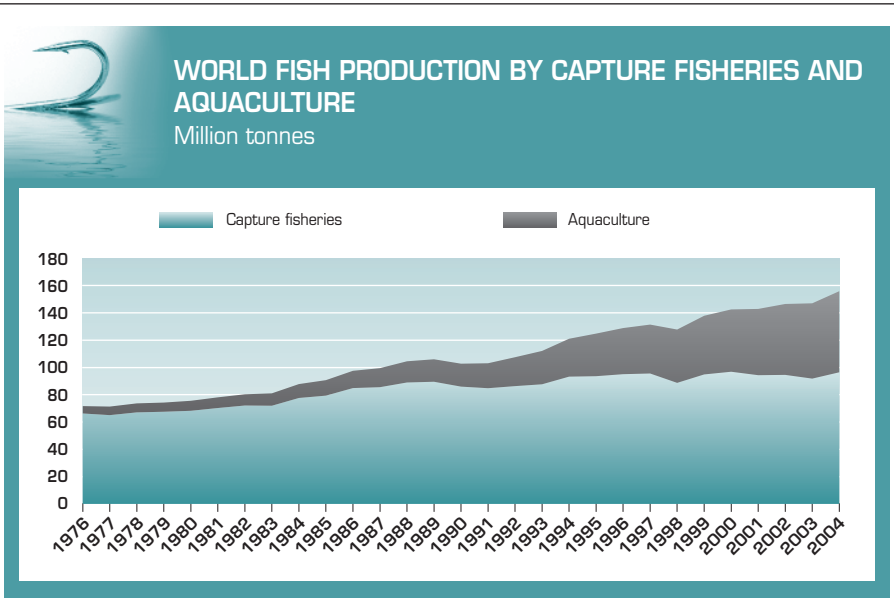
When the tsunami hit Sri Lanka in December 2004, it destroyed two-thirds of the fishing fleet and 10 of the country's 12 ports. Yet by the following August, the fish catch was back up to 70% of its previous level, having nearly recovered from a 95% drop. A year later 84% of the fishing boats had been rebuilt or replaced.

The second example concerns large-scale industrial fishing. The rise in fuel prices has serious consequences for the industry. One way to reduce costs is to sail shorter distances. Yet many fleets have to travel thousands of kilometres to get to fishing grounds. The solution is to build more fish carriers, huge ships

(some of them draw over 10 000 tons) that offload catches at sea and allow the fishing boats to stay on the fishing grounds.

More generally, as stocks of one species decline, new ones replace them. This is why the total weight caught has appeared to be fairly stable in recent years. But with half of the stocks monitored by the FAO fully exploited already and a quarter overexploited, this process of replacement is unlikely to continue without a change in fisheries management practices.

Stable catches hide another reality – there are fewer boats but they are bigger and more efficient, and need fewer crew members. So although total number of fish may remain constant, the changes in how fish are caught have a substantial negative impact on employment: the number of fishers in industrialised countries dropped by 24% over 1990-2006. In Japan and Norway, the numbers of fishers dropped by 61% and 42%, respectively over 1970-2006.



Source: Globalisation in Fisheries and Aquaculture: Opportunities and Challenges, based on FAO Fishery Statistics.
StatLink : *http://dx.doi.org/10.1787/888932295424*

Some of this decline is also due to the difficulty in replacing fishers who retire. Young people are increasingly reluctant to enter such a hard profession, especially at a time when its future appears uncertain. With output growing at almost 9% a year for the past 25 years, aquaculture now employs at least a quarter of the people working in fishing. At some point it too may run up against ecological barriers, but for the time being, growth is continuing.

The supply of fish has seen constant expansion over the past four decades, thanks to aquaculture. In 1961, an average person ate 9 kilos of fish a year. By 2006, this had risen to over 16 kilos. Significant amounts are exported. International trade in fish and fish products has expanded quite spectacularly since 2000, growing by 32% over 2000-06, even allowing for inflation.

In 2006, fish exports were worth $85.9 billion, an increase of over 60% in ten years. The actual quantities of fish traded internationally more than doubled over 1986-2006.

Developing countries are major players in international fish trade. They export about a quarter of their production, and account for almost half the value of world exports. Only 25% (in value) of these exports go to other developing countries, whereas 85% of developed country exports go to other developed countries.

The fishing industry as a whole then is not in decline, quite the contrary. It is innovative, dynamic and can count on some of the most hard-working, most resourceful people in the world. But as we'll discuss in the following chapters, it is an industry that constantly has to face up to serious challenges.

Find Out More

FROM OECD...

On the Internet
For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

Publications

Review of Fisheries in OECD Countries: Policies and Summary Statistics 2008 (2009):
This publication describes major developments affecting fisheries in OECD countries in 2004, 2005 and 2006, including changes in national and international policies, trade, and fisheries and aquaculture production. This edition contains a special chapter on foreign direct investment in OECD fisheries.

...AND OTHER SOURCES

The State of World Fisheries and Aquaculture (SOFIA), FAO (2008):
The State of World Fisheries and Aquaculture is the flagship publication of the FAO Fisheries and Aquaculture Department. This advocacy document is published every two years to provide policy makers, civil society and those whose livelihoods depend on the sector a comprehensive, objective and global view of capture fisheries and aquaculture, including associated policy issues.
www.fao.org/fishery/sofia/en

The Aquaculture Network Information Center (AquaNIC)
The Aquaculture Network Information Center (AquaNIC) was conceived in 1994 by the former USDA-Extension Service (currently Cooperative State Research, Education and Extension Service) to serve as a gateway to the world's electronic aquaculture resources and provide access to all national and international electronic aquaculture information; provide self-paced aquaculture instruction to the aquaculture industry; and obtain user input in directing AquaNIC services. *www.aquanic.org*

World Recreational Fishing Conference (WRFC) Series
The WRFC series, a regional conference, has its origins in a 1994 European Inland Fisheries Advisory Commission (EIFAC) consultation on management strategies for European inland fisheries and aquaculture. The conferences have explored four key issues identified by the EIFAC consultation: it is difficult to address the need to improve social and economic data; the wide extent and high value of recreational fisheries; a low level of understanding of the value of recreational fisheries among recreational fishermen is coupled with low public awareness; and existing legislation does not always favour sustainable use of resources.
www.worldrecfish.org

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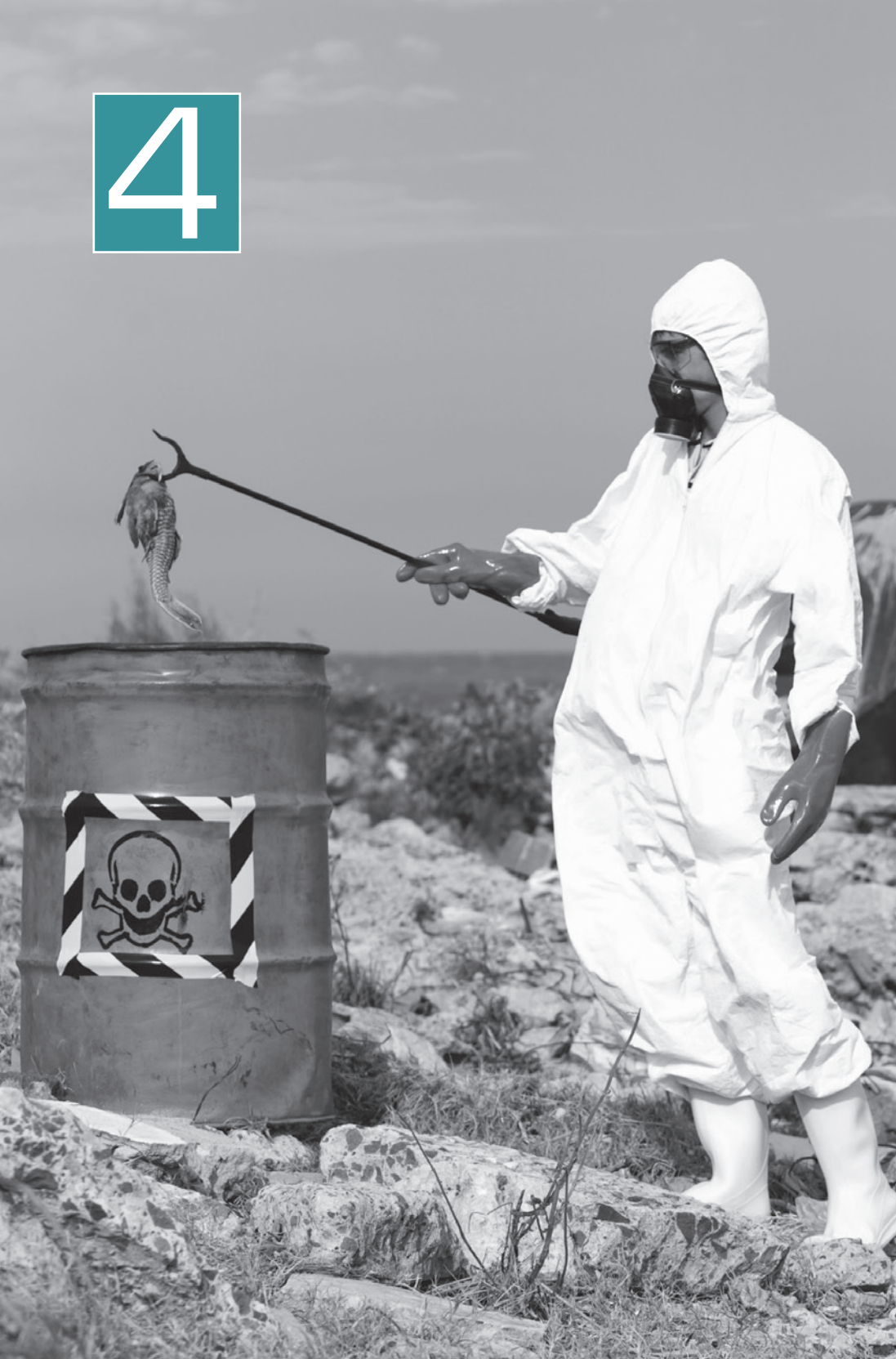


Sea of Troubles

Fishing relies on the environment. A slight change in water temperature can mean scarcity or abundance. The food chain depends on countless interactions stretching from microscopic plankton to gigantic whales. The sea bed, coral reefs and numerous other habitats form part of the global ecosystem that sustains fish. This environment is under threat from climate change and pollution, but it's also being threatened by fishing and aquaculture.

By way of introduction…

To celebrate her 80th birthday in 2006, Queen Elizabeth II invited 350 people to a special meal known as "The Great British Menu", named after a television show where chefs competed to be chosen for the big occasion. Richard Corrigan was one of the four winners, and prepared a starter of smoked Glenarm salmon from an organic farm in Northern Ireland.

A year later, the farm was wiped out in an attack by jellyfish. John Russell, the managing director, said: "In 30 years, I've never seen anything like it. The sea was red with these jellyfish and there was nothing we could do about it, absolutely nothing." The attack lasted several hours, with the jellyfish stinging and shocking the salmon. Rescue attempts failed because the sea was so thick with jellyfish the boats could hardly move, so by the time they reached the salmon cages it was too late.

The jellyfish responsible is known as the mauve stinger because of its purplish glow at night and habit of stinging bathers. Until a decade ago it was rarely found in British waters, preferring the Mediterranean. Scientists say that its migration northwards is evidence of climate change.

On Canada's Pacific coast though, farmed salmon may be the villains rather than the victims. Martin Krkosek of the University of Alberta and his colleagues compared wild salmon populations that had been in contact with salmon farms with those that had not, using data from 1970 onwards.

According to Krkosek, "The louse-induced mortality of pink salmon is commonly over 80% and exceeds previous fishing mortality." Wild salmon can also be infected, but a few lice won't kill a mature fish, and in a natural system, the fish affected are offshore, well away from the young.

The problem arises when wild fish cross the farms on their migration routes. Similar problems are reported from Scottish salmon rivers discharging into sea lochs that have fish farms.

We'll come back to the impact of aquaculture below. The point of these two stories is that fisheries are affected by what happens

in the environment, and fisheries can also have an impact on the very environment that sustains them.

Fish stocks do fluctuate, but what we're seeing in world fisheries are a number of species negatively affected by fishing practices. That said, totally "natural" impacts of the environment on fisheries can be just as significant, or more so, than human actions. In this chapter, we'll look at the various impacts of human and natural phenomena on fisheries and the interactions among them.

El Niño and climate change

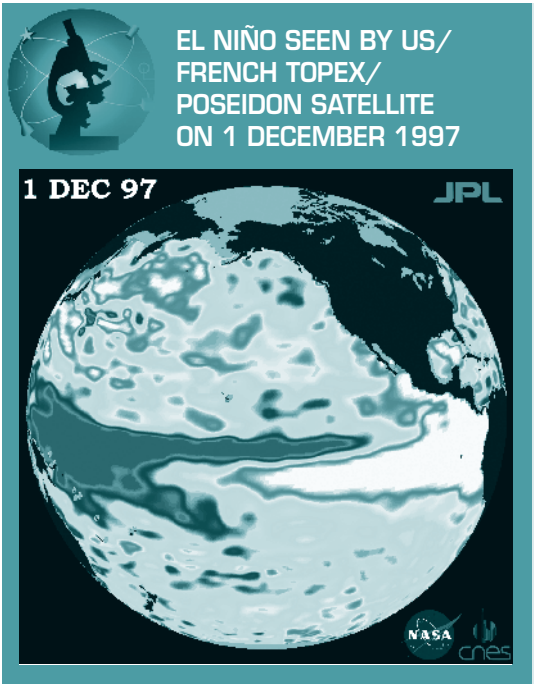
Some of the changes to global ocean temperatures may be part of a natural cycle of fluctuations, but climate change caused by human activity is undoubtedly having an impact too. One of the biggest and best known of the natural phenomena is El Niño, temperature fluctuations in the surface waters of the eastern Pacific, accompanied by fluctuations in air pressure. Scientists call this coupling ENSO – El Niño Southern Oscillation.

Among other effects, ENSO changes the way different layers of water with varying amounts of nutrients mix, and drives fish that prefer cooler water northward or to greater depths. It occurs every two to seven years with varying intensity, and the effect on fishing can be dramatic. The collapse of the Peruvian anchovy fishery in 1972-73 is attributed to El Niño (the numbers of fish dropped from 20 million to 2 million) but impacts are felt as far north as Canada and on species other than fish. Coral reefs can be damaged and the change in fish populations has been seen to reduce the number of sea lions off the California coast.

El Niño is a temporary rise in ocean temperature, even if the damage to fisheries can last for years. We may now be seeing a more permanent change on a global scale. The jellyfish attack in Ireland would not have been possible in colder waters (and may have been easier because predators such as cod have been overfished).

Since 1961, the average temperature of the ocean has increased not only on the surface as in El Niño, but at depths down to at least 3 000 metres. Measurements show that the ocean has been absorbing more than 80% of the heat added to the climate system. Water expands when it is heated, contributing to sea-level rise. Global sea level rose at an average of 1.8 mm/year from 1961 to 2003, and the rate of increase was faster (about 3.1 mm/year) from 1993 to 2003. It isn't clear whether the faster rate over these 10 years is due to an increase in the longer-term trend, but what is clear is that the rate of observed sea-level rise increased from the 19th to the 20th centuries, and in the tropics, unusually high sea surface water temperatures are becoming increasingly frequent.

The seas aren't just becoming warmer, they're becoming more acidic too. The pH of ocean surface waters is projected to fall by



The white areas indicate the unusual patterns of heat storage associated with El Niño, which also raises sea level. The dark area is cold water, where sea level is below normal. El Niño is thought to be triggered when the steady westward blowing trade winds weaken and even reverse direction. This allows a large mass of warm water normally located near Australia to move eastward along the equator to South America.

Source: NASA.

Reefer madness

In his first scientific book, *The Structure and Distribution of Coral Reefs*, published in 1842, Charles Darwin sets out the notion that change is the natural state of the Earth, an inspiration he was to pursue and refine for the next 17 years, culminating in *The Origin of Species*. Coral can tell us a lot about the Earth and how it is changing. It sums up many of the issues raised in this chapter.

For Steve Jones, author of *Coral: A Pessimist in Paradise,* "With every breath and every death we take part in a series of transactions in which the currency of life moves through the reserves held in the soil, the skies and – most of all – the seas. Its slow revolutions made the modern world, but… it may soon break down, with disastrous consequences for the corals and for ourselves."

Coral reefs are overexploited. The million tons of fish taken from them each year is three times beyond the sustainability limit. Deep-water reefs support fish populations, but they snag nets until bottom trawlers come along and pulverise them. And when nets and traps no longer find anything, fishermen, imitating the aquarium trade, use explosives or cyanide to stun the fish and make them easy to catch.

Urbanisation and the growth of coastal populations are taking their toll as well. Wastes flushed into the sea clog the organisms and provoke coral diseases. Some of these are of human origin. White pox is caused by a bacterium usually found in the human gut but that seems to be able to survive in sewage. Herpes viruses are the main cause of coral disease, and the human herpes virus has been found in corals off Panama.

Only 30% of the world's coral reefs are healthy and a fifth have already been destroyed completely, but even without overfishing and sewage, the remainder would probably be doomed anyway. Strong sunlight plus warm water causes coral bleaching, a stress-induced reaction when the coral polyps expulse algae because the algae are photosynthesising too fast and producing too much oxygen. So as the oceans heat up, the stress will become worse, and more permanent.

The effects of ocean acidification are worse still. The rate of calcification, building shells, is projected to be cut by half by 2100 if carbon emission trends continue unchanged, in a process that one expert has likened to osteoporosis in humans. This makes the coral reefs much more vulnerable to erosion, and they could simply wither away.

Atmospheric CO_2 concentration is expected to exceed 500 parts per million and global temperatures to rise by at least 2°C by 2050-2100. This is much higher than the values under which most of today's marine organisms evolved. The result will be less diverse reef communities and collapse of reef structures. As an article in *Science* pointed out in December 2007, "Climate change also exacerbates local stresses from declining water quality and overexploitation of key species, driving reefs increasingly toward the tipping point for functional collapse."

The International Coral Reef Initiative (ICRI), a partnership of governments, international organisations and NGO, declared 2008 International Year of the Reef. The Year was a worldwide campaign to raise awareness about the value and importance of coral reefs and threats to their sustainability, and to motivate people to take action to protect them. See *www.iyor.org*.

0.14 to 0.35 pH units by 2100, due to the absorption of atmospheric CO_2. Among other things, acidity affects how quickly shellfish and other species can calcify – build their shells or skeletons. At predicted rates, mussels are expected to calcify their shells 25% more slowly than at present, oysters, 10% slower.

While many aquatic organisms are adapted to temperature fluctuations, ocean acidity hasn't changed much in millions of years and nobody really knows how they will react to the projected variations.

Dirty water – pollution and other threats

Human activity has a significant impact on the marine environment and resources. Around 80% of the pollution load in the oceans comes from land-based activities, including wastes and run-off, as well as air pollution being absorbed by the sea – atmospheric deposition. The most productive areas of the marine environment such as estuaries and coastal waters near the shore are the worst affected.

Changes in land use, including draining wetlands and mangroves for use in agriculture or settlements; building dams, ports, seawalls and aquaculture installations as well as tourist facilities; and overuse of resources, including overfishing, water, sand and gravel extraction, all damage marine ecosystems.

Discharge of untreated domestic wastewater is a major source of environmental pollution. Discharging raw sewage into water destroys habitats, damages plant and animal life (the "biota") and can cause eutrophication. This is a process in which the extra nutrients stimulate excessive plant growth, often becoming an algal bloom. The new plants eventually die, and in decaying reduce the amount of oxygen in the water, causing other organisms to die, including those that fish feed on.

Sewage discharges are disgusting, highly visible and likely to get worse. There's better news concerning another form of pollution that is in many ways similar – oil spills. In the 1970s, some environmentalists predicted that at current rates of spillage,

practically the whole ocean surface would eventually be covered with oil slicks.

Fortunately, the situation seems to be improving. In 1983, around 3.2 million tons of oil entered the world's oceans. In 2003, the total was only 37% of this. That still represents over 1.2 million tons of pollution, but almost half of the total (600 000 tons) is from natural seepage of undersea deposits of gas and oil.

Pollution from tankers is diminishing thanks to stricter regulation and surveillance. In the 1970s, around 300 000 tons were spilled per year. For 2000-07, the average is 25 000 tons a year. The number of spills also declined, from over 25 a year in the 1970s to 3.6 a year for 2000-06.

Even so, a small amount of oil can do a lot of damage to a coastal ecosystem. The economic impact on fisheries can continue long after the immediate damage has been done, and well beyond the immediate area affected. When the tanker *Erika* broke up in the Bay of Biscay in 1999, many of the 100 000 or more sea birds killed had migrated from the Celtic Sea or even farther north, and sales of oysters plummeted by 50% in France, even from areas not affected by the pollution.

The increase in world shipping has aggravated another problem, the transfer of species from one part of the world to another in ballast water. The impacts can be devastating. In 1988, a ship coming from China discharged its ballast water into the Great Lakes. The zebra mussel in the water quickly colonised its new environment, forming gigantic clusters of shellfish around underwater structures including power station outlets, causing $5 billion of damage over the years.

The International Maritime Organisation estimates that up to 10 million tons of ballast water is transferred globally each year. It adopted an international convention to control and manage ballast water in 2004.

Repairing damage is long and expensive, but steps to prevent it in the first place or to find less harmful substitutes have proved their worth. The introduction of unleaded petrol has helped to reduce heavy metal pollution, but heavy metals in general are still a cause for concern, especially since their impacts can be

long-lasting. Heavy metals from electronic waste, for example, can leak from dumps and get into water and accumulate in aquatic organisms for years.

Heavy metals are not the only pollutants with long lifetimes. Persistent organic pollutants (POP) are highly toxic, highly stable chemical compounds, many from pesticides, which can last for decades before breaking down. They can bioaccumulate, be transferred over long distances and cause cancers and other diseases as well as birth defects.

High latitudes seem to be the worst affected. Many of the fish stocks in parts of the Arctic are highly contaminated by POP, and since fish are the main food of indigenous peoples living in the region, high concentrations of a POP called toxaphene have been found in breast milk of indigenous mothers. In East Greenland, the entire population has levels of blood contamination of concern, and almost a third has levels where a change of diet is advised.

Many of the pollutants described above require sophisticated techniques to detect and measure, but there is another menace that anybody who has ever walked along a beach has no doubt seen: litter, everything from cigarette lighters to bits of boats to lumps of polystyrene. Occasionally, some of the millions of tons of bombs and munitions dumped by the military (possibly containing arsenic or nerve gases) also show up.

Around 70% of litter entering the oceans lands on the seabed, 15% on beaches and 15% remains floating on the surface. It's hard to know exactly how much rubbish is dumped in the oceans, but campaigns such as the annual "International Coastal Cleanup", organised by the NGO Ocean Conservancy give some idea. In 2002, volunteers in 100 countries removed litter from more than 21 000 km of coastline and waterways, collecting 6.2 million pieces of refuse weighing 4 000 tons. Almost 58% of the litter could be attributed to recreational activities along the shore.

Much of this litter is plastic, 10 million tons a year according to some estimates. According to UNEP, there are over 46 000 pieces of litter on the surface of every square mile of ocean today. It kills birds, marine turtles, marine mammals and fish. Plastic bags are particularly lethal for turtles and mammals, which mistake them

for prey and eventually die of suffocation or blocked intestines. And that's not their only sinister impact. The plastics can act as a sort of "chemical sponge" for POP, so any animal eating them will also be taking in highly toxic pollutants.

The last wild fish?

In *Moby Dick*, Herman Melville asks a question that must have seemed odd at the time: "Whether Leviathan can long endure so wide a chase, and so remorseless a havoc; whether he must not at last be exterminated from the waters, and the last whale, like the last man, smoke his last pipe, and then himself evaporate in the final puff." Looking at populations, their habitats, behaviour and distribution and hunting techniques, Melville was optimistic: "We account the whale immortal in his species, however perishable in his individuality." That was before the "men that man the deathful whaleboat's bow" were armed with guns to shoot exploding harpoons and engines to power their craft.

Improvements in fishing techniques and growing demand mean that the most immediate and devastating impacts on marine ecosystems come from fishing itself. Only 3% of the stock groups monitored by the FAO are underexploited and 20% are moderately exploited and could perhaps produce more. About half of the stocks are fully exploited and producing catches at or close to their maximum sustainable limits, with no room for further expansion. Almost a quarter are either overexploited (17%) or depleted (7%). Only 1% are recovering from depletion.

The FAO's most recent report on the state of world fishing and aquaculture also issues a warning: "Overall, more than 75% of world fish stocks for which assessment information is available are reported as already fully exploited or overexploited (or depleted and recovering from depletion), reinforcing earlier observations that the maximum wild capture fisheries potential from the world's oceans has probably been reached."

Most of the stocks of the top ten species, which account in total for about 30% of the world capture fisheries production in terms

of quantity, are fully exploited or overexploited and therefore cannot be expected to produce major increases in catches.

> **"Without better fisheries management, overfishing and ecosystem damage is likely to lead to significantly reduced incomes…"**
>
> *OECD Environmental Outlook to 2030*

Commercially exploited fish are only one part of the ecosystem. Other links in the food chain are suffering too. Biodiversity loss not only impairs the ability of oceans to feed a growing human population, but also undermines the stability of marine environments and their ability to recover from stresses. Every species matters, and a fish or other sea creature that may be of no commercial value in itself, may be a vital food resource for commercially important species.

Aquaculture existed for thousands of years with little or no impact on wild fish stocks or the environment in general, but with the expansion of large-scale industrialised farms, a number of problems have emerged. For a start, some fish farms use juveniles captured in the wild as stock, reducing not only the population harvested, but others killed as bycatch.

Fish farms also transform wild fish into feed for caged species. It can take 2.5 to 5 kilos of wild fish to produce a kilo of farmed salmon, shrimp or other fish, and 20 kilos of wild fish are needed to produce a kilo of farmed tuna. Aquaculture now uses 59% of global fishmeal stocks and 80% of fish oil.

Not all of this feed gets eaten. The leftovers mix with excreta and dead fish near the cages, reducing biodiversity and sometimes causing algal blooms. The mix can also include medicines such as antibiotics needed to control diseases. Farmed fish are more vulnerable than wild ones and they can pass on some of their vulnerability to wild stocks through interbreeding (in 2006 over 900 000 escaped in Norway alone according to the Norwegian Fisheries Directorate, although this was an exceptionally bad year). Use of antibiotics by fish farms is contributing to the global phenomenon of bacteria becoming resistant to the drugs.

Aquaculture can also damage habitats and natural resources. Mangroves and coastal wetlands are destroyed to create shrimp

farms, leading not only to biodiversity losses and destruction of breeding grounds, but to the loss of other "services" provided such as protection from flooding and storm surges.

What can be done?

At the 2002 World Summit on Sustainable Development in Johannesburg, governments agreed to work towards restoring global fish stocks to sustainable levels by 2015, and significantly reducing the rate of biodiversity loss by 2010.

National governments and international bodies have a number of tools they can use to achieve these ambitious goals. They can limit total catch levels through the use of quotas, fishing seasons and zones. They can regulate fishing methods and gear. They can eliminate environmentally harmful subsidies. The environmental impacts of aquaculture can be tackled by regulating the location and operation of fish farms, developing alternative feeds that reduce the reliance on capture fisheries, and ensuring that consumer prices reflect environmental costs of production.

There aren't many signs that sustainability will be reached by 2015 or biodiversity loss significantly reduced by 2010. Significant change requires restoring marine biodiversity through an ecosystem-based management approach. Integrated fisheries management is part of this, but so are pollution control, maintenance of essential habitats and creation of marine reserves. It's a huge task, but it has to be done to avoid serious threats to global food security, coastal water quality and ecosystem stability.

It makes economic sense too. A study by the World Bank argues that the economic health of the world's marine capture fisheries is so bad that resilience to fuel price increases, to depressed fish prices and to the effects of climate variability and change is compromised. The study estimates the difference between what is earned and what could be earned with far-reaching reforms at around $50 billion. Even though the costs of poor management and poor practice are hard to calculate, and the figure given here

is only an estimate, the economic loss from badly run fisheries is substantial.

Moreover, this kind of calculation does not include the additional value of the environmental benefits of healthy marine ecosystems (such as tourism benefits from healthy coral reefs) and the value of efficiency gains along the value chain that gets the fish from the water to the final consumer.

The Great Pacific Garbage Patch

In 1997, yachtsman Charles Moore was coming home from a Los Angeles to Hawaii race. He decided to see if it was quicker to go via an area known as the North Pacific Gyre. The route was shorter, but sailors avoid it since there isn't usually much wind. In an article for *Natural History Magazine*, in 2003, he described what he saw. "As I gazed from the deck at the surface of what ought to have been a pristine ocean, I was confronted, as far as the eye could see, with the sight of plastic. It seemed unbelievable, but I never found a clear spot. In the week it took to cross the subtropical high, no matter what time of day I looked, plastic debris was floating everywhere: bottles, bottle caps, wrappers, fragments."

It may seem strange that the satellites and other means of remote sensing used to study the oceans hadn't spotted the plastic, especially given that NOAA had predicted such a phenomenon in 1988. But the plastic is generally translucent and much of it is below the surface, so it doesn't register on most of the imagery you have to be on a boat to see it. This suggests there could be similar garbage patches waiting to be discovered in other areas.

Curtis Ebbesmeyer, the oceanographer Moore talked to about what he'd seen, dubbed the phenomenon the Eastern Garbage Patch. In an interview with *The Independent* newspaper in February 2008, Ebbesmeyer compared the trash vortex to a living entity: "It moves around like a big animal without a leash." Big is the word, it's about the size of Texas. Big as it is, close to land, the beast can no longer hold everything in its stomach. "The garbage patch barfs, and you get a beach covered with this confetti of plastic." But there isn't much land in this area of the world so the plastics mostly stay in the gyre, six kilos of it for every kilo of plankton.

Watch the "Good Morning America" report on Charles Moore and the Garbage Patch here: *www.youtube.com/watch?v=uLrVCI4N67M*.

Ghost fish

One of the eeriest impacts of fishing on the marine environment is so-called ghost fishing. This happens when nets or other fishing gear go on working on their own, without any human intervention. Modern nets are made from synthetic fibres that do not biodegrade, so when they are lost or dumped at sea after being damaged they can slowly sink towards the bottom bed until they snag on rocks or shipwrecks. To begin with, the net catches fish like any other being tended by a crew, but since it is not emptied, the increasing weight causes the net to collapse. The dead fish then decay, attracting scavengers which can also be trapped (including commercially important species). After some time, the dead fish are cleared by decay or scavenging and the net may disentangle, return to an upright position and start fishing again.

The cycle can be repeated again and again until the net is destroyed. This may happen within a few weeks in rough seas, but in the Irish Sea a net snagged between rocks continued to fish for over a year. In shallow clear water, algae and other organisms will grow on the net, making it easier to see and avoid. This isn't the case in deep water fisheries such as the northeast Atlantic where nets are set at a depth of more than 500 metres.

The catching efficiency of ghost nets stabilises at 20 % to 30 % of commercial catch rates after 45 days, and some nets may continue to catch lower amounts of fish and crustacean more than eight years after being lost. Around 25 000 nets may be lost or deliberately discarded in the northeast Atlantic fishery each year, with a total length of around 1 250 km. In the Baltic Sea, studies show that lost cod gill nets catch 80% less than commercially set nets within three months, but they continue to fish for over two years and tend to catch smaller individuals, possibly affecting reproduction.

Pots, creels and traps are an even bigger problem since they are usually made of more durable materials than nets and don't collapse. This means they can ghost fish for much longer, in a kind of self-perpetuating cycle. Lobsters, crabs and crayfish are attracted by bait, so pots tend to be baited when they are set. If the pot is lost, in time the bait (or lost catch) attracts scavengers, which once again may be commercially important species. These scavengers become trapped and die, forming new bait for other scavengers.

A creel made from indestructible material can therefore continue to fish indefinitely, but escape panels and biodegradable materials are being introduced to reduce losses from ghost fishing in some areas. In the US, around $250 million of marketable lobster is estimated to be lost annually to ghost fishing, while in the Bristol Bay crab fishery alone 31 600 pots were lost over a two-year period. The problem got so bad that Canadian fishers complained about it. As well as the impact on commercial species, ghost fishing can affect other marine species, notably birds and marine mammals. For example, 99 seabirds were recovered from a 1.5km length of gill net found south of the Aleutian Islands, and off Newfoundland over 100 000 marine birds and mammals were killed in a four year period by ghost fishing. In the north east Pacific, 15% of the mortality of young fur seals could be due to net debris, with the average seal expected to encounter 3 to 25 pieces of net debris annually.

The US National Oceanic and Atmospheric Administration (NOAA) has a video about marine debris and ghost fishing: *www.youtube.com/watch?v=WqIOAlrl1IY*

From wondyrchoums to bottom trawling

In the opening chapter, we mentioned that many fishing techniques and issues have been around for hundreds or even thousands of years. In a report on the UK fishing industry, the WWF quotes a complaint made to the English parliament in 1376 about a new trawling gear, the wondyrchoum "of so small a mesh, no manner of fish, however small, entering within it can pass out and is compelled to remain therein and be taken… the fishermen aforesaid take so great abundance of small fish aforesaid, that they know not what to do with them, but feed and fatten the pigs with them, to the great damage of the whole commons of the kingdom, and the destruction of the fisheries." Government reactions haven't changed much either – they set up a commission.

Seven centuries later, trawling is still controversial. Bottom trawling, dragging huge nets along the seabed, was called "the world's most severe and extensive seafloor disturbance" at the 2008 meeting of the American Association for the Advancement of Science. Until the 1980s, this kind of trawling was impossible because nets snagged on seabed obstacles and were damaged or destroyed. The invention of the "rockhopper" trawl changed that. Rockhoppers have large rubber tyres or rollers that allow the net "hop" over rough surfaces. They can also shift obstacles – the largest rockhoppers can move 25-ton boulders.

An instrument as powerful as this can destroy just about everything in its path. One company markets what it calls "Canyonbusters", trawl doors that weigh up to five tons each and smash their way through obstacles such as coral. Underwater images show seabed wastelands where there used to be coral reefs and other thriving habitats. In heavily fished areas around coral seamounts off southern Australia, 90% of the surfaces where coral used to grow are now bare rock.

In January 2005, the report of the UN Millennium Project's Task Force on Environmental Sustainability recommended that global fisheries authorities must agree to eliminate bottom trawling on the high seas by 2006 to protect seamounts and other ecologically sensitive habitats and to eliminate bottom trawling globally by 2010. The call was rejected following opposition led by Iceland and Russia.

In 2006, the UN General Assembly issued a call for Regional Fisheries Management Organisations (RFMO) to establish regulations by 31 December 2008 to prevent damage to corals, sponges, seamounts and other vulnerable deep-sea marine habitats from bottom fishing on the high seas. NAFO voted to close a large area of the Grand Banks off Canada to most bottom trawling for five years. The Convention for the Conservation of Antarctic Marine Living Resources regime instituted extensive bottom trawling restrictions. The North East Atlantic Fisheries Commission closed four seamounts and part of the mid-Atlantic Ridge from all fishing, for three years. In May 2007, countries fishing in the South Pacific RFMO region (a quarter of the global ocean) agreed to exclude bottom trawling in vulnerable ecosystems until an impact assessment is undertaken. Observers are required on all high seas bottom trawlers to ensure enforcement of the regulations.

Find Out More

FROM OECD...

On the Internet

For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

Publications

Financial Support to Fisheries: Implications for Sustainable Development (2006):
OECD governments pay out around $6 billion a year to support the fisheries sector. Such support has often been linked to over-fishing and over-capitalisation, and its reform may lead to improved economic, environmental and social outcomes. This report analyses the impacts of such transfers from a sustainable development perspective by addressing the economic, environmental and social dimensions of financial transfers.

OECD Environmental Outlook to 2030 (2008):
Chapter 15 of the *Environmental Outlook* reviews the environmental pressures both from and on fisheries and aquaculture and projects global trends in production and consumption. Looking to 2030, it will be important for governments to address gaps in the institutional and legislative framework for managing the environmental impacts of fisheries and aquaculture, and to strengthen implementation of the existing agreements. At the same time, environmental degradation driven by activities in other sectors is also affecting the economic viability of fisheries.

...AND OTHER SOURCES

Fisheries and the Environment (FATE): supports NOAA's mission to ensure the sustainable use of US fishery resources under a changing climate. The focus of FATE is on the development and evaluation of leading ecological indicators, their application to practical fishery management problems, and regularly updating this information. *http://swfsc.noaa.gov/textblock.aspx?Division=ERD&id=4160*

Environmental impacts of fisheries (Onefish.org):
This topic on the Onefish Site provides access to hundreds of documents and web links looking at the impact of fisheries on the environment and the environment on fisheries. Follow the "Impacts" link on the "Marine and costal fisheries" tab. *www.onefish.org/global/index.jsp*

Defending our oceans (Greenpeace):
The oceans provide vital sources of protein, energy, minerals and other products and the rolling of the sea across the planet creates over half our oxygen, and drives weather systems and natural flows of energy and nutrients around the world. Greenpeace examines the major threats to oceans from human activities, including fishing. *www.greenpeace.org/international/campaigns/oceans*

5

Fishing is big business and profits can be huge, so competition for access to stocks is fierce. Pirate fishers ignore the rules designed to protect resources and ensure equitable shares. They destroy the livelihood of other fishers and threaten the existence of fish species. Combating pirate fishing is hard because the penalties for those caught are low compared with potential gains, and even catching them is difficult given the vast areas of ocean to be covered, the limited means of anti-piracy authorities, and the complicity of some states and customers.

Pirate Fishing

By way of introduction…

"… navy commandos boarded the vessel whose cargo was worth an estimated two million dollars." If you heard only the end of this story on the news you could probably guess the rest – drugs, violence, high-powered speedboats, international criminal networks, money laundering... How about frozen fish? Unlikely as it seems, stealing fish is big business.

The technical term for it is illegal, unreported and unregulated (IUU) fishing, also known as pirate fishing (see the box for a detailed definition).

- *Illegal fishing* is when vessels violate the laws of a fishery.
- *Unreported fishing* is fishing that has been undocumented or misreported to the relevant national authority or regional organisation.
- *Unregulated fishing* describes fishing by vessels without nationality, or vessels flying the flag of a country that isn't a member of the regional organisation governing that fishing area or species.

As with any illegal activity, estimating the economic costs of fish piracy is difficult, but the phenomenon exists in all the world's fishing grounds and is thought to be particularly serious for some high-value species. Possibly the best scientific way to estimate IUU activity is to use biological stock assessments and compare these with known catches from legal fishing operations. Other methods include data on how much fish is traded on world markets or how many fishing boats and support vessels are operating.

The ideal method would no doubt combine all of these. But even if present estimates are only educated guesses, they give some idea of the extent of the problem; for instance, around a quarter of the fish taken from the Antarctic fishing area are thought to be IUU catches.

Other impacts are likewise hard to estimate precisely, but pirate fishing certainly has the same environmental impacts as legal fishing, only more so since pirates are unlikely to respect

environmental regulations designed to protect endangered species ranging from dolphins to seabirds as well as non-target fish (bycatch) that are flung back into the water.

Marine species may not be the only ones to suffer from IUU practices. If you're wondering whether you've ever eaten stolen fish, try to remember if you felt sick afterwards. Ships that stay at sea for up to two years with no respect for fishing regulations and labour laws are not going to waste money on hygiene standards or submit themselves to the sanitary inspections legal vessels undergo.

In this chapter, we'll look at the economic reasons why pirate fishing continues and the institutional factors that allow it to flourish, such as flags of convenience. We'll also discuss attempts to combat IUU fishing, and describe the unglamorous life of the modern pirate.

Definitions of IUU Fishing in the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing

Illegal fishing refers to activities: conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations; conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organisation but operate in contravention of the conservation and management measures adopted by that organisation and by which the States are bound, or relevant provisions of the applicable international law; or in violation of national laws or international obligations, including those undertaken by co-operating States to a relevant regional fisheries management organisation.

Unreported fishing refers to fishing activities: which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or undertaken in the area of competence of a relevant regional fisheries management organisation which have not been reported or have been misreported, in contravention of the reporting procedures of that organisation.

Unregulated fishing refers to fishing activities: in the area of application of a relevant regional fisheries management organisation that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organisation, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organisation; or in areas or for fish stocks in relation to which there are no applicable conservation or management measures.

Source: FAO (2001), "International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing", *www.fao.org/docrep/003/y1224e/y1224e00.htm*.

High prices

Tuna used to be so cheap that it was even used as pet food. Now, as Brian MacKenzie of the Technical University of Denmark puts it, they are like "floating goldmines out in the ocean". Each one can be sold for $10 000 to $15 000 in Japan, and as mentioned in the first chapter, the record for a single fish is an astonishing $178 000! So the first reason why pirate fishing continues is that it can be highly profitable.

Another highly targeted species is the Patagonian toothfish, often sold as "Chilean sea bass". Again, the price has been rising steadily, practically doubling to almost $12 a kilo over 1996-2000 and doubling again since then. A Canadian study from 2005 gives some idea of the huge sums the pirates can earn from their catches. One boat arrested by the Uruguayan authorities had a catch worth over $2 million in its holds. The study gives another example of a similar catch and several worth around half a million dollars.

Other species such as squid may have lower market value but can easily be marketed through traditional channels where they are mixed with "legal" fish.

As stocks decline and demand continues to increase, the economic attractiveness of pirate fishing will grow.

Low fines

Another Canadian study shows the fines that pirates can expect if they get caught. They are rarely dissuasive and sometimes can even seem ludicrous, a $690 fine for a catch of halibut estimated at almost $120 000, for example.

One case study suggests that maximum penalties should be increased by as much as 24 times compared to current levels if they are to have any deterrent effect on IUU fishing activities. Confiscating the vessel and the catch could also prove more effective, but there are problems with these approaches too. Fines

and penalties are often based on the ability to pay; however, the actual fishers who get arrested are often too poor to pay even the level of fines in force at present, and the true owners of vessels are hard to find since they use fake operating companies or often change the company name.

Too many boats, too many fishers

Given the decline in stocks, many nations have now introduced restrictions of various kinds on how much fishing can be done. Boats that remain in the harbour still cost money to maintain, and fishers' income depends on the value of the catch. When high-value species are available, the temptation to fish illegally is strong. Better surveillance and increasing penalties make IUU fishing less attractive in the waters of the rich countries, and many developing nations are worried that the overcapacity problems of the developed countries are being "exported" into IUU fishing activities in their waters.

Once again, the ease with which vessels and ownership can be disguised by registering under a flag of convenience, changing names and so on makes it hard to identify the pirates. Some boats probably have two or more identities, with one for legal fishing, the others for piracy.

Tackling overcapacity will require a combination of measures, for instance paying owners to scrap their boats. Management systems will have to ensure that capacity removed under such schemes does not "creep" back in to the fishery later. But many of the crew may have little chance of finding alternative employment in their community and may not receive much compensation if scrapping fees are mainly given to owners.

If fishers can make a reasonable living from legal fishing in domestic waters, the incentives for pirate fishing will be reduced. This means finding the right mix of temporary restrictions, scrapping, targeted and temporary income support, management schemes, retraining and development of other activities.

Rogue states

A number of international rules and conventions are administered by Regional Fisheries Management Organisations (RFMO) and enforced by national authorities (assuming they have the capacity to enforce them, which is not always the case, particularly in developing countries). But these apply only to states that adhere to the conventions, and in cases where international law is supposed to apply to all countries, a legal loophole makes it possible to re-flag fishing vessels without any constraints.

Many of the states offering flags of convenience are doubly attractive since they are also tax havens, making it even more enticing for pirate fishers to register there. If you click on the unambiguously named *www.flagsofconvenience.com*, you'll see how easy it is to move vessels from one register to another, even for a few months. And the fact that some of the countries proposing flags are completely landlocked doesn't seem to stop them having extensive fleets. In these circumstances, even legal vessels can be tempted to switch flags.

Not all re-flagging is from "an arid plateau region with mountains in the north and the Gobi desert [in the] west, center and southeast" to quote one state proposing its seafaring expertise. Some developing countries are trying to attract foreign direct investment in their fisheries to boost their economy, and vessels from abroad are using these opportunities to re-flag their over-capacity to those countries.

Again, some developing countries do not have the management or enforcement infrastructures needed to effectively control the re-flagged vessels, increasing the chance that they will engage in IUU fishing. And it is actually difficult to distinguish between the re-flagged vessels and foreign direct investment since there is often no clear "genuine link" between the flag state and the fishing vessels flying the flag.

Another quirk of international law is that few rules of the International Maritime Organisation apply to fishing vessels, which are largely ignored as a category within the plethora of commercial vessel types. Pirates can also take advantage of

so-called "hot spots" on the high seas where adjacent Economic Exclusion Zones do not overlap fully.

Name and shame

The practical and legal difficulties of detecting and deterring IUU fishing make the fight against piracy seem like an impossible task, but there are signs of hope. Global problems call for global responses, and nations are now co-ordinating their efforts to increase the effectiveness of enforcement. The International Network for the Co-operation and Co-ordination of Fisheries-Related Monitoring Control and Surveillance Network (MCS Network) brings together professionals to help each other in general matters regarding pirate fishing as well as particular cases.

The MCS experts use techniques as sophisticated as those of the criminal investigators who star in TV series. When agents from NOAA, the US National Oceanic and Atmospheric Administration, confiscated a ton of dried shark fins a New York City dealer was planning to ship to Asia, they needed to identify the different species to see if they came from protected or illegally caught species. Scientists working with federal agents used a quick identification method that employs both nuclear and mitochondrial DNA markers to confirm that the fins were from great white sharks and the dealer was arrested.

Developing countries are also fighting back and Namibia shows what can be done. Before independence in 1990, the country's fisheries were characterised by massive and uncontrolled fishing, primarily by European and Eastern bloc fleets, followed by near collapse of many stocks. One of the first acts of the newly independent parliament was the Territorial Sea and Exclusive Economic Zone (EEZ) of Namibia Act of 1990. On the day the 200-mile EEZ was declared, more than 100 foreign vessels were fishing illegally in Namibian waters.

Other small coastal states had found it impossible to effectively control such operations in their EEZs, but Namibia decided to put in place measures to reap the gains from sustainable

exploitation of its fisheries. During 1990 and 1991, 11 Spanish trawlers and one Congolese trawler were arrested for illegal fishing and successfully prosecuted, sending a clear message to the international fishing community that Namibia was serious about its sovereignty.

There were a few further incidents of poaching after this, but an integrated programme of inspection and patrols at sea, on land, and in the air ensures a high degree of compliance with Namibia's fisheries laws by potential poachers and licensed vessels alike.

Other stakeholders are involved too. Many NGOs are also working to detect and publicise vessels catching fish illegally. TRAFFIC (a joint WWF – World Conservation Union project) and Greenpeace are currently operating a wildlife trade monitoring network to publicise illegal operators and name the companies and vessels involved in IUU fishing of toothfish.

The Coalition of Legal Toothfish Operators (COLTO) is offering rewards of up to $100 000 to anyone with information regarding illegal vessels. Such actions by private initiatives or NGOs have proven successful in gaining valuable information leading to the identification of illegal vessels. By the same token, they increase the risk that IUU operators could lose their moral and social standing which may, in certain societies, act as a deterrent to IUU fishing.

Poor pirates

Fish pirates are neither the vicious thugs portrayed by Robert Louis Stevenson nor the seductive rascals so beloved of Hollywood. All they have in common with the heroes of swashbuckling romances are harsh and dangerous working conditions with more chance of getting killed than of getting rich, and ruthless, unscrupulous masters.

Ship owners involved in IUU fishing are unlikely to care much about working conditions aboard their vessels, or about the condition of the vessel itself. Poor working, safety and social

conditions are made worse by the use of flags of convenience, as it is the flag state's rules and regulations, including labour laws, which apply.

The upshot is that for many illegal fishers, working on a pirate boat means earning a wage of around $200 to $250 dollars a month with no shore leave during a two-year voyage, no rest periods at sea, no additional overtime pay and no right to strike. The International Transport Workers' Federation gives the following examples from contracts.

"I understand fully that due to limited water supply, drinking water is supplied by ration. Therefore, sea water is to be used in bathing, washing clothes and tooth brushing."

"Breakfast, lunch and dinner is provided for free. However, things for personal use are not given free. Snack foods such as bread, biscuit, coffee, milk, sugar, soft drinks, beer, liquor, cigarettes, soap etc. should be shouldered by the fisherman."

"I also understand that the amount of $50 will be deducted by my captain to my salary every month. This will serve as my air ticket deposit in case I was not able to finish my contract but this amount should be refunded the moment I finish my contract."

The union also quotes a contract for up to three years, where the fishers were to be paid only when on board for a specific season, and were not entitled to leave payment during the rest of the period. There was a clause providing that if the fisher obtained other employment, the agent who first hired him could claim the salary for breach of contract. The agent also had the right to withhold the last two months' salary and return the money to the fisher only if he showed up for the next season.

It's bad enough not being paid overtime when you are required to work a 22-hour day, or not being paid at all when the ship is in harbour, but some fishers actually have to pay to work. There are cases where Filipinos had to pay over two months' wages ($450) to be hired on three-year contracts under the kinds of conditions mentioned above.

Chinese fishers from Yongchuan County in Sichuan province had it even worse: they not only had to pay $470 to secure a place on a boat, they had to agree to have their appendix removed before going to sea and to pay $47 for the operation themselves.

Abominable working conditions are not the only hardship crews may have to face. As mentioned elsewhere, many states do not have the resources to protect their fishing grounds from pirates, which means that local fishermen sometimes take the law into their own hands, forming vigilante groups to attack the intruders. If the authorities do look like they are going to impound a vessel, the ship and its crew may be left to rot by the owners.

The same applies to ships that are no longer seaworthy. The *Christain Science Monitor* reports the case of a rusting Chinese trawler with holes in its body so big that an adult could crawl through abandoned in the "Ships' Graveyard", a haven for pirate fishing boats off the coast of Sierra Leone.

Two of the original fourteen crew members were found on board. They'd been adrift for more than a week with no radio, no engines, and little food. Their employers, a firm based in nearby Guinea, had told them to keep the ship afloat long enough for it to be towed into port to be sold for scrap.

The rescued men had no idea when relief would arrive, if ever, but having signed the kind of contract described above, neither man wanted to abandon the boat and risk losing two years pay.

Reading these accounts makes you wonder what the alternatives are when such a deal seems like an acceptable option. And remember, these are fishers (pirates or not) who actually have a contract, but in any case there is no widely accepted global convention on safety and personnel requirements for fishing vessels and no ILO (or other) instruments on labour conditions for fishers yet in force to cover such situations.

Find Out More

FROM OECD...

On the Internet

For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

Publications

Fish Piracy: Combating Illegal, Unreported and Unregulated Fishing (2004):
Efforts to deal with IUU fishing have produced meagre results, so new approaches are needed. This OECD workshop asked whether existing institutions are capable of dealing with this often concealed, cross-border activity, and proposed new and alternative ways to deal with it.

Why Fish Piracy Persists: The Economics of Illegal, Unreported and Unregulated Fishing (2005):
This book argues that fish pirates pursue their trade because it is profitable, and will keep pursuing it as long as their income exceeds their costs. Based on data from a workshop of around 120 experts, as well as analytical documents developed specially for this study, the book presents the most systematic and consolidated information to date in order to assess measures already in place and to propose new solutions.

Also of interest

Making Sure Fish Piracy Doesn't Pay, an OECD Policy Brief (2006):
Although lots of different approaches have been tried, at heart illegal fishing is an economic issue. Therefore, this Policy Brief looks at what can be done to make IUU fishing less profitable and thus less attractive to the fishing pirates.
www.oecd.org/publications/policybriefs

...AND OTHER SOURCES

Illegal, Unreported and Unregulated (IUU) fishing (FAO), *www.fao.org/fishery/topic/3195/en*. FAO video slideshow also available: *www.youtube.com/watch?v=l6j-4jvJkHO*.

Combating illegal fishing (European Commission), *http://ec.europa.eu/fisheries/cfp/external_relations/illegal_fishing_en.htm*. EU video report available here: *www.youtube.com/watch?v=DnS_MzU9wrA*

Illegal, Unreported and Unregulated (IUU) fishing (NOAA), *www.nmfs.noaa.gov/ia/challenges/iuu.htm*

Fishing problems: illegal fishing (WWF) *www.panda.org/about_our_earth/blue_planet/problems/problems_fishing/illegal_fishing*

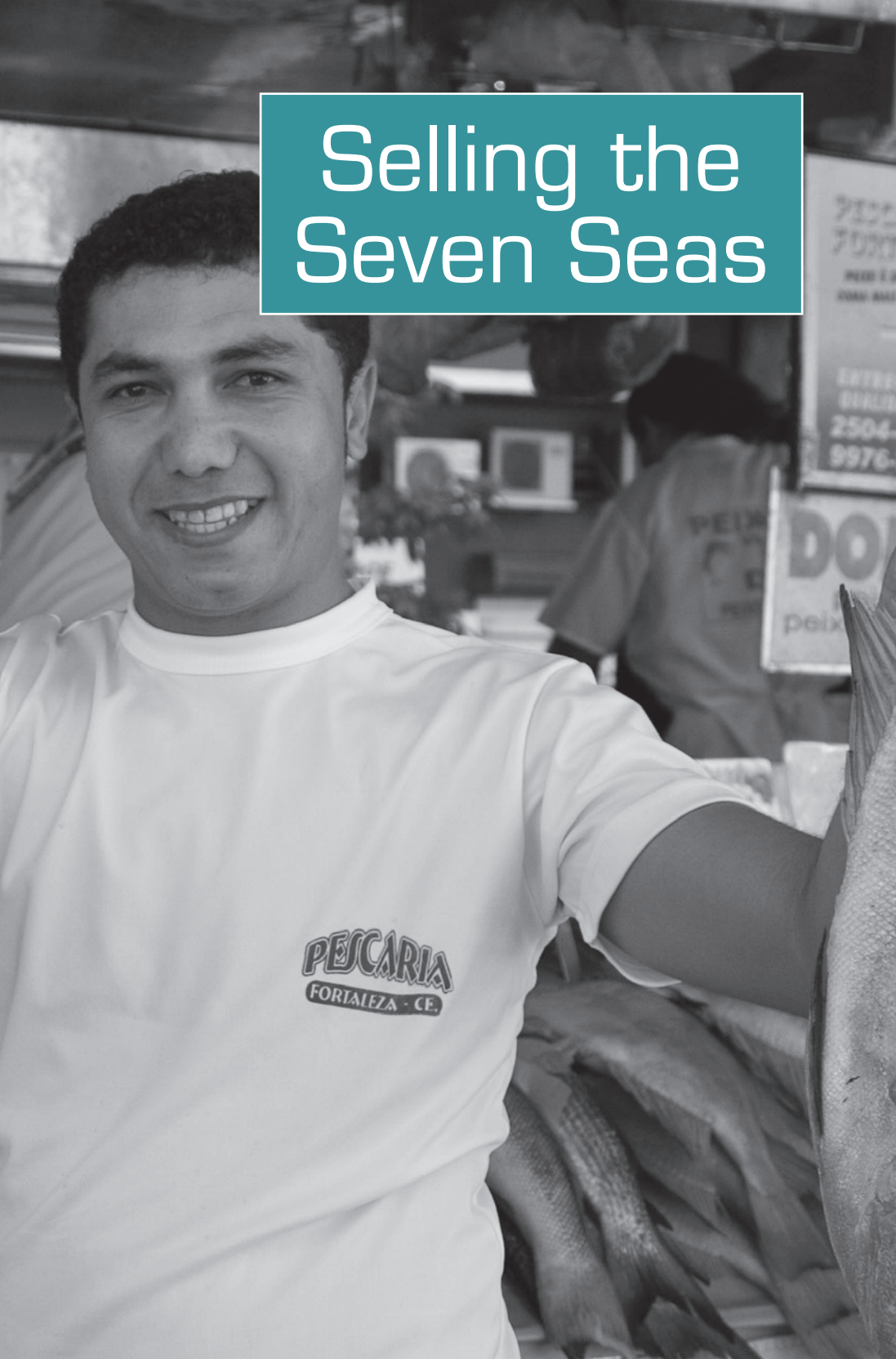
Pirate fishing (Greenpeace), *www.greenpeace.org/international/campaigns/oceans/pirate-fishing*. Video also available: *www.youtube.com/watch?v=aBm17C7hWog*

What is Illegal, Unreported and Unregulated (IUU) fishing? (Environmental Justice Foundation), *www.ejfoundation.org/page162.html*.

6

Many fishing activities are international by nature, with boats roaming far from home to hunt fish. However, the most globalised aspect of fisheries is what happens after the fish is caught. Global value chains mean that fish can be caught in an ocean in one part of the world, processed in a factory in a second and consumed in a home or restaurant in a third. Fishing is like other globalised industries in that it is bound by the rules of international trade. But it is unique in depending on a resource that the success of the industry is endangering.

Selling the Seven Seas



By way of introduction…

Few dishes are as British as fish and chips, but this national favourite wouldn't have existed without an internationalised industry, new technology and socioeconomic changes combining to supply a market, and even create one (and create a tradition too).

As with so many aspects of popular culture, the exact origins are not clear. Fried fish was popular in Portugal, thanks to the boats that fished off Newfoundland from the 15th century. Dickens mentions both fried fish and chips but not combined into a meal. What we do know is that fish and chips first became popular among the industrial working class, especially in the north of England and Scotland, in the second half of the 19th century.

One explanation is that with so many women working in the textile mills and other large enterprises, they didn't have time to cook meals and it was more practical to buy hot food to take home.

That is probably part of the story. Sally Macé grew up in a working-class neighbourhood of Paris in the 1960s and describes something similar. "The women in our area usually worked, and many of them worked on a Saturday too, leaving their husbands to look after the house and the kids. Instead of cooking, a lot of them bought a cooked meal from a woman who set up shop once a week on a little square near my father's bakery."

Sally also describes another reason for buying a prepared meal. "At that time, living conditions were much worse than now. In my class at school, I think only one girl had a bath or shower in the house. And kitchens were rare too, or really tiny, and you couldn't do much more than heat water, so being able to buy a cheap, hot meal was a godsend."

Whatever the underlying practical reasons, fish and chips, like the sausages and other dishes Sally's neighbours bought, had to be cheap. Here is where technology comes in.

Fishing techniques changed radically in the second half of the 19th century, with the widespread introduction of trawling. Trawlers caught both valuable high-quality targets such as sole, and cheaper fish such as haddock, which the fishers used to throw

away since there was no market for them. The railways changed that, making inexpensive, rapid mass transport of fish such as haddock from the coast inland to the big cities commercially viable.

And globalisation? For a start, the potato was not a native British plant – it was originally grown in South America, in the Andes. It was brought to Spain in 1570 and took over two centuries to become an established crop. The fish themselves came from a wide area of the North Sea and the Atlantic. In many places, the first people to sell them were Italian immigrants or their descendents who had started out selling ice cream to other members of their community.

Fishing today is more internationalised than ever. Practically every sea is now fished. Species that nobody apart from a few specialists had even heard of a decade or so ago are common in supermarkets. The fish may be caught on one side of the world, sent to the other for processing and then somewhere else again to be sold to the consumer.

 This chapter will look at the international business of fishing and examine how it is being transformed under the influence of changes to supply and demand and the labour market, but first we'll look at the international laws and agreements that cover trade in fisheries products and access to fisheries.

International trade and agreements

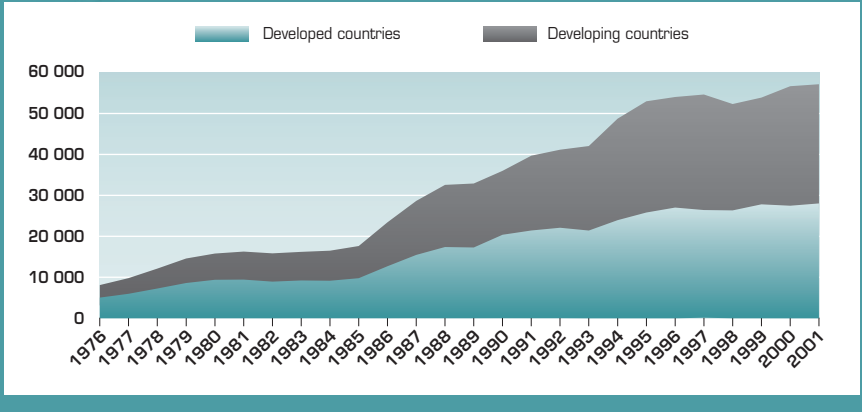
From the days of the Portuguese working the cod banks off Canada to supply the home market with salted cod (and the Vikings before them), fishing has always been more international than the rest of the agro-food industry. Techniques to preserve fish had been in use in international fisheries for centuries and there was a well-developed trade in fish long before that in other food products. Today, international commerce in fish and fish products is less subject to the kind of trade dispute that occurs over agricultural products.

Trade barriers still exist – the OECD countries collect around a billion dollars a year from tariffs on fish and fish products. But generally tariffs for fish are much lower than for agricultural products. Instead, importers suspend tariffs or have other kinds of deals such as preferential treatment for certain countries to ensure supply. The main reason for this is that the developed countries import about half their supply of fish from the developing world. In fact, developing countries earn more foreign currency from fish than from meat, tea, bananas and coffee put together.

Non-tariff barriers are more of an obstacle than import duties. The investment needed to upgrade facilities and associated costs in complying with standards can restrict trade in a similar manner to tariffs. Developing countries can find it difficult to conform to OECD countries' sanitary and phytosanitary (SPS) standards, so the developed countries could help by giving aid for what specialists call "capacity building".

INCREASING PARTICIPATION OF DEVELOPING COUNTRIES IN FISHERIES EXPORTS

USD thousand



Source: Globalisation in Fisheries and Aquaculture: Opportunities and Challenges, based on FAO Fishery Statistics.
StatLink : *http://dx.doi.org/10.1787/888932295443*

This would include improving developing countries' knowledge of SPS and making it easier to get access to scientific and technical expertise. Without technically and legally competent representatives, it can be almost impossible for a developing country to get a fair hearing in dispute settlement procedures and to demonstrate that domestic measures are equivalent to developed countries' requirements.

For example, a ban on fish exports from three East African countries and Mozambique was imposed in 1998 due to a cholera outbreak, despite the fact that cooked, dried or canned products are considered safe from cholera transmission and epidemiological data suggest that the risk from contaminated fish is negligible. At present, technical and financial assistance is normally provided once problems of SPS compliance have come up, rather than as a part of a strategy for general capacity building.

Trade limitations can undermine international trade, but they also reveal the interconnectedness of the global fisheries sector. When pangasius fish were first imported to the US from Vietnam in 2000, they were labelled as catfish, and American catfish farmers opposed the trade.

In 2003, an anti-dumping law, decided unilaterally by the US, imposed duties of up to 60% on Vietnamese exporters and they were not allowed to call pangasius catfish on the US market. Since Vietnam was not a member of the World Trade Organization, there wasn't much it could do about it. Sales to the US decreased and Vietnamese exporters targeted Europe with immediate success. Today, Vietnamese presence in the US market is limited, but Chinese producers are now exporting catfish to the US in large volumes.

In common with other sectors, international fisheries markets have become more interdependent. One reason for this is the implementation of extended (or exclusive) economic zones (EEZ). An EEZ is a zone under national jurisdiction (up to 200 nautical miles wide) outlined in the provisions of the 1982 United Nations Convention of the Law of the Sea, within which the coastal state has "the right to explore and exploit, and the responsibility to conserve and manage, living and non-living resources".

The thinking behind this was threefold. First, the coastal state jurisdiction could provide a more functional fisheries management regime. Now, over 90% of the global fish catch is taken from zones under national jurisdiction, and the 200-mile zone seemed to be a rational area for management.

Second, by placing these areas under exclusive jurisdiction of the coastal state, it was thought that entry into fisheries would be controlled, thereby reducing the potential for both overfishing and for overcapacity of fishing fleets.

Finally, prevailing theories of fisheries management were presumed to be adequate to protect and maintain fisheries if jurisdictional control and effective enforcement authority were established. Things didn't work out so well in practice, and overfishing has continued in many countries.

As far as trade and markets were concerned, the EEZ as such didn't change demand for fish, but they did change the possibilities of who could fish where and they did create a market for access rights, particularly to the waters of developing nations that did not have the capacity to exploit their resources

The Roaring 20s: Guns, gangsters and herring

Globalisation complicates a problem that economists and political scientists have been studying since the days of Adam Smith – the law of unintended consequences. It's not really a law, more an observation, or warning, that policy decisions can have negative or positive impacts they were not designed to produce. A typical example would be a new road designed to reduce traffic congestion that ends up encouraging more people to travel by car.

With the deepening integration of the global economy, unintended consequences can be far-reaching, and fishing provides one of the oddest illustrations of the phenomenon. When the United States government banned the sale of alcohol in 1920, "Scarface" Al Capone and other gangsters made fortunes from bootlegging – supplying drink illegally. This is the most well-known unintended consequence of the policy. But on the other side of the Atlantic, there was another unexpected effect.

In *I Crossed the Minch*, his account of trips around the Western Isles of Scotland, the poet Louis MacNeice describes how American saloons liked to give customers herring from Western Isles boats because it was so salty and made people drink more. When Eliot Ness and his Untouchables closed the saloons, the market disappeared, dealing a serious blow to the fishing economy.

themselves. In these cases, the coastal state receives an access fee from ships from the "distant water fishing nation".

Access agreements have often evolved into so-called partnership agreements that provide development assistance to help the coastal state's fishing interests. These agreements are often not as successful as was hoped. If the distant nation still has access, its operators are probably more efficient than local firms and may crowd them out of the market. Moreover, since the main markets are in the developed countries, the coastal state's firms would be competing as exporters against distant nation firms trading in a domestic market.

Globalised processing

Most of the big companies involved in the fishing industry don't actually do any fishing. They transform the catch into the products we buy. This is the main way globalisation affects fisheries. As we said above, fishing is a risky business and returns are more certain, and the profits greater, from the activities that happen after the fish is caught. These activities have attracted private capital, and two of the largest processors and retail brand owners have been purchased by investment funds. In line with what's happening elsewhere in the food business, Unilever's Frozen Fish International was taken over by Permira, and Youngs by Cap Vest.

Globalisation changes how local suppliers work. Traditional fish markets in developing countries are wonderful places to visit, and to shop in if you know what you're doing, but few if any of the products would be allowed on sale in shops in OECD countries.

Not so with the products from industrialised operations which have adopted international standards of production, hygiene and food safety management systems to gain access to markets in developed countries. This is costly. Apart from expertise at production level, companies need to understand non-technical aspects of exporting such as regulations or complex logistics, but the investment can pay off.

> **"The development of global value chains also offers new opportunities to small and medium enterprises (SMEs), although they also face important challenges in reaching international markets: management, finance and the ability to upgrade and protect in-house technology can all be hurdles. As suppliers, SMEs are often given more responsibilities in the value chain and more complex tasks than in the past. This places them under increasing pressure to merge with other firms in order to achieve the critical mass required to support R&D, training of personnel, control over firms in lower levels of the chain, and to fulfil requirements in terms of standards and quality."**
>
> *Moving up the (Global) Value Chain* (an OECD Policy Brief)

Consumers in Europe, the US or Japan generally trust seafood processed in developing countries since often the name on the box is a familiar brand. Country of origin or processing does not seem to influence shoppers' choice much, except when there is a food safety scare. Then, the fish or whatever stops being a Brand X product and becomes a Chinese product or a product of wherever it last came from. In other words, the multinational brand gets the credit when the product is safe and reasonably priced, but the country as a whole, and often a developing country, gets the blame when something goes wrong.

Despite occasional setbacks, processing fish is shifting to developing countries. An attempt by Scottish authorities to attract young people into the industry explains why. Worried about the level of recruitment, they organised school visits to a fish factory to explain the interest and opportunities. The pupils' verdict was clear, if not encouraging: the work's boring and the factory is cold and smelly.

An alternative to setting up processing plants abroad is to exploit a traditional feature of globalisation that is largely absent today: migration. Temporary, seasonal migrant labour from low-wage countries are given temporary work visas that compel them to go back home at the end of their contract. The jobs refused by Scottish teenagers can seem attractive to workers from Eastern Europe who may earn four or five times what they'd get at home, and to workers from even farther away. Around 2 000 foreign

workers had to be recruited to stop Scottish fish-processing firms going out of business.

Tariffs may be less present in fishing than other branches, but as we said, they still exist. Traditional processing sectors, such as fish canning in Europe, have used high levels of tariffs to protect themselves from low-wage economies, but this protection is likely to be removed eventually as the pressure to protect local jobs disappears with the ageing workforce. And profitability is being hit by canned fish from developing countries with special tariff arrangements, such as tuna canned in Mauritius or American Samoa that can enter the markets of the EU or the US tariff free.

The trend to relocate processing to developing countries is likely to become stronger. China for instance has become a leading location for processing imported fish raw materials in customs-free zones for re-export to developed countries. North America exported more than $580 million of seafood products a year to China over 2002-04 and imported more than $1.4 billion. Much of that trade was relatively unprocessed frozen fish products exported to China for further processing and re-imported back into the US and Canada (Canadian salmon being canned in China for example).

Around 800 000 tons of frozen whitefish were processed in China in 2005, and the country produces about 30% of the world supply of whitefish fillets and fillet blocks from Alaska pollock, cod, haddock and hoki, based on imports from all around the world.

The Chinese processing sector works on extremely tight margins leading some analysts to wonder how it can make any profit, given the rise in the prices of fuel and raw materials. High yield in processing is no doubt the answer, but the question then arises as to how yields can be so high.

One reason may be excessive use of water-holding additives such as sodium tripolyphosphate (STPP) and even selling short weight, but given the need to respect international standards, such practices are unlikely to be tolerated for long. The EU has already issued warnings and given the China Inspection and Quarantine (CIQ) Bureau a list of suspect factories. The Chinese authorities responded by enforcing stricter standards and banning the use of STPP in products exported to the EU.

Other developing countries are trying to move up the value chain. The Namibian industry for instance is still a primary producer with no production of ready meals or coated products such as fish covered in bread crumbs. Like many developing countries, it has relied on a partner (Spain in this case) to look after marketing and other activities. Namibia is now modernising its fillet processing sector to tailor products to individual customer specifications concerning size and is producing portions moulded from small hake fillets.

Diversifying to achieve more flexibility and shifting production towards more valuable, processed products help to create a more predictable market with longer-term contracts and less price volatility. However, to succeed requires capacity building – giving workers new skills; developing modern management methods for quality control, production planning and performance assessment; and making sure that outside the factory, the transport infrastructures and administration help to get the product to world markets on time and that capital is available to develop the capacity needed to exploit opportunities.

Retail influences

The way shops sell fish is changing. Few towns now have fishmongers and most fish is bought in supermarkets. Generally, it comes pre-packed but some bigger shops have a fish counter offering personal service. This is expensive given the need for trained personnel, large displays, strict hygiene and quick stock turnaround. As a result, the profit margins have to be higher to cover the costs, reinforcing the image of fresh fish as a bit of a luxury. The supermarkets pass some of the expense on to customers, but given their buying power, they also try to drive down the price paid to the supplier.

Fishing and processing are more fragmented than many globalised industries, so this pressure may encourage them to join forces through mergers or partnership agreements to try to negotiate a better deal.

Winning and losing strategies

Namibia's fishing grounds are rich, but when the country gained independence from South Africa in 1990, they were heavily exploited and many foreign vessels were fishing illegally. The government devised a strategy to make its fisheries sustainable and to make sure Namibians benefitted. Total allowable catches (TAC) were introduced and levies charged on the basis of quotas. Trawling at shallow depths was banned and all larger vessels had to sail with observers on board.

The TAC and landings of hake rose steadily and the proportion processed onshore jumped from just 6% in 1992 to around 60% today. The hake processing sector now employs 70% of the 14 000 permanent and seasonal workers in the industry.

This success is due to a policy of inviting the public to apply for fishing rights rather than selling them to distant water fishing nations, and enforcing property rights once accorded. Fisheries rose to 10% of GDP in 1998 from 4% at independence. Over half of this contribution is from processing, making the industry an international player, rather than a simple resource provider. Namibian vessels receive no subsidies. Their landings have increased while catches by all vessels in the south east Atlantic have been declining. The future looks promising, although there is one cloud on the horizon – the possibility that major importers will stop Namibia's duty-free access to its markets.

Mauritania also has rich fishing grounds, but adopted a different strategy. The UNCLOS agreement stipulates that a country that has a surplus it can't harvest itself should allocate some of its resources to other states. Mauritania has an access agreement with the EU that guarantees it 86 million euros a year, plus a further 22 million in fees paid by vessels directly. While this has helped Mauritania with its foreign debt, the national fleet doesn't have the technical resources to exploit the resource, and few local crewmen find work on foreign vessels. The domestic fishery sector's contribution to GDP dropped from over 12% in the 1970s to around 5% today. Over a quarter of Mauritanian fishing vessels are laid-up on a temporary or prolonged basis, and almost all the rest are experiencing financial difficulties.

The processing industry has suffered from falling supplies from both domestic and foreign vessels landing in Mauritanian ports. Only 39 factories are export-approved and their storage capacity is only 700 tonnes. Processing units operate at only 10% capacity and 95% of Mauritania's catch is exported unprocessed. The government hopes to change this by allocating 10 million euros a year to support the national fisheries strategy, with a strong emphasis on sustainable fishing. Another million has been earmarked for the conservation of the Banc d'Arguin coastal area, a UNESCO World Heritage Site.

Supermarkets can also take advantage of fish to promote their brand image. One way to do this is through emphasizing social responsibility. Peter Redmond, former vice-president of Wal-Mart explained the thinking: "So the question is: why is environmental sustainability important for Wal-Mart? One of the biggest issues Wal-Mart faces is a continued license to grow.

Consumers want to know that Wal-Mart is 'doing the right thing' to protect the environment. This is also essential in building trust with influential stakeholders."

Other big supermarket chains have adopted a similar attitude, publicly committing themselves to "responsible" sourcing policies for food generally, and using seafood as a lead product in that positioning. They obtain independent certification to confirm that fish was bought from legal sources and from well-managed fisheries.

The Marine Stewardship Council standard is the most well-known scheme. Its strategy is based on appealing directly to the industry. So far, fisheries that have been certified were close to conforming to MSC standards already and only had to implement relatively small changes.

There is no clear example of fishery investors voluntarily promoting substantial changes to management practices to obtain certification at some future date. However the fact that major brands and retail outlets say they will stock only independently certified seafood may be enough to bring about the changes the MSC's founders foresaw.

Supermarket chains also have "own-label" products, products they sell under the name of the store rather than the manufacturer or another brand. Some chains say they will buy only capture sea food items for house brands if they too are sourced from fisheries independently certified as well-managed.

This concern with social and environmental issues has arisen thanks to campaigning by the environmental movement. The NGO Oceana for example started a boycott against Royal Caribbean Cruises as part of its campaign to stop the release of toxic chemicals and waste from cruise ships and get them to install advanced wastewater purification systems.

The campaign was successful, and on the Royal Caribbean web site, you can now read: "Because we depend on the sea for our livelihood, and because it's the right thing to do, we have heavily invested in state-of-the-art treatment technologies, such as Advanced Wastewater Purification (AWP) systems."

Fishing has been affected directly by a number of campaigns, including one to protect dolphins killed by tuna nets.

Demographic and lifestyle trends

As Sally Macé suggested, the fact that large numbers of women work changes food markets, both as to the type of food and how it is consumed. Despite some progress in sharing household tasks, most of the burden still falls on women. Working women don't have as much time to cook, and with different members of the family having different timetables, the traditional meal eaten together when the man of the house gets home is largely a thing of the past.

Speed and convenience in food preparation and meals prepared for only one or two persons are now seen as essential. Fish and chips is only one example of how fisheries pioneered changes in food retailing. Clarence Birdseye is another innovator. He didn't just invent an industrial method of copying the Inuits' way of fast freezing fish, he also invented much of the machinery that made mass marketing of frozen products feasible. And in a stroke of marketing genius, the Birdseye company (sold by Clarence Birdseye to General Foods) supplied shops with the open-top freezer units to display and sell their products.

Another change that Sally points out is the spread of street food. "At that time, you couldn't buy hot food to take away, and when we were teenagers we certainly couldn't afford to go to a restaurant, so we used to get something from the lady in the square and either find a spot nearby to eat it or take it to somebody's house."

The sharp increase in eating food away from home is one of the major changes in food retailing in many OECD countries. Most food is still consumed at home, but eating out has changed shoppers' tastes and expectations, introducing them to foods from different cultures for instance. Retailers are trying to cash in on this trend, but according to a survey by the UK food industry organisation IGD, almost four-fifths of shoppers want supermarkets to do more to provide them with the feeling that they are eating out when they are eating at home.

The number of women going out to work means that the number of dual-income households has risen, and people in this group, along with people living alone, are spurring growth in ready

meals, including the premium end of the market. Higher-income consumers particularly appreciate chilled meals, seen as fresher and of better quality than canned or frozen products. Families still prefer to buy frozen meals.

Canned ready meals are the big losers in the way markets are shifting, partly because they are not seen as being as tasty as rival products, but also because they do not have a healthful image. Canned fish are resisting this downturn better than meat-based products.

Fish products benefit from the demand for healthful eating. Fishing is a photogenic industry, and photos showing a trawler battling through crashing waves convey an image of nature, vigour and healthiness. The fashion for omega oil supplements and reports in the media about a diet rich in seafood being healthy are useful in marketing fish and even highly processed fish products.

Income and taste are not the only things influencing customers' choice. Moral issues are emerging as an important factor. This is nothing new in the fishing industry. Commercial fishing in Europe gained a considerable boost in the Middle Ages when the Catholic church banned eating meat at certain times. Nowadays, as the earlier discussion about boycotts and sustainability suggests, the fishing industry is often in the spotlight because of overfishing or particular methods of catching fish.

Climate change is now becoming an issue too, with the terms "food miles" and "carbon footprints" becoming more well known to shoppers. This could have contradictory impacts on fish retailing. For a start, the concepts are often presented in an oversimplified way. Transport is not the only contributor to environmental impacts. A product grown thousands of kilometres away may be less damaging overall than a local one that needs lots of pesticides and fertilizer.

Regarding fish, there could be a reaction against processed products imported over long distances, but on the other hand replacing meat with fish would reduce the "environmental footprint" of a person's diet. Writing in *Environmental Science and Technology*, Christopher Weber and Scott Matthews conclude that: "Different food groups exhibit a large range in GHG (greenhouse gas) intensity; on average, red meat is around 150%

more GHG intensive than chicken or fish. Thus, we suggest that dietary shift can be a more effective means of lowering an average household's food-related climate footprint than 'buying local'."

Fishing is special

Many of the issues discussed above would be similar whatever industry was discussed – changing consumer tastes or globalised value chains for example. But fishing is special with regard to at least one aspect. Fishing fleets can never be sure about supplies of their basic component, the fish, and access to them is uncertain.

This isn't the case in other industries. Take computers for example. In recent years, fires have destroyed major factories supplying processors or other vital components, but customers knew that any disruption would be temporary and that the factory would eventually be back in production. In the meantime, they turned to other suppliers.

When fish stocks collapse, they may never recover no matter how much money is spent on them. Other supplies can be developed, Alaska Pollock replaced cod to some extent and more and more species are being exploited. But sooner or later the same problem occurs again.

Fishing is also special in its relation to technological progress. In other industries, better machines and more efficient ways of doing things help to boost output for as long as demand exists. In fishing, this boost may be only temporary if poor management means that the result of better technology is simply to make overfishing worse.

This is why most international investors in fishing are processors of fish products, few invest in the catching sector, and even corporations that had invested are leaving it. Unilever, one of the biggest, left in the mid-1990s (around the time it became a founding partner of the Marine Stewardship Council). Another example is the reduction in the number of tuna boats sailing under the US flag in the Pacific. A number of vessels were sold to

non-US companies when outsourcing of tuna canning to South-East Asia became common.

Companies that do decide to develop internationally by investing in catching often have to face regulations that try to reserve domestic resources for domestic fishers. To slip under these barriers, harvesting companies use local companies, joint operations, service arrangements and vessel operating agreements. They also apply a criterion that would provide an excellent guideline for fisheries both globally and domestically: they prefer well-managed fisheries with dependable stocks to quick profits from zones that are doomed to disappear.

Find Out More

FROM OECD...

On the Internet

For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

Publications

Globalisation in Fisheries and Aquaculture: Opportunities and Challenges (2010):
Global fisheries markets have changed considerably over the past few decades and are witnessing increasing interactions across countries and continents. Change has brought substantial benefits to the world economy and a number of policy challenges for governments. The key to meeting these challenges, without compromising the advantages of increasing market interactions, lies in developing and implementing fisheries management frameworks and aquaculture strategies that can accommodate globalisation without undermining resource sustainability.

Globalisation and Fisheries: Proceedings of an OECD-FAO Workshop (2007):
Globalisation is a key feature of today's fisheries industry, where fish caught or farmed in one region may be processed in a second and consumed in a third. This workshop brought together fishers, processors, consumers, NGOs, restaurant and retail chains, as well as government and academic experts. They discussed the process of fisheries globalisation and highlighted the key issues that policy makers need to address so that, on the one hand, the opportunities that are created are not missed while, on the other, the risks are addressed appropriately.

Also of interest

CSR and Trade: Informing Consumers about Social and Environmental Conditions of Globalised Production, OECD Trade Policy Working Paper No. 47, Barbara Fliess *et al.* (2007):
Information strategies through which consumers obtain information about social and environmental production conditions (certification and labelling, corporate reporting, consumer guides and corporate marketing) are investigated to determine the extent to which they are used to inform consumers in sectors with globally traded products, including fisheries.

...AND OTHER SOURCES

Impacts of globalization on fisheries, FAO Fisheries and Acquaculture Departement
While globalisation is not specific to fisheries, there are very few aspects of fisheries and aquaculture that are not affected. This web presentation looks at the positive and negative impacts of globalisation on fisheries and describes actions taken and possible solutions to the problems posed. *www.fao.org/fishery/topic/13312/en*

Globalized Trade and the Macroeconomics of Capture Fisheries, Woodrow Wilson International Center for Scholars, Environmental Change and Security Program Conference, 22 February, 2007:
The trade of fisheries products is increasingly globalised, with protein and economic benefits largely moving South to North. This conference session identifies the winners and losers of globalisation; examines the key trends in fishing subsidies, tariffs, and other trade/marketplace measures; and explores how these trends and other factors contribute to overcapacity.
A video of the session is available here: *www.wilsoncenter.org/index.cfm?topic_id=1413&fuseaction=topics.event_summary&event_id=219202*

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Subsidies can help the fishing industry to develop by financing management, research, technological improvements and other activities in the common interest. They can also cause damage by encouraging the building of too many boats or making it worthwhile to continue fishing even at the risk of damaging stocks. Subsidies also give an unfair advantage to fishers from nations that can afford them. Yet it is hard to obtain agreement on a more rational, sustainable approach to subsidies, and it is hard even to get countries to agree on what actually constitutes a subsidy.

Hooked on Handouts?

By way of introduction…

On June 4th 2008, the European Union's headquarters in Brussels were surrounded by riot police. Hundreds of fishermen, mainly from France and Italy, had come to ask the Commission to help them cope with the sudden rise in fuel costs as oil prices soared to record heights.

Sauveur Liguoeri, a skipper from Sète in the south of France, told the Belgian television channel RTBF the reason for their anger: "Our minister has proposed a series of measures, but they're not compatible with European norms. So we're here to ask all these bureaucrats to listen to us. We're the ones who pay their wages!"

Speaking to the Belgian newspaper *Le Soir*, Giuseppe, an Italian fisherman from Pescara, explained: "I've been losing money for the past month because of the rise in fuel prices. We can't go on like this. The price we get for the fish doesn't even cover our outlays."

Sauveur Liguoeri is right in saying it's the taxpayer who pays the bureaucrats' wages. But taxpayers in OECD countries also pay six billion dollars a year in financial transfers to the fishing industry, and worldwide the figure could be three times that. We say "could" because it's hard to get precise figures on subsidies.

In this chapter, we'll look at how subsidies are defined and explain the differences in estimates of how much they are worth. Next, we'll examine the economic and other impacts on the fishing industry, and the political difficulties in reforming them. But first, we'll look at why subsidies attract so much attention.

Putting fisheries subsidies on the agenda

Some governments started to grant subsidies to fisheries in the 1930s, and the practice became widespread in the 1940s to help rebuild fleets destroyed during the Second World War and to improve food supplies. As early as the mid-1960s though, the

OECD was urging its member countries to be careful about granting subsidies, and drew attention to the links between subsidies and overfishing.

However, 30 years would pass before fisheries subsidies attracted attention more widely. In 1993, the FAO blamed subsidies for most of the $54 billion shortfall between the fishing industry's estimated revenues and costs. In 1998, the World Bank published the first major estimate of subsidies at global level, arriving at a figure of $14 to 20 billion. Other international organisations such as APEC (Asia-Pacific Economic Co-operation) also started to discuss the issue.

Environmental NGOs played an important role in the debate over fisheries subsidies, and the WWF has been particularly active in addressing the data gaps on fisheries subsidies. The inclusion of fisheries subsidies in the WTO's Doha Round of trade talks in 2001 thrust the issue to the forefront of the international fisheries policy agenda. At its Fourth Ministerial Conference in 2001, the WTO undertook to "clarify and improve WTO disciplines on fisheries subsidies, taking into account the importance of this sector to developing countries".

This was followed by a call at the 2002 World Summit on Sustainable Development in Johannesburg for countries to "eliminate subsidies that contribute to illegal, unreported and unregulated fishing and to over-capacity, while completing the efforts undertaken at the WTO to clarify and improve its disciplines on fisheries subsidies". These commitments were reinforced by the WTO Hong Kong Ministerial Declaration in 2005 (WTO, 2005).

The need to develop strong analytical foundations for the WTO subsidy negotiations prompted further efforts to analyse the impacts of fisheries subsidies on resource sustainability and trade. Work done by the OECD, UNEP and the FAO was complemented by academic research. The WWF continues to convene expert forums and present detailed proposals for subsidy rules.

At the time of writing, the Doha Round is stalled, and the future of the negotiations on fisheries subsidies is uncertain. But it is clear that the policy landscape has changed significantly as a result of all the data and analyses of fisheries subsidies. There is now a general agreement that fisheries subsidies can have an

adverse impact on the fisheries sector and on resource stocks, and that there is a need to address these impacts through national, regional and international forums. In a submission to the 2008 WTO talks, the WWF painted a bleak picture:

> Inappropriate subsidies... are among the factors driving a worldwide crisis of fisheries depletion... In the Mediterranean, one of the world's richest bluefin tuna fisheries has been shut down, the target of overfishing by heavily subsidized fleets; in the north west Atlantic, the historic cod fishery remains closed after years of subsidized overfishing; in the Indian Ocean, tuna and other valuable stocks face increased pressure as subsidized competition pushes fleets into fisheries far from their traditional grounds; off the coasts of Africa, local fishermen compete in their own national fisheries with subsidized foreign vessels, many fishing illegally. (WWF, 2008)

Defining and estimating fisheries subsidies

While there is consensus on the need to reassess subsidy programmes, there is not so much agreement on what actually counts as a subsidy. Very broadly, a subsidy is any undertaking by the government designed to increase the profitability of goods or services. The only legally agreed definition of a subsidy at international level is in the WTO's 1999 Agreement on Subsidies and Countervailing Measures (ASCM). Under Article 1 of the ASCM, a subsidy is said to exist if a benefit is conferred thanks to a financial contribution by a government or any public body where, among other things:

- A government practice involves a direct transfer of funds (*e.g.* grants, loans and equity infusion), potential direct transfers of funds or liabilities (*e.g.* loan guarantees).
- Government revenue that is otherwise due is foregone or not collected (*e.g.* fiscal incentives such as tax credits).
- A government provides goods or services other than general infrastructure, or purchases goods.

The OECD's definition of a subsidy, or "government financial transfer" (GFT), covers subsidies as defined by the WTO as well as transfers related to management, research and enforcement, fisheries access agreements and fisheries-specific infrastructure. In principle, the OECD definition also includes market price support, but data are rarely available.

The FAO and some other analysts use a much broader definition. For them, subsidies include all government interventions, or even lack of intervention, that affect the fisheries industry and that have an economic value. This covers services, direct financial transfers and indirect transfers (such as tax exemptions); regulations (such as import quotas, foreign direct investment regulations, gear regulations); and lack of intervention (for example, free access to fishing grounds, lack of management measures, inadequate enforcement).

Estimates for the value of subsidies depend very much on which definition is used, with figures in the following table ranging from $54 billion to just over $1 billion. It is hard to compare these estimates, given the different data sources, methodologies, timescales, geographical areas and definitions used. The most recent figures are from the OECD (up to 2006). At just over $6 billion, the OECD estimate is one of the lower ones, but only OECD countries are covered.

In practice, most analysis focuses on the narrower definitions of fisheries subsidies, given the practical problems of trying to put an economic value on many of the practices covered by the broader definitions.

Economic and other impacts of subsidies

The most immediate economic effect of fisheries subsidies is to increase the revenue or decrease the costs of fishing enterprises, and subsidies can represent a significant part of the value of a catch. However, transfers to the fishing sector also have economy-wide effects. These have received little attention in the debate about fisheries, mainly because the sector is not very important in most countries, and effects tend to be regional.

SUMMARY OF ESTIMATES OF FISHERIES SUBSIDIES

Source	Time period	Subsidy definition	Geographic coverage	Subsidy estimate	Data sources and methodology
FAO (1993)	1992	..	Global	USD 54 billion	Calculated as the difference between estimated revenue and estimated costs of the global fishing sector.
Milazzo (1998)	1996	WTO definition (plus unrecovered management costs)	Global	USD 14–20.5 billion	Based on publicly available budget information in China, EU, Japan, Norway, Russia, United States, and extrapolated to the global level. Plus estimates of the costs of management not recovered from industry.
OECD (2000 and annual reports)	1996-2006 (Ongoing)	Government financial transfers, based on the WTO definition	OECD	USD 6.2 billion (2006 data)	Based on annual data collection from OECD Member countries. Excludes most fuel tax exemptions, sub-national transfers.
APEC (2000)	1996	Support policies and programs	APEC	USD 12.6 billion	Data compiled from surveys of APEC Member countries and interviews with government officials.
Khan *et al.* (2006)	2000	Non-fuel subsidies	Developed countries Developing countries	USD 13.4 billion USD 12.3 billion	Data on 11 subsidy program types compiled from primary and grey literature, internet, newspaper articles. Data estimated when only qualitative data available.
Sumaila *et al.* (2008)	2000	Fuel subsidies	Developed countries Developing countries	USD 3.02–7.02 billion USD 1.16–1.51 billion	Data on fuel tax exemptions compiled from primary and grey literature, internet, newspaper articles. Data estimated when only qualitative data available.

The impacts depend critically on the state of fish stocks, the type of management regime and how well rules are enforced. In "open access" fisheries, where anyone can fish as much as possible, subsidies are unequivocally a poor policy option both economically and for sustaining resources.

By lowering costs, subsidies encourage more vessels to enter the fishery or stay in it. They may increase their revenue initially,

but eventually catches get smaller, costs increase since boats have to stay at sea longer and profits suffer.

Fish stocks suffer too, since the incentive is to catch as much as possible as quickly as possible to prevent other fishers profiting from the resource. Controls on the total size of the catch ("regulated open access") do not eliminate this race to catch fish, since the main difference is simply to intensify competition for a smaller possible catch.

In fisheries managed through a system of access rights, such as individual transferable catch or effort quotas, the adverse impacts of subsides on the resource will be substantially reduced.

In these systems, fishers have individual shares of a total quota, so there is no need for them to race to catch the fish before anyone else. In this situation, subsidies will raise the profits in the industry, which will raise the market value of the individual quotas if these are transferable – if the quota holder can sell it to someone else. And since the quota can be fixed to ensure sustainability, the impact on stocks should be negligible, or positive. The subsidy will be a pure transfer from taxpayers to the fishing industry.

> **"It is difficult to achieve the goal of reducing the fishing effort while continuing to subsidise the modernisation of production for an increase in productivity. The modernisation of production tools and an increase in productivity have a considerable impact on the fishing effort and therefore on the depletion of fish stocks. In addition, the benefits of these policies for coastal countries are not always obvious."**
>
> *Fishing for Coherence in West Africa: Policy Coherence in the Fisheries Sector in Seven West African Countries*

However, perfect enforcement of such regimes is rarely (if ever) achieved in practice, and the introduction of subsidies to an apparently well-managed fishery can be damaging. This isn't just a problem with subsidising regimes based on individual quotas. Even apparently useful subsidies such as buyback programmes designed to reduce excess capacity can be counterproductive. Fishers may come to expect that the government will cover losses due to overinvestment in vessels, and make investment decisions

based on anticipated subsidies rather than the true economic and ecological viability of the fishing grounds.

This can have economy-wide effects too. Investors from outside the industry may decide to take advantage of the short-term gains to be made by investing in fisheries rather than elsewhere in the economy where the benefit to society may be more long-lasting. And the overall impact may even be negative if the subsidies make the depletion of fish stocks worse and thereby accelerate the decline of the industry.

Financial transfers to fisheries may have goals other than to improve conditions in the industry, such as supporting local communities or preserving a cultural heritage. These objectives are rarely explicit in programmes, making it hard to know what the concrete objectives are and difficult to judge if they are being achieved.

For example, subsidies to build or upgrade fishing boats may not be the most cost-efficient way of achieving regional development objectives such as maintaining a shipbuilding industry. Indeed, using subsidies in fisheries to support social and development policies when many fish stocks are overexploited may only undermine the medium- and long-term development goals of countries.

Giving the money directly to the fishing communities may be more cost-effective, allowing them to make their own choices about how to best manage their affairs. The money may also be better spent in promoting the participation of fishers in management schemes, and in enforcing fisheries management decisions, or in helping fisheries workers to acquire new skills.

As for the industry, subsidies may help individual fisheries workers in the short term, but not in the longer term. Often, the money would be better spent helping people to acquire new skills or exploit new opportunities. When the economy is doing well, support to relatively small industries that would otherwise disappear or face radical restructuring may not attract much attention. But in harder times, this support may be reduced drastically, and with little warning, and it will then be too late for people who have come to expect government support to develop alternatives.

Fisheries subsidies, trade and the Doha Round

Financial transfers to fisheries are likely to have some effect on international trade although it is hard to determine the overall impact. Fishers who receive subsidies can expand into markets they would not otherwise be in, and have access to resources that would be uneconomic otherwise. Industrialised fleets operating far from home and affecting the livelihood of local fishers is one consequence of this. Without competition from subsidised rivals, local firms may have been able to export more of their own produce.

Questions concerning international trade and competition in the fisheries industry were discussed in the WTO's Doha Round of trade talks, including fisheries subsidies. This helped to focus the attention of policy makers on the complexities and imperatives of such reform. The fisheries talks also broke new ground in multilateral negotiations about international trade by including a strong environmental aspect. Fisheries have thus become a testing ground for the integration of trade and environmental objectives in the WTO system. The outcome of the fisheries subsidies negotiations may well set a precedent for future negotiations (if any) in other resource sectors.

A wide range of difficult issues is yet to be fully resolved in the negotiations. For example, questions still remain over the scope of the prohibition on subsidies. While there is general agreement that direct subsidies to capital and operating costs contribute to overcapacity and overfishing, the inclusion of subsidies that are less direct in their contribution (such as port infrastructure and income support) is strongly debated.

The issue of how sustainability criteria, as a precondition of the provision of some types of subsidies, are developed and applied is also controversial. It is though widely accepted in the negotiations that the management regime, and the effectiveness of enforcement, will have a significant influence on the potential impact of subsidies.

Special treatment for developing countries has been a central feature of the WTO negotiations. The challenge lies in allowing developing countries sufficient "policy space" to be able to

develop their domestic fisheries industries, while at the same time ensuring that impacts on resource sustainability are minimised and that international fisheries are not affected negatively by any increased capacity.

This issue highlights the fact that although terms such as "developing country" can be useful labels when talking very generally, they are increasingly meaningless in describing a group with common characteristics and interests.

"Fishers from developing countries" may conjure up an image of small boats and fishing villages dotted along the shore. But in WTO negotiations, it includes major fishing powers such as China and India and their massive factory ships and fleets of large trawlers competing (and out-competing) on the world's oceans with rivals from the "developed countries". The prospect of these countries being exempt from large elements of the subsidy disciplines is potentially problematic.

The future of the Doha Round is uncertain, but significant progress has been made on the fisheries subsidies negotiations. From an initial high degree of scepticism, there is now agreement on a broad framework for moving forward. While there are difficult issues to be resolved, the WTO negotiations have been very effective in focusing analytical and political attention on the potential benefits from reforming fisheries subsidies.

Reforming subsidies

Calls to reform fisheries subsidies, as shown in the Doha Round, have grown louder over the past couple of decades, both nationally and internationally. Pressure on government budgets, campaigns by NGOs, collapses of fish stocks and low profitability have made it clear that "business as usual" is no longer a feasible option. However, recognising that something has to be done is not the same as agreeing on what this something should be, and then doing it, especially if there are negative consequences for some people.

In many ways, fisheries provide a textbook example of the political economy problems surrounding policy reform. Fisheries

are characterised by relatively concentrated groups with a high incentive to maintain the status quo and resist any reduction in subsidies. The costs of subsidy reform are relatively high while the benefits of reform (in terms of reduced government expenditure) are spread very widely across all the taxpayers in the community. This gives the people receiving subsidies much higher stakes in defending a policy that most other people don't care much about one way or the other.

As a result, the group that gains from the status quo – that receives the subsidies in this case – is seen as politically "strong", while the losers (the rest of the population) are regarded as politically "weak". This unequal distribution of gains and losses from change hinders reform efforts and reinforces the status quo.

The result is often protests by a few people with a lot to lose, of the kind mentioned at the start of the chapter.

Despite these difficulties, the experiences of a wide range of countries demonstrate that subsidy reform is feasible and will lead to improved sustainability, profitability and resilience in the industry.

In Norway, for example, a series of resource crises in the 1980s, with low profitability, excess capacity in many fleets and high levels of subsidies, led the government to make fundamental changes to the way in which fisheries were run. Subsidies were slashed from over 1.3 billion kroner in the early 1980s to less than 200 million by 1994 and only 50 million in 2006.

Fisheries management was reformed too, with a shift from open to closed access to the fisheries and the gradual introduction of market-based management measures and a strictly enforced licensing regime. This led to the sector becoming more self-reliant and flexible in generating profits, rather than depending on government money.

Reform of the European Union's Common Fisheries Policy (CFP) in 2002 and later also reflected the increasing pressure for reform. While the total amount of subsidies was not significantly reduced, the reforms targeted the conditions under which the subsidies could be provided. In particular, there was a shift towards "greener" practices, with a ban on subsidies for vessel construction from 2005 and tighter controls on vessel

modernisation subsidies to ensure that total fishing capacity does not increase as a result of the subsidy. These principles were later adopted under the European Fisheries Fund, which became effective in 2007.

Short term versus long term

Subsidies are neither good nor bad in themselves. They are used to provide research, management and enforcement services that may not be supplied if left to market forces. They can also help the industry to cope with temporary problems during restructuring.

Apart from that, the rationale for subsidies is unclear. They are often used as the main tool to address social problems or regional development issues that could be better tackled with a package of economic, employment, environmental and other policies in which subsidies would only play a minor, and temporary, role.

Subsidies can even make problems worse by subsidising unsustainable practices. Transfers increase the profits of the industry in the short term but more often than not, the longer term result is too many fishers chasing too few fish and only being able to do so thanks to government assistance.

The fishing industry is better organised when it comes to influencing policy than the groups trying to get rid of subsidies or campaigning on other issues the industry sees as against its interests. This is changing though. Pressure from NGOs has already forced a change of vocabulary with at least lip service being paid to sustainability. It should be possible to build on this to promote real change by convincing fishers that ultimately, subsidies are often part of the problem, not the solution.

Fisheries subsidies

Price subsidies Some governments pay a certain sum per kilo of fish landed or guarantee a minimum price. Not all of this subsidy benefits the fishers, since buyers may benefit too. Price subsidies may make it profitable to keep on fishing even when market prices are low.

Operating subsidies Many governments give grants to build boats or improve their equipment, or offer other kinds of assistance with fixed costs such as tax breaks or loan guarantees. Fuel costs, the reason for the demonstrations mentioned above, are the most frequent example of subsidies to variable costs.

Globally, fisheries need on average 620 litres of fuel to catch a ton of fish, and fishing is probably the only industry in the world that is becoming less fuel efficient. The boats have to go farther, stay at sea longer, drag bigger nets and work less productive waters to maintain catches.

Fuel subsidies are part of a vicious circle that enables firms to do this without going bankrupt, but makes the problem worse in the end, meaning more fuel is needed to stay in business. Governments also subsidise some other variable costs such as insurance coverage or bait.

Decommissioning of vessels and retirement Many countries have paid grants to owners to take their boats out of the fishery. Sometimes they have to destroy the boat, while other schemes allow them to sell it to another fishery. The aim is threefold: cushion the loss to boat owners and license holders; improve the profitability of those remaining in the industry; and rebuild fish stocks.

Paying workers to leave fishing seems to be less developed than schemes for decommissioning boats, and fishers seem reluctant to participate. Only 7% of over 5 000 fishers eligible in Newfoundland following the collapse of cod stocks accepted, perhaps because the sums offered were too small, or because they expected the cod to return and accepting the payoff meant agreeing to leave fishing forever.

Fishery infrastructure What counts as fishery infrastructure seems straightforward – things like harbours and so on. But it's not as simple as it looks. Fishing harbours are used by a whole range of other craft. To say that subsidising a fishing port is subsidising fisheries implies that only fisheries benefit. Governments also subsidise roads, airports and rail, but this isn't considered as a subsidy to the transport sector. To complicate things further, infrastructure may be subsidised only partially, as when boats have to pay landing fees.

Management, research and enforcement It can be argued that having the government pay the costs of fisheries management, research and enforcement amounts to a subsidy, since the profits of the industry depend critically on how well the fishery is managed. The costs of fisheries management can be substantial: in Newfoundland they ranged from 15 to 25% of the gross value of catches in the 1990s and in Norway they were close to 10%. Fishing profits would be substantially affected if firms had to pay all the costs.

Continued on following page

Fisheries subsidies *(continued)*

Access to other countries' waters Countries sometimes pay to allow their fleet access to another country's economic exclusion zone. Some arrangements are transparent, but in other cases, it is very hard to determine whether a subsidy is being paid, or even if an arrangement exists. A country may grant access to its waters in exchange for something that has nothing to do with fishing. This could be something tangible such as help with building a road, or more intangible such as diplomatic support in international negotiations.

Income support and unemployment insurance Income support can target either crews or owners and is clearly a subsidy. It can take the form of tax rebates, while unemployment insurance is essentially the same as in any other industry, even though fishing may benefit from special arrangements accorded to industries where work is seasonal. Subsidies do not raise fishers' income much, since the money tends to replace what owners would have paid rather than supplementing it.

Find Out More

FROM OECD...

On the Internet

For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

Publications

Financial Support to Fisheries: Implications for Sustainable Development (2006):
OECD governments pay out around $6 billion a year to support the fisheries sector. Such support has often been linked to over-fishing and over-capitalisation, and its reform may lead to improved economic, environmental and social outcomes. This report analyses the impacts of such transfers from a sustainable development perspective by addressing the economic, environmental and social dimensions of financial transfers.

Also of interest

Subsidies: A Way Towards Sustainable Fisheries?, an OECD Policy Brief (2005):
Public money, variously called subsidies, support or financial transfers, is used to help manage fish stocks, to modernise fishing fleets and to help communities and regions that can no longer make a living out of fishing to develop other economic activity. The money is also intended to assist in resolving problems of over-fishing and over-capacity that affect many parts of the OECD fishing industry. But are subsidies really helping to achieve a sustainable fisheries sector? Or are they encouraging too many vessels and people to stay in a fishing industry that may not be able to support them in the medium to long term?
www.oecd.org/publications/policybriefs

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ftp://ftp.fao.org/docrep/fao/006/y4647e/Y4647e00.pdf

Sustainability Criteria for Fisheries Subsidies: Options for the WTO and Beyond, UNEP and WWF, Geneva (2007):
This paper, jointly commissioned by UNEP and WWF, provides an analysis of the fisheries conditions and management practices governments should consider as prerequisites to the use of subsidies. Given the tendency of many subsidies to encourage overcapacity and overfishing, such prerequisites cannot hope to eliminate the risks altogether. But they can provide both domestic policymakers and WTO negotiators with an important starting point in their efforts to ensure that fisheries subsidies are subjected to meaningful limits and conditions. *http://assets.panda.org/downloads/unep_wwf__si_report__final_.pdf*

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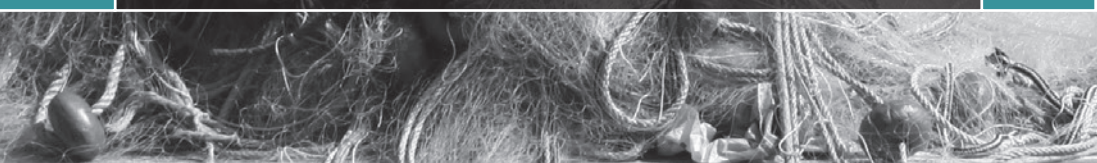
Despite the high-tech, globalised nature of much of modern fishing, it is still based on communities where tradition is important and fishing is a way of life as much as a job. Practically everybody in the community may be affected by a decline in fishing activity, whether they are directly involved in catching and processing fish or not. This makes change hard, especially if there are few other industries in the region. Yet the alternative can be much worse – the collapse of fishing and the decay of the communities it supported.



Sea Changes

By way of introduction…

> **Oh the work was hard and the hours were long,**
> **And the treatment, sure, it took some bearing;**
> **There was little kindness, and the kicks were many,**
> **As we hunted for the shoals of herring.**
>
> Ewan MacColl, *The Shoals of Herring*

Ewan MacColl's remarkably unsentimental ballad about a boy learning his trade is only one example of artists being inspired by the life and work of fishers. Neil Gunn's *The Silver Darlings* (also about herring) or Pierre Loti's *An Iceland Fisherman* give a more romantic view, but these works, like many descriptions of fishing, insist on the strong sense of community among people who depend on the sea for their livelihood.

Danish author Hans Kirk describes what happens when a fishing community is uprooted. In his 1928 masterpiece *The Fishermen*, the protagonists decide themselves to abandon their harsh traditional life in one part of Jutland and move to another area where conditions promise to be easier. Kirk follows the group as, for a number of reasons, their community slowly disintegrates.

Fishers need to be able to depend on each other simply to survive the harsh, dangerous conditions at sea, and the crew on the boats need to know that someone will help their family if anything happens to them. A higher percentage of workers are killed and injured in fisheries than in any other profession, in the developed countries at least.

The songs, novels and other depictions have another point in common – they deal with a way of life that is under threat, or has even disappeared, due to a combination of declining stocks, modernisation of the industry and competition from fish farms.

Other traditional industries – mining or textiles for example – have faced similar challenges when the main employers disappeared, leading to job losses and painful restructuring. "Adjustment" sounds fairly straightforward: something is not quite as you'd like it, so you change it a bit, and this fixes the problem.

But to people directly affected, it can be traumatic. Not only are they losing their livelihood in regions where there may be few or no alternatives, there is often a feeling of betrayal. They've done everything asked of them by the authorities – invested in new technology or reduced catches depending on the policy of the day. They've even thrown fish back into the sea. And suddenly it's over, their job no longer exists.

The reaction is often violent. In the Spring of 1994, there were riots and protests in practically every major fishing port in New England following the announcement of limits on the number of days boats could go to sea. Since then, fishers in many countries have regularly taken to the streets to make their voice heard.

Adjustment in the fishing industry seems to be harder, to take longer and to be more conflictual than in other sectors. This chapter will look at what adjustment programmes try to accomplish, and the tools they use to do this. We will also discuss the close relationship between fishing and the communities that depend on it, and why the human side of fisheries adjustment is so important.

Why adjust in the first place?

The obvious answer is that you just have to read the papers or watch the news on TV to be aware of stories about the problems of the fishing industry and realise that something has to be done. Fish stocks are disappearing and with them not only jobs, but a vital source of food for millions of people and a major source of revenue, particularly in developing countries.

Fisheries represent up to 30% of state budget revenues in West African countries and employ 7 million people in West and Central Africa. Figures from the FAO for 1995 show that while fish provide slightly over 7% of animal protein in North and Central America and more than 9% in Europe, in Africa they provide over 17%, in Asia over 26%, and in the low-income food-deficit countries including China they provide nearly 22%.

Fisheries adjustment, or lack of adjustment, has numerous implications. Another way of understanding the necessity of adjustment is through the lens of sustainability. If certain changes are not made, then the result will likely be one of total depletion or collapse of many fish stocks – and without fish there can be no fishing industry, no employment for fishing communities.

So while adjustment measures may at times be unpopular, it is important to remember that they are merely a means to an end: to find a balance between the different groups that rely on fish for their livelihood, one that allows for fishing to continue indefinitely.

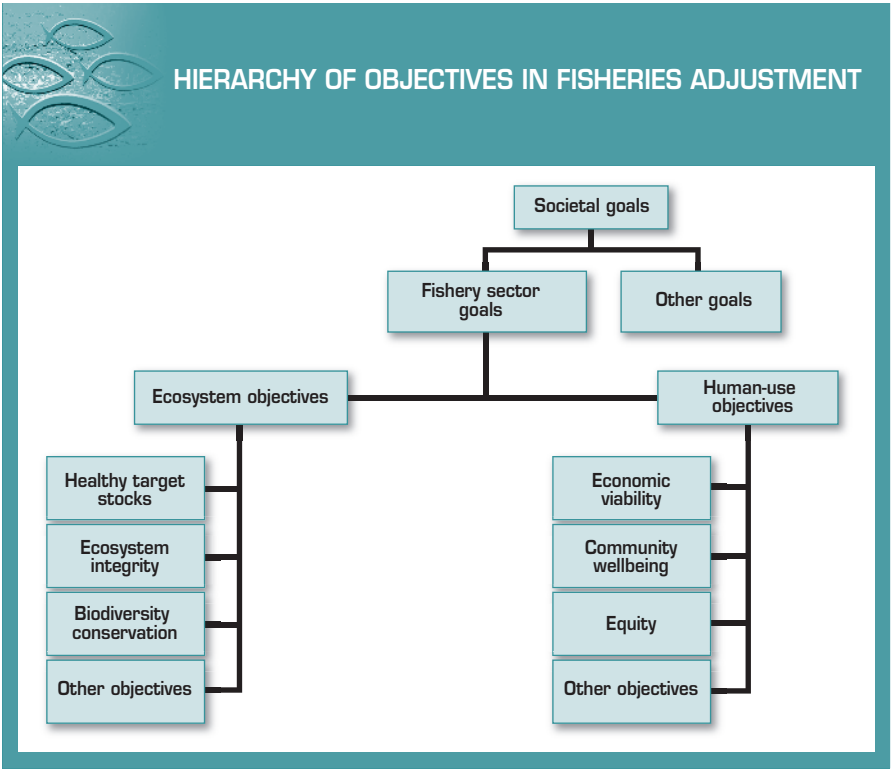
That said, there is little agreement on what constitutes "the best" adjustment program. Adjustment in any industry usually brings distress in its wake for the people whose lives are the most affected, so before implementing an adjustment programme, it's important to be clear as to the objectives. In the present case, that means taking account of the wider implications as well as industry-specific goals. The diagram below shows how these are linked.

In an "objectives-based" approach like this, hierarchy is important. Another point to remember, even if it seems like stating the obvious, is that actions and objectives are not the same thing. Reducing fishing capacity is a good illustration of what we mean. This is often seen as an objective, whereas in fact it's a tool. It's not an end in itself, it's supposed to contribute to one or more of the objectives illustrated above, such as healthy target stocks. We'll discuss this in more detail below.

Sometimes the goals may be hard to reconcile, in fact they might even be contradictory, at least in the short or medium term. In some fisheries, the best solution to conserve stocks or biodiversity might be a total ban on fishing for a few years, but the impact on fishing communities would be devastating.

That doesn't mean that policy makers should abandon long-term objectives. On the contrary, one of the roles of government is (or should be) to look beyond the immediate situation to see how best to achieve longer-term aims, while taking care of the negative short-term consequences.

In the case of fisheries, this involves finding the right mix among commercial, recreational, and subsistence fishers; small-scale *versus* large-scale operations, artisanal *versus* industrial



Source: Structural Change in Fisheries: Dealing with the Human Dimension.

fishing; and types of nets, boats and other gear used. And within any given user group or type of gear, the policy has to find the right balance among a variety of factors that contribute to fishing, including labour, capital, technology and management.

Adjustment, development and capacity

Usually when you talk about developing a sector, it's in terms of expanding it. Here, we take adjustment to mean increasing the overall long-term level of benefits from the fishery without necessarily increasing the catch (indeed, sometimes this could mean maintaining the level of benefits while decreasing the catch).

This can be done first through a range of measures including market development, quality control and improvements to distribution processes. And second, by improving the physical infrastructure, technological capabilities, institutions and productivity in the fishery system.

As we said above, adjustment is often talked about in terms of managing fishing capacity, mainly the number of boats or their catching power in a fishery. Overcapacity is worrying because it can encourage overfishing, leading to lower production levels and even the total disappearance of the fishery and its benefits. It can also mean depriving other sectors of the economy of workers and investment that could be better used.

Nevertheless, the question of overcapacity is not as simple as it seems. In investment terms, you could say that the damage has already been done. The boats have been bought and the money used to buy them is no longer available to invest elsewhere. The question then is whether it would be more cost-effective to use public funds to remove these boats from the fleet, or whether it would be better to spend this money on improving management and controlling catches.

Likewise, if the fishers have few or no alternatives to fishing, then spending money on getting them to leave the industry may not be very cost-effective. Economists call this the "social opportunity cost of labour" – the cost to society of having the fisher working in the fishery rather than doing something else.

When the fishers have no alternative, this cost is zero since keeping them in the fishery is not depriving another sector of their labour. In fact removing them from the fisheries may lead to an economic loss to the regional economy. If they have no other jobs to go to and no other means to maintain their income, local businesses will start to suffer from reduced spending power.

Forms of adjustment

The "fishing effort" involves capital, technology, fishers, management, and regulations and their enforcement. Adjustment

could target any or all of these components. The actual strategy will depend on the objectives that adjustment is supposed to promote.

When the aim is to expand the industry, adjustment programmes may provide loans to buy new boats or more powerful engines. The technology may be more low-key. Artisanal Indian fishers now use mobile phones to call ashore for information about market conditions before deciding where to land their catches. Phone technology could be developed to offer many more services, such as telepayment.

When the aim is to reduce catches, adjustment involves schemes such as quotas or buying back boats to destroy them.

Apart from encouraging or banning certain technologies (such as huge "wall of death" nets that catch just about everything they touch), restructuring can take a number of shapes involving ecosystems and socioeconomic systems, or management and policy measures:

- physical restructuring such as decommissioning schemes;
- biological restructuring, meaning human-induced change in the attributes of marine species such as population size or biodiversity measures;
- social restructuring, covering socioeconomic processes such as urbanisation or demographic change;
- industrial restructuring, for example changing employment structure;
- institutional restructuring, notably change in fisheries management, and government policies and programmes.

How does adjustment affect aspects other than fishing?

"Close-knit" is one of those clichés used when disaster strikes a small community, usually to describe the solidarity shown by people not directly affected. But the image of a number of interconnected strands is actually a good metaphor for the complexity of the interactions of the fishing industry with the

communities in which it is based, the natural environment on which it depends, and the economic and other factors shaping its destiny.

Many people in fishing communities depend on fishing for their livelihood, not just those on the boats. This aspect is often overlooked in analyses (and indeed policies) that concentrate on the "core" elements of fish and fleets.

In some communities, almost two-thirds of jobs may depend on fishing. Members of a fisher's family may work in a fish processing factory or in the distribution networks that get the fish from the boats to consumers. Any decline in fishing can have an immediate impact on the incomes of a range of occupations and in the longer term, the outcome can be the decay of communities as local shops and services start to suffer.

This can even affect sectors expected to provide alternatives to fishing, such as tourism, if harbours and other infrastructures linked to commercial fishing are no longer maintained.

Moreover, alternatives to fishing are often lacking in coastal communities, and when the skills learned through fishing can be transferred to other sectors, the jobs are usually based elsewhere. The North Sea oil and gas industries require skilled boat masters, but these occupations tend to be based in large towns and cities, not in traditional fishing villages.

"The global economic crisis has resulted in new government programs designed to alleviate the unique difficulties facing fishing and other single industry communities. Many communities have taken advantage of government grants to invest in infrastructure projects and employment initiatives. The crisis and government response serves as a catalyst for economic diversification."

Paul Ma, Fisheries and Oceans Canada,
OECD Rural Conference, Quebec City, Oct 13-15, 2009

Some fishers therefore continue fishing illegally after plans to limit capacity are implemented. If this was limited to a fisher taking a few fish from time to time, it wouldn't make much difference, but it can also be big business and threaten efforts to save the fisheries. In August 2007, seventeen people went on trial

in Sweden accused of illegally fishing more than 100 metric tons of cod and passing it off as pollack to circumvent EU quotas. The extra catch was worth almost $300 000.

Finding adjustment strategies that will produce good, long-lasting results therefore means considering how it affects a range of issues and people. The first of these is the "post-harvest" sector, what happens to the fish once it's caught.

The fish have to be processed before being sold. Here there are enormous differences between a factory ship costing millions of dollars able to handle a wide range of operations from cleaning through deep freezing, and a trawler with rudimentary storage in ice or water.

On-shore too, post-harvest operations may involve high levels of investment in plants and equipment, such as fish meal factories, or more labour-intensive processing done by fishers and their families.

Once the fish is processed, it has to be sold, and adjustment strategies have to take market trends into account; for example they could encourage fishing that qualifies for "sustainable" labels. So as well as recognising the role of fishing in the community, adjustment proposals have to consider fishing as part of the international food industry with its global value chains and competition among producers and products.

Windfall payments

Ewan MacColl's fisher mentions how at one point "I was cook and I'd a quarter sharing". When he talks about "quarter sharing", he doesn't mean sharing living quarters, he's referring to the system of payment common in fishing. This affects not only the equity of adjustment policies, but many other aspects of working conditions too, and is worth describing in some detail.

In the share system, crew and owner cover certain operating expenses which are deducted from the money received from the sale of the catch. What is left is divided among the boat owner and the members of the crew according to an agreed formula.

In MacColl's case, a quarter wouldn't be a quarter of the final profit. Instead, there would have been an agreement before setting out that the profit would be divided into a certain number of shares. The owner would probably get the most, followed by the captain, the mate, and so on down the hierarchy to the young apprentice (who also had to cook for the crew) who is entitled to a quarter of *one* share.

The share system encourages the crew to improve productivity since the fewer people sharing, the more there is for each person involved. Their share in the costs is bigger too, so if the catch is bad, they may end up with little or no money to take home.

To maximise their expected earnings, fishermen tend to operate with as few crew members as possible. But the right number for a particular campaign is hard to estimate, given how catches can fluctuate from one season to the next, and even from day to day. This means that sometimes the crew have little or nothing to do, while at other times they may be working round the clock.

"This study shows that in recent years commercial fishing has been by far the most hazardous occupation in Great Britain, with a fatal accident rate that is 115 times greater than in the general British work force, and almost 4 times greater than the second most hazardous occupation, dockers and stevedores."

Roberts (2009),
"Britain's Most Hazardous Occupation: Commercial Fishing"

Sometimes, share fishermen are also paid a minimum wage. Their income still depends on the size of the catch and the proceeds from its sale, but the sharing is usually done before, rather than after, the deduction of operating costs. In some operations, fishermen receive both a regular salary stipulated by contract or collective agreement and also receive a share of the catch calculated on the basis of the gross proceeds from its sale.

This admittedly complicated system may mean that adjustment measures do not correspond very closely to the financial realities of the industry. Adjustment may be approached directly through buybacks of fishing vessels or fishing licenses, or indirectly through introducing a system of fishing rights to encourage capacity reduction.

However, both the direct and indirect approaches can produce situations where a certain group in the fishery (often the vessel owners) receive windfall payments from the government. This can be cash for surrendering their vessels and licenses, or a "gift" of fishing rights (such as a quota). In either case, this enriches a small number of people and gives the majority nothing.

A classic instance of this inequity is the free provision of individual quota rights to vessel owners in a fishery, while nothing is provided to those in the same communities who happen to be crew members on the same vessels, and who have contributed to building the catch history on which the quotas are often based. The feeling of injustice this provokes has a negative impact on the social cohesion of fishing communities.

Crew members are not the only victims. Adjustment programmes based on buyback do nothing for other groups hit by the crisis such as the people working in processing and other fishery support industries. In fact buyback programmes typically decrease employment opportunities for these groups. Of course they may get help from other schemes such as unemployment compensation, early retirement pensions, job training and placement programs, financial assistance for post-secondary education, or grants to develop a new business.

Ghost town

In 1998, following the collapse of cod fishing off Newfoundland, the *UNESCO Courier* described what happened to the town of Trepassey, which apart from fishing, also had a fish processing plant.

Trepassey is practically a ghost town now. The Sunday-night bingo game which used to draw hundreds of residents now sees about a dozen people gambling for a measly jackpot. The community used to screen movies in the parish hall but no one can afford admission these days, and many of the young people have left anyway. Families drift out of town almost every week, abandoning homes they know they'll never sell. "Some of them didn't even bother to board their windows", says Don Corrigan, a veteran fisherman who still lives in Trepassey. "They just locked the doors and moved on. They've no intention of coming back."

This is the human side of an environmental disaster.

Source: *UNESCO Courier*, July-August 1998.

Another problem with the share system when adjustment means job losses, is that calculations of redundancy payments, unemployment benefits and pensions may not take shares fully into account, whereas the share may have represented a substantial part of a fisher's income.

A further problem is that some benefits depend on time worked, but fishing is seasonal, with earnings concentrated in relatively short, intense periods of activity followed by periods of idleness.

Decay in fishing communities

Financial loss may not be the only consequence of losing one's job in fishing. When the whole community and the social relations within it are defined by the hierarchies, traditions and practicalities of fishing, those removed from a fishery in the course of adjustment may well feel their sense of identity lessened. They may even feel they are no longer a full participant in their community.

This can happen even if the individual was compensated well for leaving the fishery, but may be much more intense in the case of uncompensated crew members on vessels removed from the fishery through mechanisms in which the vessel owners accepted buyouts or sold their fishing rights.

The consequences can be dramatic both for the person concerned and the whole community. Drug and alcohol abuse, already a problem in many fishing communities, can worsen to the extent that even if other employment becomes available, or fishing picks up again, those affected may not be fit for work.

In a region where fishing is the main activity, coastal communities will typically have the fishery sector as the engine of the local economy. A decline in the fishery, whether through a decline in fish stocks or through deliberate restructuring in the sector, can have dramatic impacts on the integrity of the communities. A process of decay can set in.

The most evident to begin with may be the physical decay of infrastructure related to fishing (wharves, boat houses, market

buildings and the like). If people start to leave to seek jobs elsewhere, community services will start to be affected. There may not be enough children to keep the school open for instance. This process will be accelerated if fishing and related activities are centralised in a bigger place elsewhere. Ultimately, this can lead to decay in the spirit and cohesion of the communities.

The end of fishing also affects other industries that rely indirectly on it. Fishing villages are popular with tourists, but if the harbours fall into disrepair and social problems become serious, they will go elsewhere. Of course they may start to come back once the fishers and their families have gone, buying up traditional cottages for holiday homes, but the fishing community will no longer exist.

Adjustment off Cape Cod

The *Boston Globe* described the sequence of events that provoked the 1994 riots mentioned above. Its reports on New England contain many elements typical of adjustment everywhere.

Fish stocks declined by almost 70% over 1963-74, and in 1976 the government passed the Magnuson-Stevens Fisheries Conservation and Management Act, creating a 200-mile exclusion zone off the US coast. Foreign trawlers were banned and federal agencies offered loans and other incentives to modernise the New England fleet. Construction tripled, and a new fleet of highly efficient boats helped productivity to grow by 10% a year over 1977-82.

The Magnuson Act had also created the New England Fishery Management Council, mainly composed of fishermen. Not surprisingly, the Council was hostile to restrictions on fishing, and stocks of groundfish (fish such as sole or halibut that live near the sea bed) declined by two-thirds in ten years. The Council was facing a crisis. There were around 1 500 boats in a fishery that could sustain a fifth of that number. It decided to control the fishing effort – in effect keeping the same number of boats, but making them less efficient by reducing the number of days at sea and changing the type of gear they could use.

"Effort control" didn't work: during the 1996 season for example, the fleet caught four times as much Georges Bank cod as it was supposed to.

The next attempt involved buyback – Congress spent $24 million buying boats and destroying them, but others quickly took their place. Finally, in 2002 a federal judge ordered the government to drastically reduce fishing. The case went back and forth through the courts for several years, with conservation groups complaining about continued overfishing and industry groups and fishers complaining that the measures imposed were unnecessary and unfair.

The politics of adjustment

It is often difficult for policy makers to design successful adjustment policy and programme options, because the state of fishing resources and the general economy may be unfavourable. As well as that, decisions to close fisheries are usually taken only at the last minute, leaving little time to develop policy options and programmes.

Sometimes this is because attempts to find solutions are blocked by the industry itself. Fishers who accept the need for quotas may disagree with how the actual numbers are calculated or how the licences are distributed, particularly when the agreement is international and they see foreign boats working their traditional fishing grounds while they have to stay in port.

It can also be hard to determine who qualifies for adjustment measures. Many Newfoundland communities lost up to 20% of their populations, mostly in the 18-35 age group during 10 years of fisheries adjustment over 1992-2002. Canada has had success with a voluntary, multiple-round, reverse auction process where fishers set the value they will accept to return the licence, and regional review boards, managed by fishing industry representatives, evaluate bids of comparable price against a number of factors.

Given that most forms of adjustment involve a certain degree of dislocation, social stress and potentially negative economic impacts, at least in the shorter term, it is important to treat the problem in its wider context, looking at what effect the proposed measures might have on the communities targeted and the region they belong to.

Perhaps the greatest challenge is acting before it's too late. Temporary measures can buy time, but often they are seen as illogical and ill thought out and only delay finding a real solution:

- After risking their lives at sea, fishers are understandably upset at having to throw away part of their catch which is dead anyway.
- It's hard for members of a community to accept that some of them can no longer do a job they love, despite its hardships.

- Scientists measuring a constant decline in stocks are frustrated to see their advice ignored.
- Policy makers who have to design a solution get the impression that a reasonable compromise is impossible.

But these groups can agree that they all want a healthy fishing industry and healthy fishing communities. They can try to understand, too, that the others are not motivated purely by greed, ignorance or opportunism. They can then perhaps start to build on this in the interests of everybody, and themselves.

Gender considerations and the role of women

Gender-related impacts, notably the different effects of adjustment on women and men, should be taken into account in adjustment policies. In much of the world, women are either involved in fishing itself, or play a major role in on-shore components of the fishery.

In many countries, it is mostly women who are engaged in inland fishing. Many more women engage in fishing with small implements, wading and gleaning the shores for shellfish, and collecting seaweed. In artisanal fishing communities, in addition, women are mainly responsible for performing the skilled and time-consuming jobs that take place on-shore, such as net making and mending.

Women are actively involved in the processing of fish catch – sun-drying, salting, smoking and preparing fish and fish-derived foods such as fish paste and cakes, either in cottage-level industries, or in large scale processing industries.

In many areas, women have also assumed a leading role in the rapid growth of aquaculture, often performing most of the work of feeding and harvesting fish, as well as in processing the catch.

In some developing regions women have become important fish entrepreneurs. As such, women earn, administer and control significant sums of money, financing a variety of fish-based enterprises and generating substantial returns for their household as well as the community.

Sustained improvements in productivity and the sustainable use of fisheries and other natural resources can be achieved if women's crucial role is acknowledged. A striking example is the development and widespread adoption of the Chorkor oven, an improved version of a traditional fish-smoking oven, which has improved the working lives and incomes of women fisherfolk throughout Africa.

Yet most women in fisheries lack access to physical and capital resources, to decision-making and leadership positions, to training and formal education. Access to these critical resources and services would improve the efficiency, profitability and sustainability of their activities.

Although large-scale fisheries development projects, mechanisation, and improved technology may increase productive capacities in fisheries, they can also increase the post-harvest workload of women. This extra burden is often undertaken without a rise in pay or at the expense of other possible income-generating activities. If a fisheries activity is enlarged or mechanised, it often becomes the domain of men.

Find Out More

FROM OECD...

On the Internet

For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

Publications

Structural Change in Fisheries: Dealing with the Human Dimension (2007):
Declining fish stocks and expanding fishing fleets have combined with growing competition from aquaculture to put increased pressure on the fishing sector to adjust the size and nature of its operations in many countries. In some fishing communities, almost 60% of jobs are linked to fishing and in many coastal areas there are few alternative employment opportunities for fishers. This conference proceedings analyses the social issues and policy challenges that arise from fisheries adjustment policies, and how OECD member countries are meeting those challenges.

... OTHER SOURCES

The role of structural policy and the European Fisheries Fund
The EU's structural policy in the fisheries sector combines two objectives: it must protect resources and the marine environment to guarantee sustainable fisheries, while ensuring the economic and social development of fisheries areas.
http://ec.europa.eu/fisheries/cfp/structural_policy_overview_en.htm

Evaluation of the Quebec Fishing Communities Adjustment Measures (QFCAM) program
The QFCAM ran from 2003 to 2005 to support projects for the creation of short-term jobs in communities affected by closure of the cod fishery in parts of the Atlantic and the Gulf of St Lawrence. Almost 90% of workers expressed satisfaction with the program. The report describes the implementation of the QFCAM, lessons learned and unforeseen effects.
www.dec-ced.gc.ca/eng/publications/agency/evaluation/51/index.html

Vulnerability and Resilience in the Northeast Fishing Industry, Special section, Human Ecology Review, Vol. 15, No. 2, 2008:
This special section focuses on vulnerability and resilience among fisheries stakeholders in the Northeast US, although conclusions and approaches are likely to resonate for those working on similar issues elsewhere. Methods and approaches used include ethnography, case studies, interviews, participant observation and quantitative data analysis.

Fisheries Structural Adjustment, Australian Department of Agriculture, Fisheries and Forestry
The fisheries structural adjustment component of the Australian government's Securing our Fishing Future package includes: business exit assistance; business advice assistance; assistance for skippers and crew; onshore business assistance; fishing community assistance; and Australian Fisheries Management Authority Levy Subsidy and Research.
www.daff.gov.au/fisheries/domestic/fishingfuture/fsa

AND...

An Iceland Fisherman, Pierre Loti, BiblioBazaar, LLC, Charleston, 2009

The Silver Darlings, Neil M. Gunn, Faber and Faber, London, 1999
Ewan MacColl sings *The Shoals of Herring* here, accompanied by old photos of the Yarmouth herring fleet: *www.youtube.com/watch?v=60v81aogaxg*


9

Fisheries: Common Wealth?

The oceans are the last great global commons. The UN Law of the Sea governs some aspects such as the 200-mile zones around coasts and the right to exploit the continental shelf, but in theory, anyone can travel the rest of the world's seas and exploit their resources relatively unhindered. Governing a shared, global resource like fish poses special problems. Conservation efforts by one group can be worthless if the only result is to allow another a bigger share of the catch. Yet if fisheries are to be sustainable, the political and other barriers to effective co-operation have to be overcome.

By way of introduction…

There is not one fishing industry. Capture fisheries, aquaculture, industrial fishing, small-scale fishing and sports fishing all have different participants and face different challenges. Aquaculture is in many ways like agriculture, with a fairly predictable output for any given input. Sports fishing is a case apart, not driven by the same profit needs as professional fishing. Capture fisheries, whether large or small-scale, are based on a raw material whose availability can be highly unstable and unpredictable.

Because of his argument that the high seas belong to everyone, Hugo Grotius, the 17th century Dutch writer we mentioned at the start of the book, is in a way at the origin of the issues we'll discuss in this last chapter.

Agriculture had to deal with the consequences of getting rid of a "commons" too. In England, the "Enclosures" deprived many poor peasants of access to land their families had used for centuries. The conflicts and misery generated were even worse than those that will inevitably accompany any solution for fisheries. For example, in one incident in 1607, known as the Newton Rebellion, a battle between the gentry and peasantry left around 50 people dead, and the peasant ringleaders were hanged and quartered.

In the United States, cattle ranchers and shepherds fought range wars over access to water and grazing rights on the open range.

Fishing today is in some respects in a similar situation to agriculture in previous centuries. Access to some resources is controlled, notably in EEZ, and there are attempts to extend control to the whole "territory". Yet despite thirty years of fishery management programmes, most coastal nations have not yet mastered ways to control fishing effort and maintain healthy fish stocks. Why is this? Why have so many governments consistently failed? This last chapter will discuss the policy issues the industry will have to resolve if it is to survive.

A global commons?

There are two big differences between the loss of common land in agriculture and attempts to regulate access to the oceans. The first is purely physical. The English landed gentry and US cattle barons could use hedges or barbed wire to fence off the land they claimed (or stole, depending on your point of view), however vast the extent. Second, there was a government actively promoting the new property regime, with the means to enforce it if private attempts failed.

Some fish are territorial, or their movement can be restrained, but overfishing concerns the many valuable species that roam far and wide, with no physical means of fencing them in. Moreover, fishing grounds are many times bigger than even the biggest ranch, and policing such huge stretches of ocean is extremely costly. The difficulty in dealing with a few pirates off the Somali coast gives some idea of how hard it can be to impose law and order on even a relatively limited maritime zone. Despite a variety of mechanisms designed to help countries co-operate in managing oceans and fisheries, no international agency exists to enforce a new regime of restricted access or exploitation on unwilling countries.

Some changes have been implemented. The traditional three-mile limit for territorial waters has been increased to 12 miles, and states can claim jurisdiction over exclusive economic zones up to 200 miles off their coasts. Regional Fisheries Management Organisations (RFMO) promote international co-operation in managing fisheries resources.

But clearly, they are not solving the problem of too many boats chasing too few fish. For example, boats from a country that is a member of an RFMO can simply reflag to a flag of convenience to avoid being bound by RFMO rules. And if the RFMO succeeds in preserving or even developing stocks, the fact that the ocean is a global commons means that non-RFMO fishers can fish in the area.

Aquaculture does not have these problems since it is done near the shore or even inland. But although it takes the pressure off capture fisheries in some respects, it is not a solution in itself. For a start, it couldn't thrive without wild stocks. As we pointed

out earlier, it can take 2.5 to 5 kilos of wild fish to produce a kilo of farmed salmon, shrimp or other fish, and the least demanding methods still need a kilo of captured fish to provide the feed for the kilo of fish that ends up in the supermarket, although the industry is developing substitute products and commercialising new species that don't rely on wild fish.

Ending the free-for-all

The obvious answer to overfishing of shared resources would seem to be to end the free for all, and make sure that as well as the right to fish, there is an obligation to manage the resource sustainably. Before exploring this further, it's worth specifying what we mean by "sustainable". Sustainability has three aspects, or pillars: environment, economy and society.

In the case of fishing, it's clear that if the basic natural resource is destroyed by overfishing, there will be little or no economic benefit in the long term, and the social consequences will be grave. But preserving this resource also means dealing with the economic and social consequences too. If fishers have no alternative but to fish illegally, they will do so, and harm or destroy efforts to promote ecological sustainability.

Fisheries researchers, policy experts and fisheries authorities agree on the need to reform the industry, and most of them would accept the evidence that giving fishers individual licenses, individual quotas, and exclusive user-rights to certain areas promotes improved stock conservation, reduction in overcapacity and better economic performance overall. So why don't they do it?

As so often with simple questions, the answers are far from simple. For a start, actually estimating how many fish are in the sea and how many it is safe to take is enormously complicated. As described in the chapter on subsidies, quotas are based on a combination of recorded catches and scientific surveys, but these are not precise and generally cannot take account of the local fluctuations or sudden increases and decreases in numbers that are typical of ocean ecology.

It's also difficult to take into account all the interactions among the many species in a fishing area. In some areas, when the numbers of a predator such as cod fall, more valuable prey species such as lobster flourish, while in other zones, the space is occupied by jellyfish.

Getting numbers wrong is inevitable, but it discredits the system, especially when fishers have to discard fish they've already caught because they're over the quota. Fishers in the US complained that they could not even give the fish to local charities to help feed poor people, while a conference in 2008 estimated that in a year, fishers in Scotland were throwing £40 million worth of marketable fish back into the North Sea.

Apart from estimating optimal quotas, another practical problem is implementing them. Checking the quantity and species of fish and the amounts landed at every port (as well as making sure it isn't transferred at sea to be landed illegally elsewhere) is expensive and time consuming.

The actual cost varies from one fishery to another. One study found that Iceland, Norway and Newfoundland have, respectively, low, medium and high cost-of-management, with management costing the equivalent of 3-4%, 8-13% and 11-28% of landed value. As we mentioned in the chapter on subsidies, this cost is usually borne by the taxpayer, although some countries do charge the industry through cost-recovery schemes.

Making sure the management system is seen as being as equitable as possible is another challenge. Logically, if quotas are being introduced, it's because there are not enough fish for everybody, but deciding who gets the right to fish, how much can be fished and when, and how much is paid for this right is bound to lead to conflict.

Disputes can block or seriously weaken the process. They can arise among the fishers themselves (with the rights of foreign boats a particularly sore point) or among fishers and other people, including recreational fishers, environmental groups or the tourist industry.

There can also be tensions among the different sectors of the fishing industry. For example, processors and fishers may disagree over price-setting mechanisms. Small-scale fishers may feel threatened by some schemes if they do not have the means to compete with larger operations.

Governance and fisheries reform

Beyond these practical difficulties, there is a wider problem of governance, and political economy. In other words, how decisions are made, and in whose interest. How reform is promoted or obstructed and why.

Fishing is not just about economic efficiency. It is a way of life and a strong component of social and cultural identities and can be an important element in regional economies. Any fisheries initiative has to take into account impacts outside fisheries.

The expression used to describe this is "policy coherence", and in this context it means two things. First, making sure that fisheries policy does not stop other policies from achieving their objectives, and *vice versa*. In reality, the choices are rarely clear cut. Developing tourism might bring jobs, improved infrastructures and various other economic benefits, but transforming a fishing harbour and its installations into a yacht marina may make life much more difficult for fishers, especially if tourism and economic development means more pollution of coastal waters.

A second strand of policy coherence is making sure the right policy is used to address the issue at hand. This sounds self-evident, but in practice, it's not always the case. Fisheries policy is often expected to deal with questions of employment or regional development for instance. These objectives may damage fish stocks for the sake of what turn out to be short-term gains.

> **"The short-sightedness on both demand and supply sides combines to favour legislation that provides easily identified current benefits at the expense of future costs that are complex and difficult to identify. Conservation, which requires short-term sacrifice in exchange for long-term gains, tends to be disfavoured in this environment."**
>
> Sutinen, J. G. (2008), "Major Challenges for Fishery Policy Reform: A Political Economy Perspective", an OECD Food, Agriculture and Fisheries Working Paper

Many of these obstacles to "rational" fisheries management can be analysed from the perspective of political economy. Experience of reform in various fisheries provides some general lessons.

A tragedy?

Elinor Ostrom was awarded the 2009 Nobel Prize for economics for her work on economic governance. Ostrom's field of research is common-pool resources. These are resources such as fish stocks to which more than one individual has access, but where each person's consumption reduces availability of the resource to others.

One of the most well-known treatments of the question is Garrett Hardin's 1968 book *The Tragedy of the Commons*, which describes how overexploitation of common pools was rapidly increasing worldwide.

Economists proposed two common responses to overexploitation. The first is privatisation with adequate means of measurement and control. This depends on having the necessary technical and financial means to exercise adequate control and may be feasible only if ownership is restricted to a few agents. The second is government ownership and a tax on using the resource.

Ostrom proposed a third solution: retain the resource as common property and let the users create their own system of governance. In *Governing the Commons: The Evolution of Institutions for Collective Action*, Ostrom argues that common property governance doesn't have to be tragic, and that users themselves can devise rules and enforcement mechanisms that may be better than restrictions imposed by outsiders with little knowledge or understanding of local conditions.

One of the more surprising conclusions of her research is that users should take care of monitoring and sanctions themselves (or entrust this to someone accountable to them). As the Nobel committee points out, this "challenges conventional notions whereby enforcement should be left to impartial outsiders".

Monitoring and sanctioning can be costly, if only in the time spent doing them, yet Ostrom's case studies show that many people are prepared to carry out governance duties. Her research raises questions as to exactly why individuals are willing to bear the burden of these often thankless tasks that benefit others.

Economic or environmental crises can promote change. The need for reform has to be identified clearly, otherwise fishers, politicians and the general public are unlikely to push for change or to agree on the priorities of any new policy. Crises are the most obvious sign that change is needed, but their influence on the desire to reform is not clear cut.

Because the industry relies on natural resources, environment and economics are closely linked. A damaged environment has economic consequences sooner or later, but, as the closure of the Newfoundland cod fisheries in 1992 shows, the crisis usually has to be severe before it has any impact on policy.

Unfortunately, as this kind of example illustrates, the danger of waiting until it's too late is often ignored and the damage is worse than if timely action had been taken. In the EU, for example, repeated warnings from the International Council for Exploration of the Sea about the state of cod and hake stocks in the North Sea have not been matched by significant cuts in the total allowable catches of the species at risk.

In purely economic terms too, it seems that things have to be really bad before the crisis provokes calls for reform. Reform of the New Zealand fisheries in the 1980s was provoked by an economy-wide crisis, although poor profitability in the fisheries sector also played a part.

Economy-wide structural reform can also affect fishing, giving support to calls for fisheries reform in line with what is happening in other sectors. It can also be argued that it is easier to reform when things are going well, and the transitional costs of reform can be borne more easily.

Reform is often accompanied by calls for increased transparency in the availability, impacts and beneficiaries of government programmes. Voter opposition to subsidies seen as having unacceptable economic costs and environmental effects makes subsidy reform less politically damaging for governments. Identifying who benefits from subsidies, and highlighting their relative "bargaining power", can provide a higher degree of transparency and thus can be a particularly powerful motivating force for change.

Fisheries managers need an early warning system to highlight deteriorating environmental or economic conditions and to supply any information and risk analysis needed to trigger changes in policy or to management arrangements.

Call for reform may come from within the sector if profits are uncertain, and there is widespread overcapacity and overfishing. Specific groups within the fishing sector may push for reform even if the sector as a whole seems happy to continue with business as usual. Practical experience provides several examples of vessel owners pushing for change when the proposed reforms promised to improve profitability.

Owners backed the introduction of individual vessel quotas in the Canadian Pacific halibut fishery in the early 1990s for instance. The fishery was suffering from the classic problems of low returns under the open access fishery, and fishers' expectations about increasing profitability played a major role in the push for reform.

The success of the Canadian reform showed the neighbouring US Pacific halibut fishery the potential for increased earnings and, in 1995, Alaska adopted an individual fishing quota system for the fishery.

Determining the scope for reform is easier in fisheries with fewer participants and less complex biological and fishing interactions, such as single species fisheries. The introduction of individual transferable quotas into the Australian southern bluefin tuna fishery was made considerably easier because the fishery was a single species fishery with a single breeding stock and had been the subject of many years of intensive research. There were also a relatively small and concentrated number of fishers located in South Australia, and a small number of market outlets from which to monitor catch information.

These features made the introduction of reform much easier as the fishers were able to more accurately assess the potential gains from the reform and could identify with the post-reform fishery.

International factors may influence domestic reform. Foreign competition resulting from trade liberalisation under WTO or similar agreements incites domestic firms to seek reform of policies that put them at a disadvantage. In the fisheries sector, this can occur through the linkages in the value chain between, for example, harvesting and processing.

Processing companies are increasingly pressing governments to reform the management of domestic fisheries in order to improve the quality and consistency of product supply. This was a factor in the shift towards individual vessel quotas in Canada's halibut fishery mentioned above.

International treaties or agreements can also lead to sectoral reforms, even in the face of domestic opposition. Examples include the FAO International Plans of Action on various issues, including the management of fishing capacity and pirate fishing,

or the commitments on fisheries subsidies made under the World Summit on Sustainable Development Plan of Implementation, being negotiated in the WTO. At the regional level, the EU's Common Fisheries Policy places certain obligations on Member countries with respect to their domestic fisheries policies and has been a catalyst for policy reform in many countries.

Much of what we're discussing here comes down to knowledge and influence. Poor management practices suit the immediate needs of the fishing industry, because they know the issues best and are skilful at exercising political influence on management decisions.

This is changing though. The "information imbalance" is being redressed by knowledgeable, well-organised campaigners actively engaged in fisheries research and pushing for the adoption of sustainable practices.

Such groups are beginning to have some success in changing public opinion. Supermarket chains are adhering to labelling schemes such as MSC that promote sustainable fisheries. Other important industry players are forming working partnerships with NGOs, such as Unilever with the WWF or McDonalds with Conservation International.

Reform is a long-term process, before and after implementation. Building support is essential to the success of the reform, and can't be rushed. Fisheries policy reform generally benefits specific groups only, while the costs are borne by the whole community.

Stock rebuilding or responses to changes in management policies can take time, creating a burden that may reduce support for change during the transition period. Identifying the potential winners and losers from reform enables the government to better target compensation and transitional measures (such as vessel decommissioning and license buyback programmes, temporary and targeted social support schemes) and to build support for reform.

Fishers have to be involved in the reform process from the start, not only because they are going to gain or lose most, but also because of their intimate knowledge and experience of the fisheries concerned.

Once the reforms have been implemented, they have to be sustained over the long term. Pressure to wind back reforms can be significant, especially if particular interest groups have retained sufficient power or cohesiveness to influence the future course of policy.

Withstanding such pressure can require significant political commitment and may need to be coupled with further measures to gain the support of remaining disaffected groups. Successful reform is generally not a one-off event, but is actually a process of continuous improvement over time that fine-tunes and adapts policies to evolving circumstances.

International governance

All the issues discussed above can be seen in terms of international governance. The seas are a global commons that an increasing number of people are seeking to exploit, but the international structures designed to manage this resource have reached their limits.

There is no shortage of codes, agreements, conventions or other legal instruments. The problem lies in applying and enforcing them, as pirate fishing shows. There may even be conflicts of interest when it comes to practical aspects of access. Governments administer the global commons, but they also defend the interests of their national fishing industry.

The fact that fishing is now being discussed in the WTO's Doha Round is encouraging. Despite the difficulties in reaching agreement on other aspects of international trade in these talks, there is a consensus on many of the most vital issues affecting fishing, such as the need to manage stocks sustainably. Governments should seize this opportunity to deal with fisheries on a multilateral, international basis and take advantage of international rules to enforce significant reforms.

The picture of fishing as an industry and a way of life presented in this book is not particularly cheerful. The sector faces enormous challenges, some of its own making.

The good news is that attitudes are changing, sometimes because there is no other choice, sometimes because another choice seems better and more desirable.

We opened the book by quoting Bernard Groisard. We'll give him the last word too, on the strategy the fishing industry should adopt. "It has to be sustainable, and we have to be careful. The collapse of the anchovy fishery is there to remind us: when stocks are low, all you can do is wait. Nature knows what it's doing, given time the resource will recover."

Find Out More

FROM OECD...

On the Internet

For an introduction to OECD work on fisheries, visit *www.oecd.org/fisheries*.

Publications

Review of Fisheries in OECD Countries: Policies and Summary Statistics 2008 (2009):
This publication describes major developments affecting fisheries in OECD countries in 2004, 2005 and 2006, including changes in national and international policies, trade, and fisheries and aquaculture production. This edition contains a special chapter on foreign direct investment in OECD fisheries.

Fishing for Coherence in West Africa: Policy Coherence in the Fisheries Sector in Seven West African Countries (2008):
Fisheries represent up to 30% of state budget revenues in West African countries and employ 7 million people in West and Central Africa. If the sector is to develop, or simply continue to exist at present levels, a number of policy challenges will have to be addressed in a coherent manner, covering the environment, technology, economic aspects, social aspects, governance and the contribution of fisheries to poverty alleviation and basic nutrition.

Also of interest

Major Challenges for Fishery Policy Reform: A Political Economy Perspective, Jon G. Sutinen, an OECD Food, Agriculture and Fisheries Working Paper.
Potential threats to successful fisheries governance and management are examined from a political economy perspective. The influence of special, private interests in the management and regulatory process may be the most serious such threat.

...AND OTHER SOURCES

Governing the Commons: The Evolution of Institutions for Collective Action, Elinor Ostrom, Cambridge University Press (2010):
The governance of natural resources used by many individuals in common is discussed. Neither the state nor the market has been uniformly successful in solving common pool resource problems. Offering a critique of the foundations of policy analysis as applied to natural resources, Elinor Ostrom provides empirical data to explore conditions under which common pool resource problems have been satisfactorily or unsatisfactorily solved.

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